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# Final Program

## Thirty-Eighth Annual Meeting

### International Neuropsychological Society

February 3-6, 2010  
Acapulco, Mexico

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#### WEDNESDAY, FEBRUARY 3, 2010

9:00 AM–12:00 PM

**Wednesday Morning Continuing Education Courses**  
Refer to CE Schedule for Location

1:00–4:00 PM

**Wednesday Afternoon Continuing Education Courses**  
Refer to CE Schedule for Location

4:00–5:00 PM

**Presidential Address: The Asymmetrical Brain**  
**INS President: Michael Corballis**  
**Diamante Ballroom I**

1. CORBALLIS, MC

Presidential address: The asymmetrical brain.

5:15–6:45 PM

**Symposium 1: Progress in Understanding Executive Functions in Clinical Populations Using Neuroimaging Techniques**  
**Chair: Glenn Wylie, Discussant: Frank Hillary**  
**Diamante Ballroom I**

1. WYLIE, G
2. JAVITT, D
3. DELUCA, J
4. WYLIE, G
5. GUNNING-DIXON, F

Progress in Understanding Executive Functions in Clinical Populations Using Neuroimaging Techniques.  
Executive dysfunction in schizophrenia: Is it all in your frontal lobes?  
Is executive dysfunction an independent deficit in multiple sclerosis, or merely a product of slowed processing speed?  
Change is good: brain activity in a working memory task is higher in TBI than in HC, but shows comparable changes across time.  
Neurobiological Correlates of Executive Dysfunction in Late-Life Depression: Structural and Functional MRI Findings.

5:15–6:45 PM

**Symposium 2: Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes**  
**Chair: Max Gunther, Discussant: Erin Bigler**  
**Diamante Ballroom II**

1. GUNTHER, ML
2. JOHNSON, SC
3. GUNTHER, ML
4. STEVENS, RD
5. HOPKINS, RO

Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.  
Serial Imaging and cognitive outcomes after Traumatic Brain Injury.  
Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.  
Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.  
Quantitative Brain Imaging and Cognitive outcomes in Survivors of Critical Illness.

5:15–6:45 PM

**Paper Session 1: Language**  
**Diamante Ballroom III**

1. WALDRON, EJ
2. SUAREZ, PA
3. CASTRO-CALDAS, A
4. CIRINO, PT
5. BENNETT, J

Second Language Age of Acquisition Effects Across the Lifespan Support the Sensorimotor/Emergentist Model of Language Development.  
Degree of Bilingualism predicts Interference scores on a Spanish version of the Stroop Test.  
Measuring the impact of literacy in paraphasias of aphasic patients.  
Reading Components and Difficulties in Middle School Students.  
The Importance of Bilingual History in Assessing Tasks Requiring Cognitive Flexibility.

## 5:15–6:45 PM

**Poster Session 1: Aging, Dementia (Alzheimer's), HIV/AIDS/Infectious Disease, Condesa Ballroom****Aging**

1. ARENTSEN, TJ Interhemispheric Transfer Time (IHTT) and Executive Functioning: A Healthy Aging Examination of the Speed of Cortical Communication.
  2. AUSTIN, AL State Anxiety, Trait Anxiety and Depressive Symptoms minimally affect Global Cognitive Performance in an Elderly Sample.
  3. DRAG, L Patterns of Brain Activation Associated with Visuospatial Processing in Older and Younger Adults.
  4. FISCHER, AL Presence of Vascular Illness Negatively Impacts Theory of Mind in Older Adults.
  5. ~~GONZÁLEZ, HM~~ ~~What do parents have to do with my cognitive reserve?~~
  6. GUIDOTTI, L Semantic Knowledge and Recognition Accuracy for Famous Names from Different Time Epochs Predicts Memory Decline in Asymptomatic Elderly.
  7. GURCZYNSKI, J Association Between Verbal "Intelligence" and Verbal Memory in the Elderly.
  8. GURCZYNSKI, J Association Between Verbal and Visual-Graphic Memory Change in the Elderly.
  9. HIRSHSON, CI Using robust sampling procedures to examine gender differences in Neuropsychological test performance in older adults.
  10. INSCORE, AB Yoga Improves Cognitive Functioning in Postmenopausal Women: A Preliminary Study.
  11. KAUNG, A Relationship between Framingham Stroke Risk Profile and Clock Drawing Performance.
  12. KRAYBILL, M The Utility of a Motor Programming Task in the Prediction of Functional Independence Over Time.
  13. KUBIK, JL Medical Illness Burden and Self-rated Health in Relation to Older Adults' Everyday Problem Solving.
  14. LANE, EM The Role of IQ as a Protective Measure Against Age-Related Decline in Frontal White Matter and Cognition.
  15. LERITZ, EC The Relation of Source Memory and Item Memory to Brain Structure in Cerebrovascular Risk.
  16. LINCK, J Classification Rates in a Group of Outpatients with Neurologic Illness and a Group of Healthy Controls Using the RBANS.
  17. MORGAN, DR Assessment of the RBANS Visual and Verbal Indices in a Sample of Neurologically Impaired Elderly Subjects.
  18. MORGAN, DR Classification Rates of the RBANS Verbal and Visual Indices versus RBANS Original Indices Across Neurologically Impaired Older Adults.
  19. LOWE, DA How Do Gender and Marital Status Impact Older Adults' Language and Visuospatial Skills?
  20. MCINERNEY, KF Relationship Between Cognitive Activity and Cognitive Functioning in Older Adults Without Dementia.
  21. MOORE, CS Gender and Neuropsychological Performance in Atherosclerotic Vascular Disease.
  22. NATION, DA Pulse Pressure and Cognitive Functioning in Older Adults.
  23. NGUYEN, CM Personality Characteristics Associated With Poor Decision-Making In Normal Elderly.
  24. ORTIZ, X Changes on Behavioral Inhibition in Elderly People.
  25. PATWARDHAN, SY Effects Of Semantic Versus Phonemic Cues In The Episodic Memory Performances Of "Young-Old" Versus "Old-Old" Normal Elderly Adults.
  26. PAUL, R Brain MRI Correlates of the Montreal Cognitive Assessment in a Non-Clinical Older Population.
  27. RAYMER, AM Effects of Aging on Gesture Recognition and Production.
  28. RISHER, EL The Impact of Marital Status on Memory Among Older Adults.
  29. RODRIGUEZ-ARANDA, C Contribution of cognitive and psychomotor mechanisms to the age-related slowing of verbal processing.
  30. ROGERS, SA Does Anxiety Impact Older Adults' Memory? A Pilot Study.
  31. ROGERS, SA Predicting Older Adults' Functional Status from Executive Measures.
  32. ROSSETTI, H Impact of Life-Long Exercise Training on Cognitive Functioning: A Neuropsychological Investigation of Master Athletes.
  33. ~~RUIZ-RIZZO, AL~~ ~~Qualitative measures including grammar types of words in Controlled Oral Word Association Test (COWAT) for healthy older adults. Preliminary.~~
  34. SHUMAN, MJ Cognitive Fatigue Effects on Attention Networks in Aging.
  35. SPAT, J Effect of Age on Attention Demands.
  36. SUHR, J Perceived Threat of Alzheimer's Disease (AD) in Young-Old and Old-Old Participants in Dementia Screening.
  37. VALMAS, MM Source Memory and Item Memory are Differentially Related to Neuropsychological Test Performance and Cerebrovascular Risk.
  38. WESTHAFFER, JG Aging, Cognitive Reserve, and PET.
  39. YEUNG, SE The Utility of Blood Pressure in Predicting Traditional and Everyday Cognition in Older Women.
  40. YI, D Interhemispheric transfer predicts error monitoring disruption in executive functioning and bimanual coordination tasks for younger but not older adults: Implications for healthy aging of white matter pathways.
  41. ZEC, RF Effects of Age, Education, and Gender on Animal Fluency in Older Adults.
- Dementia (Alzheimer's)**
42. CLARK, L Cognitive Discrepancies Predict Cognitive Decline Whereas APOE Genotype Does Not.
  43. COOK, SE Health Factors in the Reversion from Mild Cognitive Impairment to Normal.

44. CORNETT, PF  
~~Depression in Geriatric Patients with Cognitive Impairment: The Effects that Staging of Disease has on Depression.~~
45. EPPIG, J  
Time of Day Effects on Everyday Action Impairment in Alzheimer's Disease.
46. GAVETT, BE  
Validation of the NAB List Learning Test in the Prediction of Cognitive Decline in Older Adults.
47. GLASS, L  
Neuropsychological Differences between Men and Women with Alzheimer's Disease.
48. GLOSCH, CE  
Prediction of Conversion to Alzheimer's Disease from Mild Cognitive Impairment.
49. HANE, L  
Block Design Performance in Alzheimer's Patients: Differential Relationships with other Neuropsychological Measures in Men and Women.
50. HANTKE, N  
Event-Related fMRI of Episodic and Semantic Memory in Cognitively Intact Elders: Patterns of Activation as a Function of Risk Factors for Alzheimer's Disease.
51. HAUGRUD, NA  
Comparing Qualitative Verbal Fluency Scoring Procedures in Healthy Aging and Early Stage Alzheimer's Disease.
52. KIEWEL, N  
Apolipoprotein E Genotype and Neuropsychiatric Features in Alzheimer's Disease.
53. LEMAIRE, AW  
The Dementia Severity Rating Scale: Factor Structure and Neuropsychological Correlates.
54. MAESTAS, KL  
Veterans with Dementia and their Caregivers: Neuropsychological Correlates of Caregiver Burden.
55. MARTYR, A  
Verbal fluency and impaired functional ability in people with dementia.
56. MARTYR, A  
The emotional Stroop effect for memory related words in people with dementia and their caregivers: investigating the implicit awareness system.
57. MIMURA, M  
Effect of high dose donepezil on cognitive function and serum insulin-like growth factor-I (IGF-I) level in Alzheimer's disease.
58. REED, B  
Is Idea Density a Marker of Cognitive Reserve? Effects on Cognitive Decline.
59. RYAN, KA  
Resolving Diagnostic Inaccuracies in Frontotemporal Dementia: A Role for [11C]PiB Scanning.
60. STRAUSS, C  
Delayed Memory, but not Executive Skills, Predicts Functional Impairment in Newly Diagnosed Alzheimer's Disease.
61. TREMONT, G  
Relationship Between Cognition and Awareness Deficits in Mild Cognitive Impairment.
62. WONG, JT  
Patterns of Deficits in Daily Functioning and Cognitive Performance of Patients with Alzheimer's Disease.
- HIV/AIDS/Infectious Disease**
63. BADIEE, J  
Suicidality and Neuropsychological Impairment in HIV-Infected Persons.
64. BOGDANOVA, Y  
Apathy, Alexithymia and Their Relation to Cognition in Asymptomatic HIV.
65. EASTVOLD, A  
Herpes simplex virus encephalitis: Serial neuropsychological assessments characterize memory, language and executive impairments.
66. HEAPS, JM  
Cognitive dysfunction in HIV/HCV co-infection and the relationship with APRI.
67. HINES, LJ  
Reaction Time Variability and Driving Ability in HIV+ Individuals.
68. IUDICELLO, JE  
Additive effects of HIV infection and aging on neuropsychological functioning.
69. LEVINE, A  
Dopamine-related genes affect cognitive functioning and risk for HIV-associated neurocognitive disorders.
70. LEVINE, A  
Assessment of the NEUROPSI in Detecting Neurocognitive Deficits in HIV+ Spanish Speakers.
71. LIN, K  
Effects of Traumatic Brain Injury on Cognitive Functioning and Cerebral Metabolites in HIV+ Individuals.
72. MARTIN, LM  
Deficits in Response Inhibition are Associated with Poor Medication Adherence Among HIV+ Drug Users.
73. MARTIN-THORMEYER, E  
Possible Additive Effects of HIV and Drug Use on Impaired Response Inhibition.
74. MOORE, DJ  
Acute and early HIV-infected persons evidence learning impairments.
75. MORGAN, EE  
CSF Amyloid Beta and Tau Do Not Predict Mild HIV-associated Neurocognitive Disorders.
76. NIEHOFF, JA  
Relationship Between Subjective Memory Reports and Performance on Objective Measures of Memory in HIV Mono-infection or HIV/HCV Co-infection.
77. PALTIN, I  
The Functional Impact of HIV-Related Neuropsychological Impairment & Depression: A Longitudinal Study.
78. PANOS, SE  
Cross-Sectional and Longitudinal Studies of Medication Adherence and Cognition among HIV+ Adults: Comparison between Optimal Adherers, Sub-Optimal Adherers, and Poor Adherers.
79. POSADA, C  
Visual Recall Difficulties among HIV Infected Individuals with Comorbid Bipolar Disorder Are Associated with Worse Medication Adherence.
80. RAMEZANI, A  
Longitudinal Study of Neurocognition in Aging HIV+ Adults.
81. ROMERO, RA  
The Effects of HIV on Attention, Memory, and Cognition of Ugandan Preschool-aged Children.
82. SCHEINER, D  
Triple Diagnosis: The Combined Roles of Comorbid Antisocial Personality Disorder and Substance Use upon Neurocognitive Functioning in HIV Infection.
83. SCOTT, J  
Multitasking in HIV-1 Infection: Implications for Everyday Functioning.
84. SUHR, JA  
The Impact of Psychological States on Perceived and Actual Neurocognitive Functioning in HIV-positive Older Adults.
85. THAMES, AD  
Executive Function Deficits Among HIV Positive Hypertensive Adults.
86. VANCE, D  
Predictors of Neuropsychological Functioning in Adults with HIV.
87. WEBER, E  
Cognitive Reserve and Prospective Memory in HIV Infection.
88. YADAVALLI, S  
Association between cognitive function and medication adherence in people living with HIV.
- Dementia (Subcortical, Specific Disorders, MCI, etc.)**
89. RODRIGUEZ, M  
Diencephalic Atrophy Measures on MRI in Lewy Body Dementia and Alzheimer's Disease.

6:45–7:30 PM

**Wednesday Evening Reception**  
**Plaza Las Fuentes**

## THURSDAY, FEBRUARY 4, 2010

7:20–8:50 AM

**Thursday Morning Continuing Education Courses**  
**Refer to CE Schedule for Location**

9:00–10:00 AM

**Invited Address: Attention Networks: Normal Development and Pathology**  
**Speaker: Michael Posner**  
**Diamante Ballroom II**

1. POSNER, MI

Attention networks: Normal development and pathology.

9:00–10:30 AM

**Paper Session 2: Autism**  
**Diamante Ballroom I**

1. MANFREDI, R

Executive Functioning in High-Functioning Autism Spectrum Disorders: Relationship to Social and Adaptive Skills.

2. BOORSTEIN, HC

Regressive and non-regressive autism spectrum disorders: [111][111]A comparison of developmental trajectories, autistic behaviors, [111]and medical histories.

3. BIGLER, ED

Inconsistent Recall on a Verbal Selective Reminding Task in Autism.

4. BIGLER, ED

Stability of Brain Volume from Mid-childhood Through Adolescence and Early Adulthood in Autism.

9:00–10:30 AM

**Symposium 3: Neurocognitive, Psychosocial and Cultural Determinants of Awareness of Deficit in Early Stage Dementia**  
**Chair: Feggy Ostrosky-Solis, Discussant: George Prigatano**  
**Diamante Ballroom III**

1. CLARE, L

Testing a biopsychosocial model of awareness in early-stage Alzheimer's disease.

2. MORRIS, RG

Neuropsychological correlates of awareness of cognitive or behavioural dysfunction in early dementia.

3. NELIS, S

Awareness of social and emotional functioning in early stage dementia.

4. MORRIS, RG

Neurocognitive, psychosocial and cultural determinants of awareness of deficit in early stage dementia.

5. MOGRABI, D

Lack of awareness (anosognosia) of memory impairment in dementia: findings from the 10/66 Dementia Research Group project.

9:30–11:00 AM

**Poster Session 2: Drug/Toxin-Related Disorders, Memory Functions, Psychopathology/Neuropsychiatry (Schizophrenia & Other)**  
**Condesa Ballroom**

### Drug/Toxin-Related Disorders (Including Alcoholism)

1. CARRILLO, JR

Visual-Motor Deficits in Children with Histories of Heavy Prenatal Alcohol Exposure are Not Accounted for by More Basic Skills.

2. KANG, NS

Children with FASD and ADHD are Not Distinguishable Using a Visual Continuous Performance Paradigm.

3. NORMAN, AL

Spatial and Object Working Memory in Children with Histories of Heavy Prenatal Alcohol Exposure.

4. O'BRIEN, JW

Directed Attention in Children with Histories of Heavy Prenatal Alcohol Exposure.

5. WAGNER, AE

Children with Histories of Heavy Prenatal Alcohol Exposure Display Impairments in Spatial Orientating of Attention.

6. DOLAN, S

Affective Processing in Alcoholics.

7. GAYTÁN, CE

PERSONALITY PROFILE IN COLLEGE STUDENTS CONSUMERS OF MARIJUANA.

8. GONZALEZ, R

Cannabis Use, Risky Decision-Making, and its Negative Consequences among Young Adults.

9. SCHUSTER, RM

Neurocognitive Disinhibition and Risky Sexual Behavior Among Emerging Adults With and Without Cannabis Use.

10. HARCIAREK, M

Predictors of Memory Performance of Dialyzed Patients with End-Stage Renal Disease.

11. KRENGEL, M

Independent neuropsychological effects of pesticide exposures in military pesticide applicators from Gulf War I.

12. KRIVITZKY, L

Neuropsychological functioning in two adolescents with leukoencephalopathy from "chasing the dragon".

13. NEILSON, HA

Stimulant-Specific Effects on Decision Making in Polysubstance Users.

14. VALDERRAMA, AG

Cognitive flexibility differences between cocaine and methamphetamine abusers.

15. VELEZ, A

Marijuana Users and its Effects on Cerebral Metabolism.

16. WEINBORN, M  
Prospective Memory Deficits amongst Polysubstance Dependent Individuals in Treatment.
- Memory Functions**
17. BERMAN, R  
Reminiscent: Contextual Effects on Odor-Evoked Emotional Memory.
18. CHESTER, SK  
The Relationship Between the Item Specific Deficit Approach (ISDA) and List Learning Characteristics on the California Verbal Learning Test-Second Edition (CVLT-II).  
Development of Verbal Memory and Categorization in Children.
19. DUROCHER, A  
Verbal Memory in Agenesis of the Corpus Callosum: Logical Memory and Paired Associates.
20. ERICKSON, RL  
~~Relationship between Prospective/Retrospective Memory and Fibromyalgia Impact.~~
21. ~~CONZÁLEZ RAMÍREZ, M~~  
Improvement in verbal memory after withdrawal of carbamazepine and valproate in seizure-free epilepsy patients: A randomized, double-blind study.
22. HESSEN, E  
Temporal Gradient in Younger and Older Adults: Semantic Knowledge of Recent and Remote Famous Names.
23. NOVITSKI, J  
Prospective Memory Following Moderate to Severe Traumatic Brain Injury: A Formal Multinomial Modeling Approach.
24. PAVAWALLA, S  
The Neural Correlates of the O-SPAN: A Working Memory Task.
25. PUENTE, AN  
Neural Correlates of Retrieval during a Working Memory task.
26. PUENTE, AN  
A Differential Deficit in Time- versus Event-based Prospective Memory in Parkinson's Disease.
27. RASKIN, S  
Learning and Memory Decrements in Symptomatic and Remitted Depression.
28. WALKER, SJ
- Psychopathology/Neuropsychiatry (Other)**
29. AVERY, E  
Executive Functioning and Emotion Processing Predictors of Treatment Response in Major Depressive Disorder.
30. BENITEZ, A  
Comorbid Depression and Anxiety and Executive Functioning.
31. DOTSON, VM  
Recurrence of Depressive Symptoms and Risk for All-Cause Dementia and AD.
32. EDWARDS, KM  
The Neuropsychological Correlates of Sexual Aggression.
33. HELDER, EJ  
Emotional and behavioral adjustment in children with hydrocephalus.
34. KILLGORE, WD  
Neural Correlates of Anxiety Sensitivity Factors During Presentation of Masked Fearful Faces.
35. MCFADDEN, M  
Auditory Memory Decrements are Present in Major Depressive Disorder, with no Evidence of Increased Levels of Dissimulation.
36. RICH, BA  
A Magnetoencephalography (MEG) Study of Irritability in Pediatric Bipolar Disorder.
37. RYAN, KA  
Executive Functioning Performance Across Phase of Illness in Bipolar Disorder.
38. SCHRETLEN, DJ  
Validation of the 15-Item Geriatric Depression Scale (GDS-15) for Clinical Use with Young and Middle-Aged Adults.
39. SEMKOVSKA, M  
~~Retrograde Memory following Treatment for Severe Depression – Is Electroconvulsive Therapy Worse than Pharmacotherapy?~~
40. STANEK, KM  
Neuropsychological Correlates of Body Image Disturbance.
41. SUTTERBY, SR  
Neuropsychological Functioning in Social Phobia.
42. ZEDLITZ, A  
Depression and Fatigue after Acquired Brain Damage, a review of the literature.
43. ~~ZIMAK, EH~~  
~~Neuropsychological Correlates Of Primary And Secondary Psychopathic Characteristics In An Undergraduate Sample.~~
44. SEGARRA, R  
Insight in First Episode Psychosis and its relation to clinical symptoms, treatment adherence and global functioning: One year follow-up.
- Psychopathology/Neuropsychiatry (Schizophrenia)**
45. ~~OJEDA, N~~  
~~Is it time to include executive functioning as diagnostic criteria for schizophrenia?~~
46. ~~PEÑA, J~~  
~~Speed Explains Differences in Cognitive Performance between Patients with Schizophrenia and Normal Controls.~~
47. GARCIA AGUILAR, G  
Inhibition Of The Prepotent Response To Emotional Stimuli In Schizophrenia.
48. GIOVANNETTI, T  
Everyday Distraction in People with Schizophrenia.
49. GODDARD, K  
The Sensitivity and Specificity of d' Scores in Distinguishing First Episode Schizophrenia from Substance Induced Psychosis.
50. HARTZELL, AM  
Declarative and Non-Declarative Memory in Schizophrenia.
51. IAMPIETRO, M  
Empirically Defined Patterns of Executive Function Deficits in Schizophrenia and their Relation to Everyday Functioning: A Latent Class Analysis Approach.
52. OREM, DM  
The Role of Emotional Content on Selective Attention in Individuals with Schizophrenia and Demographically Matched Controls.
53. TIRADO-DURÁN, EG  
Neuropsychology of Delusional Thinking: Reasoning or Meaning.
54. TWAMLEY, EW  
COMT Genotype, Cognition, and Everyday Functioning in Schizophrenia.
55. VELLA, L  
Improvements in Neuropsychological, Functional, and Clinical Outcomes after Compensatory Cognitive Training in Psychosis.
- Genetics/Genetic Disorders**
56. WALSH, KS  
Gender differences in quality of life in children with Neurofibromatosis Type 1: The role of neurocognitive impairments and resiliency.

**Other**

57. AASE, D Longitudinal Neuropsychological Symptom Changes Following Electrical Injury: An Exploratory Study.
58. BEEBE, DW Association Between Sleep-Disordered Breathing and Neurobehavioral Functioning During Middle to Late Childhood.
59. CÁRDENAS, KV Characteristics of Eye Movements in Reading Words and Nonwords with and without Stress Mark.
60. CAMPBELL, M Cognition in Parkinson disease: Effects of levodopa and an adenosine A2a antagonist.
61. CARLOZZI, N The NIH Toolbox Project: The Development of a Measure of Working Memory.
62. DIKMEN, S The NIH Toolbox: The Development of a Measure of Episodic Memory/Learning.
63. TULSKY, D The NIH Toolbox Project: The Development of a Measure of Processing Speed.
64. EL-MESSIDI, L Etiology and Lesion Level in Early Hydrocephalus: Effects on Cognitive Functioning.
65. FERNANDEZ, V The Development of Automaticity.
66. GRAEFE, AC The Relationship Between Warzone Deployment Stress and Post-deployment Neuropsychological Outcomes in Active Duty Army Personnel.
67. HENRY, M Problem-Solving in Maltreated Children.
68. JAYAKAR, R Self-Efficacy and Everyday Problem Solving Performance.
69. ~~JEFFREYS, A~~ ~~THE COGNITIVE AND HAEMODYNAMIC OUTCOME OF PATIENTS WITH LARGE AND ELOQUENTLY LOCATED AVM FOLLOWING HYPOFRACTIONATED STEREOTACTIC RADIOTHERAPY.~~
70. KANDALAFT, MR Theory of Mind in Asperger's Syndrome and Schizophrenia.
71. KATZENSTEIN, J Neurodevelopmental Skills Continue to Lag Behind in Pre-Term Children Following Cochlear Implantation.
72. ~~KERNS, KA~~ ~~An Examination of Multitasking in Children with FASD: The Impact of Increasing Task Demands.~~
73. KOZORA, E Comparing Rey-Osterrieth Scoring Systems in nonNPSLE Patients and Controls.
74. MACE, M A Survey of Regional Referring Providers' Use of and Perceived Utility of Neuropsychological Services.
75. MAHONEY, CA A Neuropsychological Comparison Study of Differing Types of Maltreatment on School-Age Children.
76. MYERSON, C Redefining the Link Between Apathy and Cognition in Parkinson's Disease.
77. NEMETH, DG Integrating the Practices of Outpatient Clinical Neuropsychology and Medical Psychology.
78. ~~NORDLUND, A~~ ~~The Effects of Vascular Disease and Alzheimer-typical Biomarkers in MCI: Additive or Synergistic?~~
79. OLSZEWSKI, A Social Integration in Children with Differing Onset and Type of Disability.
80. PARRA, V The Prevalence and Clinical Significance of Fatigue following Deep Brain Surgery in Parkinson's Disease.
81. PERRY AVERY, J Preterm - Birth Preschoolers With Intrauterine Growth Restriction: a Comparison of Neuropsychological Outcome With Birthweight Controls.
82. PULLEN, SJ Neuropsychiatric Outcomes Of Pediatric Deep Brain Stimulation.
83. RACINE, CA Effect of Subthalamic Nucleus (STN) Deep Brain Stimulation (DBS) on Cognition and Mood in Individuals with Primary Cranial and Cervical Dystonia.
84. RAMOS, V Predictors of Cognitive Ability in Preterm Infants with Bronchopulmonary Dysplasia at Preschool Age.
85. RANE, S Adaptive Functioning in Children with Spina Bifida Myelomeningocele (SBMM).
86. REESMAN, J Serial Neuropsychological Assessment of Sturge-Weber Syndrome Post-Hemispherectomy: 3 Case Presentations.
87. RYLAND, HK The protective effect of normal to high intellectual function on mental health in children with a chronic physical illness.
88. ~~SANCHEZ, S~~ ~~Cognitive Functioning Before and After Kidney Transplant.~~
89. SCHWARTZ, DD Neuropsychological Screening at Diabetes Diagnosis: Preliminary Findings.
90. SMART, CM Mentoring in Neuropsychology: Incidence and Impact on Professional and Psychosocial Functioning with a Focus on Women and Minorities.
91. SUHR, J Relation of Cogniphobia to Cognitive Test Performance in Chronic Headache.
92. WARD, J Cognitive Functioning and Work Status in Systemic Lupus Erythematosus.

**10:15–11:45 AM****Invited Symposium: Structural and Functional Cerebral Asymmetries: Handedness, Hormones, and Developmental Disorders.****Chair: Ian Kirk****Diamante Ballroom II**

1. KIRK, IJ Structural and Functional Cerebral Asymmetries: Handedness, Hormones, and Developmental Disorders.
2. KIRK, IJ Hemispheric Asymmetries in White Matter Architecture.
3. BADZAKOVA, G Functional Lateralization and Handedness: an fMRI Study.
4. WALDIE, KE Brain Activity in Bilingual Developmental Dyslexia During Lexical Decision Tasks.
5. HAUSMANN, M Sex Hormones and Plasticity in Functional Brain Asymmetries.

**10:45 AM–12:15 PM**

1. SUMOWSKI, JF
2. BIGLER, ED
3. SUMOWSKI, JF
4. ROE, CM
5. STERN, Y

**Symposium 4: The Cognitive Reserve Hypothesis: Clinical Expression of Neurologic Disease Across the Lifespan**

**Chair: James Sumowski, Discussant: Yaakov Stern**  
**Diamante Ballroom III**

- The Cognitive Reserve Hypothesis: Clinical Expression of Neurologic Disease Across the Lifespan.  
 Cognitive Reserve in Pediatric Traumatic Brain Injury.  
 Lifetime Intellectual Enrichment Lessens the Negative Impact of Brain Atrophy on Cognition in Multiple Sclerosis.  
 Alzheimer's and Cognitive Reserve: Education Effect Varies with [<sup>11</sup>C]PIB Uptake.  
 fMRI studies of Cognitive Reserve in Aging.

**10:45 AM–12:15 PM**

1. ORCHINIK, L
2. CLARK, CA
3. PA, J
4. CONKLIN, HM
5. ANDERSON, VA

**Paper Session 3: Executive Functions**  
**Diamante Ballroom I**

- Effects of extreme prematurity on executive function and other cognitive measures in kindergarten.  
 AN ENRICHED HOME ENVIRONMENT IS ASSOCIATED WITH ADVANCED EARLY EXECUTIVE CAPABILITIES.  
 Gray Matter Correlates of Set-Shifting in Neurodegenerative Disease.  
 Working Memory Performance in Childhood Brain Tumor Survivors.  
 Children's Executive Functions And Age at Brain Insult.

**11:30 AM–1:00 PM**

1. ARANGO, JC
2. DIAS, AM
3. FYRBERG,
4. GRILLI, MD
5. HAMILTON, RH
6. ~~HICKEY, EM~~
7. KESSLER, R
8. LÓPEZ LOZANO, DM
9. ~~MACSWEEN, J~~
10. ~~MENDOZA GONZALEZ, E~~
11. MEZA-CAVAZOS, S
12. PHILLIPS, PA
13. RITCHIE, LJ
14. SMART, CM
15. SUMOWSKI, JF
16. ~~VAN DEUSEN, A~~
17. VANCE, D
18. WELFRINGER, A
19. CERNICH, AN
20. HAJEK, CA
21. HEVERLY-FITT, S
22. HSU, C
23. SCOTT, CA
24. VANNEST, J
25. VAN RIJSBERGEN, MW

**Poster Session 3: Cognitive Intervention/Rehabilitation, Stroke/Aneurysm,TBI (Adult)**  
**Condesa Ballroom**

**Cognitive Intervention/Rehabilitation**

- Cognitive rehabilitation to improve learning and memory in Spanish-speaking individuals with traumatic brain injury.  
 Intentional Blood flow Perfusion in the Prefrontal Cortex, Cognitive Performance and Aging.  
 The effect of cognitive sequelae on communication skills in adolescents with Acquired Brain Injury (ABI).  
 Improving Prospective Memory with Self-Imagining in Individuals Who Have Neurologically-Based Memory Deficits.  
 Stimulating Conversation: Enhancement of Spontaneous Speech in a Patient with Chronic Nonfluent Aphasia Following Transcranial Magnetic Stimulation.  
~~Strength-based Rehabilitation for Adolescents with Chronic Acquired Brain Injury: Participant profiles and program satisfaction.~~  
 Comparing Error Patterns on Two Different Versions of the Naturalistic Action Test.  
 Neuropsychological Rehabilitation in a Case of Pure Alexia and Visual Search-field Disease.  
~~Evaluation of a Computerized Attention Training Program in Children with Fetal Alcohol Spectrum Disorder (FASD): A Pilot Feasibility Study.~~  
~~Mental imagery techniques in movement training of parietal superior limb.~~  
 Memory Improvement Workshops in a Mexican Academic Geriatric Centre.  
 Explicit Memory Training Facilitates Learning and Retention of Object-Location Associations in Patients with Amnesic Mild Cognitive Impairment.  
 A Case Study of Goal Management Training in an Inpatient Rehabilitation Setting Following ACoA Aneurysm Rupture.  
 An Open Trial of Mindfulness-Based Stress Reduction for Individuals with Mild Traumatic Brain Injury/Post-Concussive Syndrome.  
 Retrieval Practice Improves Memory in Persons with Traumatic Brain Injury.  
~~Improved EEG Neurofeedback Protocol for the Treatment of Major Depression.~~  
 Improving Speed of Processing in Adults Aging with HIV: A Pilot Study.  
 Visuomotor Imagery in Chronic Neglect Patients.

**Stroke/Aneurysm**

- Initial Findings from a Controlled Trial of Aerobic Exercise to Effect Cognition in the Chronic Stroke Population.  
 Cognitive Outcomes Following Ischemic Stroke in Children.  
 The Effect of Aortic Valve Replacement Surgery on Cognitive Functioning: Prospective Neuropsychological Comparison to Disease-Matched Controls.  
 The Effects of Carotid Artery Stenting on Neuropsychological Performance in Taiwanese Male Samples: A Preliminary Study.  
 Awareness of Deficit and Driving Simulator Performance after Stroke.  
 Post-stroke aphasia recovery assessment in chronic stroke using repetitive fMRI and picture naming test.  
 Cognitive Complaints after Stroke: No Differences with the Healthy Population.

**TBI (Adult)**

26. ARANGO, JC Nueropsychological and neurobehavioral profile of a group of individuals with Traumatic Brain Injury from Colombia, South America.
27. ASMUSSEN, SB Mild Traumatic Brain Injury: Personality Assessment in the Military Population.
28. BANOS, JH Impact of Traumatic Brain Injury on Ratings of Emotion-Invoking Photographs: Preliminary Data.
29. BELKONEN, S The Relationship Between Performance on Neuropsychological Tests of Memory and Self-Reported Memory Difficulties in Older Adults with Traumatic Brain Injury (TBI).
30. BIELIAUSKAS, LA Enough is Enough: Minimizing Redundancy When Assessing Emotional Function in Veterans with Traumatic Brain Injury.
31. BINEY, F The Relationship Between BAL and Outcome at 6 Months Post Injury in Severe TBI Adults: Effects of Best Day 1 GCS and Age.
32. CHIOU, KS Effects of Task Structure on Metacognition in Traumatic Brain Injury.
33. CLARK, A Measuring Attention Impairments in Mild Head Injury.
34. CLARK, JA Neuropsychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.
35. DESORMEAU, JS Quality of Life and Emotional Well-Being in People with a TBI 1 to 7 Years after Rehabilitation.
36. DIKMEN, S Post Traumatic Symptoms in Patients with Complicated Mild TBI.
37. DOMEN, CH Psychometrics of Timed Alphabet Writing Forward and Backward Among Veterans Suspected of Traumatic Brain Injury.
38. FAIR, JE Negative Affect Predicts Performance-Monitoring Dysfunction beyond Cognitive Performance in Survivors of Severe Traumatic Brain Injury.
39. HAMMEKE, T Measurement of Response Bias in a Postconcussion Symptom Scale.
40. HAMMEKE, T Dizziness After Concussion Is Associated with Attentional Problems.
41. HARP, JP Neuropsychological Profile Patterns of Combat Veterans Feigning Mild Head Trauma.
42. ~~HENRY, LC~~ ~~Metabolic disturbances in the concussed brain: Acute and post-acute findings using MRS.~~
43. HIMANEN, LM COGNITIVE FUNCTIONS AND APOLIPOPROTEIN GENOTYPES IN CHRONIC TRAUMATIC BRAIN INJURY.
44. HOELZLE, J Blast-Related Concussion (mTBI): Preliminary Neuropsychological Findings.
45. HOLCOMB, M How Is Sleep Disturbance Related to TBI Status, Cognitive Performance, and Affective Symptoms in OEF/OIF Veterans?
46. HOLDNACK, J Social Perception Deficits after Moderate to Severe Traumatic Brain Injury.
47. ~~HULL, A~~ ~~Comparison of the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) and Neuropsychological Assessment Battery Screening Module (S-NAB) in Veterans Who Screened Positive for History of TBI.~~
48. HUNGERFORD, L Comparison of Mechanism of Injury in Soldiers with Mild Traumatic Brain Injury.
49. HUNGERFORD, L Multi-Tiered Approach To Evaluation and Treatment of Mild Traumatic Brain Injury In A Military Environment.
50. JACKSON, A Full Scale IQ and Independent Living after ABI: More than just a Number.
51. KELLEY, E Patient-Informant (PI) Discrepancy Ratings 5 – 15 years Post-Injury After Moderate to Severe Traumatic Brain Injury (msTBI): Relation to Injury Severity and Vocational Outcome.
52. KELLY, MA Decision Making after Traumatic Brain Injury: Attempting to Identify Impairments in Social Functioning Using a Novel Task.
53. KRISHNAN, K Structural And Functional Connectivity of Hippocampal Circuits after Diffuse Axonal Injury.
54. KROL, A Does an Athlete's Level of Fitness Impact the Report of Concussion Symptoms?
55. LABBE, D Body Mass Index Following Traumatic Brain Injury.
56. LANGE, RT Influence of Depression on Postconcussion Symptom Reporting Following Mild Traumatic Brain Injury.
57. LANGE, RT Influence of Poor Cognitive Effort on Self Reported Symptoms and Neurocognitive Test Performance Following Mild Traumatic Brain Injury.
58. LANGE, RT Examination of the 'Good Old Days' Bias Following Mild Traumatic Brain Injury: A Retrospective Rosy View of the Past.
59. LIPPA, SM Blast and Non-blast Related Traumatic Brain Injuries in Afghanistan and Iraq War Veterans: An Analysis of Post-concussive Symptom Report.
60. LOUGHLIN, J The Relationship Between Patient Community Integration, Caregiver Burden, and Caregiver Life Satisfaction 5-15 Years After Moderate to Severe TBI.
61. LUC, N Quantitative Tractography of the Fornix and Associations with Working Memory in Veterans with Traumatic Brain Injury.
62. MEACHEN, S Awareness of Deficit and Cortisol Stress Reactivity in Persons with TBI and Their Caregivers.
63. MEDAGLIA, JD Involvement of the Cerebellum in Task Proceduralization and Speeded Performance in Adult TBI.
64. MEETH, SK Prediction of Return to Productivity 3 Months Following Hospitalisation for Trauma.
65. O'DELL, KM Ethnic, Gender, and Age Differences in Blood Alcohol Level upon Admission to a Level 1 Trauma Center in a Sample of Severe TBI Patients.
66. OZEN, LJ Persistent Attention and Memory Impairments in Young Adults With a Mild Head Injury.
67. PENNA, S Residence Following Traumatic Brain Injury: A Longitudinal Study.
68. RAMANATHAN, D Axial Diffusivity and Fractional Anisotropy Correlate With Performance Following Traumatic Brain Injury.
69. RAMANATHAN, D A Longitudinal fMRI Investigation of Recovery From Concussion.

70. RAMIREZ, M RELATIONSHIP BETWEEN SELF-AWARENESS, COGNITION AND OUTCOME IN TRAUMATIC BRAIN INJURY.
71. SARAH, GL Reliability and Validity of the Hospital Anxiety and Depression Scale Among Veterans Suspected of Having a Traumatic Brain Injury.
72. SCHIEHSER, D Different Maladaptive Behaviors Are Associated With Specific Patterns Of Emotional And Cognitive Changes Following TBI.
73. SHANDERA, AL Psychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.
74. SPENCER, RJ Mild Traumatic Brain Injury has a Small Effect on Cognitive Performance among Returning Soldiers: Preliminary Findings.
75. SWARTWOUT, MD Relationship of Pre-Injury Family Environment to Community Integration in Adults with Traumatic Brain Injury.
76. SWIER-VOSNOS, A Factors Influencing Clinical Decision-Making in a VA TBI Clinic.
77. TARTAR, S Neuropsychological Functioning Following Mild Traumatic Brain Injury: Complicated versus Uncomplicated Injury Outcomes.
78. TSAO, JW Trail Making Test A and B and Verbal Fluency Performance in Military Personnel Following Blast Exposure In-Theater.
79. TUN, S Interim findings on diagnosis of PTSD predicting subjective cognitive complaints, and not objective cognitive performance in blast-exposed Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans.
80. VINCENT, A Cognitive Functioning Following Military Deployment.
81. WALDRON-PERRINE, B Predicting Functional Outcome After TBI: Unique Contributions of Facets of Religion/Spirituality.
82. WARDECKER, BM The Influence of Cognitive Functioning and Dispositional Optimism on Psychological Distress After Traumatic Brain Injury.
83. WU, TC Alterations of the Cerebral Peduncle Following Severe Traumatic Brain Injury.
- Assessment/Psychometrics/Methods (Adult)**
84. DAMS-O'CONNOR, K The Factor Structure of the Brain Injury Screening Questionnaire (BISQ).
85. DAMS-O'CONNOR, K Ethnic Group Differences in Symptom Reporting on the Brain Injury Screening Questionnaire (BISQ).
86. DAMS-O'CONNOR, K The Relative Utility of the URICA-TBI and the SADI as a Rehabilitation Readiness Screening Tool.

**12:00–1:30 PM**

1. MOYER, KH
2. VON AH, D
3. CLANTON, NR
4. ARMSTRONG, CL
5. ANNETT, RD

**Paper Session 4: Cancer  
Diamante Ballroom II**

Clinical Significance and Ecological Impact of Attention Deficits in Pediatric Cancer Survivors.  
Effect of Cognitive Impairment on Quality of Life Among Breast Cancer Survivors.  
Fatigue, Vitality, Sleep Quality, and Neurocognitive Functioning in Adult Survivors of Childhood Cancer: A Report From the Childhood Cancer Survivor Study.  
Radiotherapy Damage Affects Semantic Memory Networks: A Group Controlled Prospective Study.  
Acute And Long-Term Neuropsychological Impairment Associated With Chemotherapy And Whole Brain Radiotherapy For Children Treated For Intermediate Risk Leukemia.

**1:00–4:00 PM****Thursday Afternoon Continuing Education Courses  
Refer to CE Schedule for Location****2:00–3:00 PM****Invited Address: Neurocognitive Endophenotypes for Bipolar Disorder  
Identified in Multiplex Multigenerational Families from Latin America  
Speaker: Humberto Nicolini  
Diamante Ballroom III**

1. NICOLINI, H

Neurocognitive Endophenotypes for Bipolar Disorder Identified in Multiplex Multigenerational Families from Latin America.

**2:00–3:30 PM****Paper Session 5: Imaging  
Diamante Ballroom I**

1. CASTILLO, E
2. KAMATH, V
3. RUIZ, SM
4. JERRAM, M
5. VANNORS DALL, TD

Right Hemisphere Damage and Attentional Control: a MEG Study.  
Orbitofrontal Morphology Correlates with Cognitive Flexibility and Memory in Bipolar Disorder.  
Alcoholism and Gender Effects in Relation to Measures of Alcoholism Severity, Alcohol Craving, and Regional Brain Volumes.  
Examining the Neural Correlates of the Color-Word Interference Test (CWIT) using Voxel-Based Morphometry.  
Neuroanatomic Correlates of Automatic and Controlled Processes in Verbal Fluency.

## 3:45–5:15 PM

**Poster Session 4: Behavioral Neurology, Cancer, Cognitive Neuroscience, Electrophysiology/EEG/ERP, Epilepsy/Seizures, Language and Speech Functions/Aphasia**  
**Condessa Ballroom**

**Behavioral Neurology**

1. ASSURAS, S  
Neuropsychological Profile of Adults with Chiari I Malformation.
2. FELIX, L  
NF-2: A Case Study of Complex Neurobehavioral Disability.
3. HALEY, AP  
Subjective Cognitive Complaints, Blood Pressure, Mood, and Cerebrovascular Response to Cognitive Function in Midlife.
4. KESAYAN, T  
Allocentric vs Egocentric Spacial Performance in Normals.
5. KOHL, A  
Processing Speed Mediates the Relationship Between Increased Neurological Events and Academic Achievement in Adult Survivors of Childhood Brain Tumors.
6. KOPALD, B  
Cognitive Functioning in Children with Chiari Malformation Type I.
7. KRUEGER, CE  
Know Thyself: Real World Behavioral Correlates of Self-Appraisal Accuracy.
8. PENNER, K  
Neurodevelopmental profiling in school-aged children referred for possible Alcohol Related Neurodevelopmental Disorder (ARND).
9. POORZAND, P  
A Simple Rating Scale Identifies Distinct Patterns of Interpersonal Behavior in AD, SemD, and bvFTD.

**Cancer**

10. BORDES, V  
Differentiating Psychosocial and Health-Related Quality of Life for Children Following Hematopoietic Cell Transplant for ALL or AML.
11. CASTELLON, S  
Subjective and Objective Characteristics of Cognitive Functioning Following Breast Cancer Treatment.
12. JAIN, N  
Neurobehavioral Functioning and Fatigue in Very Long-Term Survivors of Hodgkin's Lymphoma.
13. MARTIN, R  
Longitudinal Study of Twins Discordant for Brain Tumor and Radiation Therapy.
14. MELTON, A  
Influence of COMT Gene Variant on Working Memory in Survivors of Childhood Brain Tumors.
15. NETSON, KL  
Parent and Teacher Ratings of Attention during a Year-Long Methylphenidate Trial in Children Treated for Childhood Cancer.
16. PATWARDHAN, SY  
Assessment of the Efficacy of Immediate Release Methylphenidate, Sustained Release Methylphenidate, and Modafinil for Patients with Primary Brain Tumor.

**Cognitive Neuroscience**

17. ALVAREZ-TOSTADO, JP  
The Effect of Age and Gender in Sexually Dimorphic Tasks.
18. ARMSTRONG, CL  
Neuroanatomical Correlates of Auditory Selective Attention.
19. ARMSTRONG, KM  
Meta-Cognition in Obsessive-Compulsive Disorder: An Evaluation of Implicit Learning and Thought-Focused Attention.
20. BISIACCHI, P  
Cognitive Alterations in Cirrhotic Patients with Minimal Hepatic Encephalopathy investigated with the Inhibitory Control Test.
21. CHAKRABORTY, BH  
Influence of Parasympathetic and Sympathetic Activity on Pupillary Dilation Elicited During the Digit Span Task.
22. CLARK, CA  
NEUROLOGICAL STRUCTURE AND ASSOCIATED TRAJECTORIES OF ACADEMIC ACHIEVEMENT AMONGST CHILDREN OF DIFFERING BIRTH WEIGHTS.
23. CORREIA-PASSINHAS, R  
About the Interdependence between Clustering and Switching in Successful Semantic Verbal Fluency: a Non-linear Approach.
24. ~~DIAS, AM~~  
~~Modeling the Cognitive and Neurobiological Basis of the Process of Coping with Bargains in the Ultimatum Game.~~
25. EVANS, KL  
Is There a Male Advantage on Tasks Recruiting the Ventral Prefrontal Cortex?
26. GILBERT, CD  
Associations Between Schizotypy and Executive Function in a Large Healthy Sample [The UCLA LA2K Study].
27. GOEDERT, KM  
Prism Adaptation and Spatial Bias in Young and Aged Subjects: Adaptation Depends on Pre-Existing Bias Direction.
28. GOEDERT, KM  
Spatial "Aiming" Motor Intentional Systems Adapt to Left-, But Not Right-Shifting Optical Prisms.
29. GONZÁLEZ-OSORNIO, MG  
A psychobiological approach to personality: examination between sexual orientation.
30. JIRIK-BABB, P  
Cognitive Neuropsychology of Spatial Processing.
31. KILLGORE, WD  
Sex Differences in Cortico-Limbic Responses to Images of High Calorie Food.
32. KOTSOPOULOS, E  
Visual Selective Attention: The Effect of Temporal Separation and Perceptual Load on Distractor Interference.
33. KOTSOPOULOS, E  
Visual Selective Attention: The Effect of Perceptual Load and Working Memory Demand on Distractor Interference.
34. LARSON, MJ  
Cognitive Control, Performance Monitoring, and Neurocognitive Functioning: Is Bigger Really Better?
35. LOPEZ-FRANCO, A  
Visual Word Recognition In Children And Adults.
36. MCCLINTOCK, SM  
Differential Effects of Magnetic and Electric Seizure Therapy on Strategies for Spatial Working Memory.
37. MURPHY, K  
Phonetically Irregular Word Pronunciation and Cortical Thickness in the Adult Brain.
38. NAVARRETE, G  
Neural Networks on Phonetic Verbal Fluency: Discovering Language-Specific Variables.
39. PAQUETTE, N  
Using Near-Infrared Spectroscopy to Assess Receptive Language in Healthy Adults.

40. SABB, FW  
Covariation between measures of executive function: Experimental correlates for Task-Switching in a healthy community sample [The UCLA LA2k Study].
41. SCHMID, MT  
Executive functioning in patients with First episode Major Depression and in patients with Recurrent Major Depression- Preliminary results.
42. ~~SITSKOORN, M~~  
~~Neural Correlates of the Seven Sins.~~
43. THOMAS, NA  
Do Perceptual Asymmetries Differ in Peripersonal and Extrapersonal Space?
44. VALLUZZI, JA  
Chronotype and Neuropsychological Measures of Cognitive Ability in a Large Community Sample [The UCLA LA2k Study].
45. YAMIN, S  
The Role of Task Difficulty on Processing and Storage in Working Memory: Evidence for Single Capacity Models.
46. YAMIN, S  
Understanding the Relationship between Task Switching and Working Memory: Using a Modified Task-Span Procedure.
47. ZUCKERMAN, K  
Comparing Three Childrens Draw-a Clock Test Systems: Quantifying Qualitative Errors.
48. ÅRDAL, G  
Impaired cognitive inhibition - a trait marker for recurrent depression? Results from a ten year follow up study.
- Electrophysiology/EEG/ERP**
49. GOOD, DA  
Empathy and Error Processing.
50. KILLGORE, WD  
Intellectual Capacity is Related to REM Sleep Following Sleep Deprivation.
51. LUKIE, C  
Neural Mechanisms of Individual Differences in Personality Traits.
52. MOLFESE, P  
Neural Correlates of Response to Intervention in Children.
53. SOLIS, R  
Involuntary attention in Parkinson's disease: an event related potential study.
- Epilepsy/Seizures**
54. BLACKSTONE, K  
Executive Functioning Profile in Pediatric Epilepsy.
55. BLACKWELL, M  
Behavioral Difficulties after Left and Right Hemispherectomy.
56. BOATWRIGHT, BA  
MCMI-III Dependent Scale and Differentiation of Epileptic and Non-Epileptic Seizure Patients.
57. BOGOD, NM  
Very rapid forgetting and autobiographical memory loss in new onset ideopathic adult epilepsy.
58. BONGIOLATTI, SR  
Attention in Children with Epilepsy and Co-Morbid Sleep Disturbance.
59. BUSCH, RM  
APOE ε4 is Not Related to Hippocampal or Brain Volume in Patients with Medically Intractable Temporal Lobe Epilepsy.
60. CHAPIN, JS  
Development of an equation to predict risk of verbal memory decline after left temporal lobectomy.
61. HUNTER, SJ  
Neurocognitive and Behavioral Outcomes of Pediatric Epilepsy Surgery.
62. KARANTZOULIS, S  
Associative Memory Following Anterior Temporal Lobectomy.
63. KORMAN, BM  
Memory in Pediatric Epilepsy: Effects of Histopathology and Lesion Location on Word List Retrieval.
64. KRISHNAN, M  
The Roles of Depression, Healthcare Attitudes, and Beliefs in Predicting Anti-Epileptic Drug Adherence.
65. LEE, J  
General Cognitive Functioning Following Hemispherectomy in Children with Intractable Seizures.
66. LUNDY KRIGBAUM, S  
Emotional, Behavioral and Executive Dysfunction is Associated with a Greater Degree of Epileptiform Discharges in Children with Benign Rolandic Epilepsy with Centro-Temporal Spikes (BRECTS).
67. NASLUND, J  
Comparison of language and semantic memory abilities in left and right mesial temporal sclerosis.
68. PATEL, SM  
The Relationship Between Language and Verbal Memory in Mesial Temporal Lobe Epilepsy Patients with Right Hemisphere Speech.
69. PHILLIPS, KD  
Cognitive and Behavioral Outcomes in Pediatric Epilepsy Surgery: The Significance of Attention.
70. PHILLIPS, PA  
Memory of Complex, Three-Dimensional Objects Appears Sensitive to Visuospatial Memory Deficits in Patients After Unilateral Amygdalohippocampectomy.
71. PULSIPHER, DT  
Developmental Changes in Frontal-Subcortical Circuitry in Pediatric Idiopathic Generalized Epilepsy: A Voxel-Based Morphometry Study.
72. SANZ, JH  
Behavioral Predictors of Quality of Life Following Hemispherectomy Surgery.
73. SMITH, MM  
Personality Characteristics in Patients with Epileptic Vs. Nonepileptic Seizures.
74. SOPER, AC  
A Neurosurgical Case Report of Transient Epileptic Amnesia.
75. STROBER, L  
Psychometric properties of the Beck Depression Inventory-II (BDI-II), Beck Depression Inventory-Fast Screen (BDI-FS) and Center for Epidemiological Studies-Depression (CES-D) in an epilepsy sample: Are our present measures sufficient?
76. STROBER, L  
Beyond endorsement: A closer look at the impact of seizure activity and antiepileptic medication side effects on patients' reports of depression.
77. WALKOWIAK, JL  
Reading Performance in Children with Localization Related Epilepsy.
78. WILSON, R  
Language and Visual-Spatial Function Following Hemispherectomy.
79. WITTENBERG, D  
Verbal and Nonverbal Memory Function in Right vs. Left MTS.
80. ZAYTSEV, L  
Long-Term Sequelae of Neonatal, Early Childhood, and Late Childhood Onset Seizures.
- Language and Speech Functions/Aphasia**
81. ALTMANN, LJ  
Training Effects on Repetition Priming of Picture Naming: Generalization to Untrained Items.
82. ALTMANN, LJ  
Effects of Working Memory and Executive Function on Language Production.
83. BENNETT, J  
Hispanic Bilinguals and Verbal Fluency Performance.
84. FOLSOM, RC  
Semantic Analysis of Awareness of Consequences in Agenesis of the Corpus.

85. GIDLEY LARSON, JC The Contribution of Language to Motor Control.  
 86. LACEY, EH Development of an Overlearning Treatment Paradigm for Naming in Aphasia.  
 87. TELLEZ, H Neuropsychological Study of Pragmatics.  
 88. WAMBAUGH, J ~~Generalization Effects of Semantic Feature Training for Word Retrieval Deficits in Agrammatic Aphasia.~~  
 89. WRIGHT, HH Narrative Discourse Processing in Aphasia.
- ADHD/Attentional Functions**
90. GOPIN, C The Influence of IQ on Neuropsychological Profiles in Preschoolers with ADHD and ADHD+ODD.  
 91. GOPIN, C ADHD Preschoolers with and without ODD: Sensitivity to Task Engagement/Reward?  
 92. RABINOVITZ, B Language Ability and Lateralized Motor Functions in Children: Evidence for Reduced Hemispheric Specialization in ADHD.

**4:00–5:30 PM****Paper Session 6: Dementia  
Diamante Ballroom III**

1. GIOVANNETTI, T Distractor Interference in Everyday Action: Evidence from Participants with Dementia.
2. KANE, T Visual Confrontation Naming Associated with Left Inferior Temporal Gray Matter Volume in Alzheimer's Disease and Mild Cognitive Impairment.
3. POSSIN, KL Visual Spatial Construction Deficits are Due to Impairments in Different Neural Mechanisms in Alzheimer's Disease and Frontotemporal Dementia.
4. BETTCHER, BM The Task Training Naturalistic Action Test: Increasing Everyday Error Detection, One Picture At A Time.

**4:00–5:30 PM****Symposium 5: Beyond the Mean: Variability as an Outcome in ADHD, MS, and Concussion  
Chair: Peter Arnett  
Diamante Ballroom II**

1. ARNETT, P Beyond the Mean: Variability as an Outcome in ADHD, MS, and Concussion.
2. RABINOWITZ, A Intraindividual Variability and Baseline Concussion Testing: Implications for Motivation.
3. BARWICK, F Relationship between Personality Factors and Post-Concussion Changes in Neuropsychological Performance Mean and Variability among College Athletes.
4. BRUCE, J Response Variability is Associated with Self-Reported Cognitive Fatigue in Multiple Sclerosis.
5. VARGAS, G Change in Performance Variability Predicts Worry in Multiple Sclerosis Patients.
6. KARALUNAS, S Patterns of Variability in ADHD & Association with Symptom Domains.

**4:15–5:15 PM****Invited Address: Neuroimaging In Single-Case Neuropsychological Studies  
Speaker: Mitchell Valdes-Sosa  
Diamante Ballroom I**

1. VALDES-SOSA, MJ Neuroimaging in single-case neuropsychological studies.

**5:30–6:30 PM****Birch Lecture: The Importance Of Cross-Syndrome Comparisons: A Neuroconstructivist, Domain-Relevant Approach  
Speaker: Annette Karmiloff-Smith  
Diamante Ballroom I**

1. KARMILOFF- SMITH, AD The Importance Of Cross-Syndrome Comparisons: A Neuroconstructivist, Domain-Relevant Approach.

**FRIDAY, FEBRUARY 5, 2010****7:20–8:50 AM****Friday Morning Continuing Education Courses  
Refer to CE Schedule for Location****9:00–10:00 AM****Invited Address: Searching For The Rules Governing Brain Plasticity Throughout Life  
Speaker: Bryan Kolb  
Diamante Ballroom II**

1. KOLB, B Searching for the rules governing brain plasticity throughout life.

**9:00–10:30 AM**

1. RASKIN, S
2. ELLIS, J
3. KLIEGEL, M
4. WOODS, S
5. RASKIN, S

**Symposium 6: Recent Advances in Prospective Memory and Aging: From the Laboratory to Daily Life**

**Chair: Sarah Raskin, Discussant: Elizabeth Glisky  
Diamante Ballroom I**

- Recent Advances in Prospective Memory and Aging: From the Laboratory to Daily Life.  
Why are retrieval cues more accessible after an implementation intention is formed?  
The role of cognitive control and motivation in the age prospective memory paradox.  
Event-Based Prospective Memory in Older Adults with HIV Infection.  
The relationship between prospective memory, medication adherence and the onset of dementia.

**9:30–11:00 AM**

1. AGRANOVICH, A
2. CAGIGAS, XE
3. ~~CARR, L~~
4. CASAS, R
5. CHERNER, M
6. KAMAT, R
7. OJEDA, CA
8. PEREZ-ARCE, P
9. RIVERA, MO
10. SEDO, MA
11. SEDO, MA

**Poster Session 5: Cross-Cultural, Executive Function/Frontal Lobes, Imaging(Functional)  
Condesa Ballroom****Cross Cultural**

- The Culture of Time in Neuropsychological Assessment: Do Culture-Specific Time Attitudes Explain the Differences in Timed Test Performance between Russian and American Adults?  
Are bilingual norms the answer for research within the Latina/o community? Preliminary data from a large community sample [the UCLA LA2k].  
~~Neuropsychological Profiles of English and Spanish Speaking Children with Spina Bifida.~~  
Cross-Ethnic Equivalence of the Hopkins Symptom Checklist in Caucasian and Latino Adults in a Large Community Sample [the UCLA LA2k].  
Demographically Adjusted Norms for the Paced Auditory Serial Addition Task (PASAT) in Spanish.  
Literacy and Education Predict Neuropsychological Performance in a Cohort with a Broad Spectrum of Educational Levels.  
A List of Neuropsychological and Psychological Tests Available in Spanish: The Challenge of Testing Spanish Speakers.  
A Neurocognitive Comparison of Hispanic and White Welders Exposed to Manganese.  
Reading Instruction for English Language Learners.  
A STROOP FOR ALL PEOPLE IN ALL LANGUAGES?  
EXECUTIVE TESTING OF THREE INDIGENOUS GROUPS IN THE ANDES IN SPANISH AND IN QUECHUAN.

**Executive Functions/Frontal Lobes**

12. AERTS, S
  13. AMEZCUA GUTIÉRREZ, C
  14. ANDERSON, L
  15. BORJA, KC
  16. BORRANI, J
  17. BRITO, D
  18. BURTON, CZ
  19. CADAVIDI, N
  20. CADAVIDI, N
  21. CAMPBELL, J
  22. CANCELLIERE, A
  23. CHIOU, KS
  24. COOLIN, AC
  25. CORREIA, S
  26. CURIEL, A
  27. DOLAN, S
  28. DZIERZAK, E
  29. FELIX, L
  30. FIGUEROA, F
  31. FLAHERTY CRAIG, C
  32. FLORES LÁZARO, JC
  33. FLORES LÁZARO, JC
  34. FOURNIER, I
  35. GARCIA, A
- Executive Function and Functional Mobility in Parkinson's Disease.  
Cerebral Functionality During Visual Erotic Stimulation and While Solving the Towers of Hanoi: Effects of Sexual Arousal.  
Decision Making in Agenesis of the Corpus Callosum: Computational Analysis of the Iowa Gambling Task.  
Decision making in drug users.  
Behavioral Inhibition and Cognitive Flexibility in Juvenile Delinquents.  
Development of inhibitory response in pre-school age.  
Differential Effects of Executive Functioning on Suicide Attempts.  
What do Socio-economic Variables can tell us about Children Executive Functioning?  
Approaching Executive Function (EF) studies with Functional Analysis: An Ecological perspective.  
Using Cognitive Models to Explore Performance on Decision Making Tasks: The Importance of Dorsolateral Prefrontal Cortex Functioning in Establishing Payoff Expectancies.  
DKEFS Subtest Sensitivity in Traumatic Brain Injury.  
Relationship Between Executive Functioning and Metacognitive Monitoring Following Traumatic Brain Injury.  
Toward a Process-Pure Measure of False-Belief Reasoning in Adults.  
Frontal Systems Behavioral Scale and Cortical Atrophy in Frontotemporal Dementia.  
Predicting Cognitive Status Using Executive Functioning Measures.  
Executive Functioning is Related to Use of Relapse Prevention Coping Skills Utilized by Substance Abusers in Recovery.  
Dynamics of Changes of Executive Functions in Patients with Mild Traumatic Brain Injuries (MTBI).  
Executive Functioning Skills in High Functioning Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorder, Combined Type.  
"Correlation between neuropsychological and functional evaluation of the executive functions".  
Validation of the Penn State Brief Exam for Frontal and Temporal Dysfunction Syndromes (PSFTS) in Amyotrophic Lateral Sclerosis: Application of Guilford's Structure of Intellect Theory.  
Neuropsychological Study of Executive Functions Development from 6 to 30 years old.  
Risk Detection Development: Complexity Processing Models vs. Traditional Neuropsychological Interpretation.  
Executive functions in children : the contribution of socioeconomic status.  
Analysis of Behavioral Inhibition and Flexibility on a Shifting Criteria Task.

36. GARCIA, A Design of a map task to assess prevision.
37. GONZÁLEZ-OSORNIO, MG Personality correlates of Executive Functions in Problem Drinkers.
38. HARRELL, KM Processing Speed on the Trail Making Test in Agenesis of the Corpus Callosum.
39. HEINRICH, KP CANTAB Performance in Children Undergoing Open Heart Surgery.
40. HERNÁNDEZ, M Age-effect on the prefrontal-parietal correlation: Performance of the Tower of Hanoi task.
41. JACOBSON, L Verbal Working Memory Influences Processing Speed and Reading Fluency Deficits in ADHD.
42. JACOBSON, L Executive Functions and Self-Care Initiation in Adolescents and Young Adults With Spina Bifida.
43. JOB, JM Executive Function and Memory in Children with Fetal Alcohol Spectrum Disorder.
44. JOSEPH, J Exploring Different Facets of Impulsive Sensation Seeking in a Response Inhibition Task.
45. KELLY, NC Executive Functioning and Psychosocial Adjustment in Young Adolescents with Spina Bifida.
46. KHEN, S Gender Effects on Executive Functions in Behaviorally Disturbed Adolescents.
47. KILLGORE, WD Caffeine Minimizes Behavioral Risk-Taking During 75 Hours of Sleep Deprivation.
48. KILLGORE, WD Vulnerability to Sleep Loss is Affected by Baseline Executive Function Capacity.
49. ~~LINDQVIST, S~~ Hot and Cool Executive Function in 4-12-year-olds: Development and Relations to Emotional Aspects.
50. LIPPA, SM Inhibition/switching is Not Necessarily Harder Than Inhibition: An Analysis of the D-KEFS Color-Word Interference Test.
51. LOZANO, A Multifactorial Characteristics of Executive Functions Development in Pre-schoolers.
52. LUBOYESKI KALKUT, E Subjective and Objective Neuropsychological Assessment of Executive Functioning in Young Adults.
53. MCCANN, S Latent Growth Curve (LGC) Analysis of the Development of Working Memory (WM) and Set-Shifting Abilities in a Prospective, Longitudinal Cohort of Children with Prenatal Cocaine Exposure (PCE).
54. MOLNAR, AE Relations Between Regions of the Cingulate and Cognitive Measures in Children with Dyslexia or ADHD.
55. NOVAKOVIC-AGOPIAN, T Assessment of Executive Functioning with Goal Processing Scale - a Complex "Real-Life" Functional Performance Test: Pilot Results.
56. O'HALLORAN, CJ Impairments in Dorsolateral, Mesial, and Orbito-Frontal Executive Functions Following Localised Cerebellar Lesions.
57. POSSIN, KL The EXAMINER 1-Back Test of Spatial Attention is Associated with Right Frontal-Parietal Grey Matter Volume in Neurodegenerative Disease.
58. RABIN, LA Academic Procrastination: The Role of Self-Reported Executive Function.
59. RAU, HK Profiles of Executive Functioning in Healthy Adults.
60. REYES AGUILAR, A Gender Differences in Executive Function: Emotional-Social Reasoning.
61. RIDDLE, T Aging Effects on Contingency Naming Test Performance.
62. ~~SANDOVAL, CS~~ FUNCTION EXECUTIVE EVALUATION: COGNITIVE FLEXIBILITY BASIS.
63. SIRA, C Psychometric Evaluation of The Twelve Elements Test and Other Commonly Used Measures of Executive Function.
64. SMAIL, JB Neuropsychological Evaluation of Deaf Children's Executive Functions.
65. THORGUSEN, SR Working Memory Span Predicts Neuroticism.
66. TUMINELLO, ER Discrepancies between IQ and Executive Functioning are associated with Socioeconomic Status and Substance Abuse.
- Imaging (Functional)**
67. BUTTS, AM Resting State Functional Connectivity: Influence of Risk Factors for AD.
68. CASTILLO, EM Integrity of the Corticospinal Tract and Periorlandic Slowing after Stroke.
69. ~~FELDMANN, A~~ Self-recognition and self-allocation in egocentric and allocentric reference frames: an fMRI study.
70. ~~FELDMANN, A~~ Neurocognitive pathways of high impulsivity and conflicted risk perception: An fMRI study measuring response inhibition in a Go/No go task on a non-clinical sample.
71. GENOVA, HM Throwing the Baby Out with the Movement Artifact: Movement as a Source of Systematic Error in fMRI.
72. GONZALES, M Impact of Obesity and Hypertension on Working Memory: an fMRI Study.
73. HARRELL, WR Functional MRI and Working Memory in Children with Chronic Kidney Disease.
74. JOHNSON, S Early cerebral blood flow change in cognitively normal middle-age subjects who have high risk for Alzheimer's disease.
75. KILLGORE, WD Self-Reported Insomnia is Associated with Increased Activation within the Default-Mode Network During a Simple Attention Task.
76. KRIVITZKY, L A novel task of working memory and inhibitory control for fMRI: Pilot study in mTBI and healthy children.
77. LALUZ, VR Frontotemporal Dementia Patients Show Increased Dorsolateral Prefrontal Cortex Activation on a Cognitive Control Task Relative to Healthy Controls.
78. ~~MCKENNA, B~~ Isolating Component Processes of Verbal Working Memory using fMRI.
79. MCQUEENY, T Functional Connectivity and Age-Related Gender Differences in Inhibitory Processing Across Adolescence.
80. MECHANIC-HAMILTON, D Default Network Response to a Working Memory Challenge after Withdrawal of CPAP Treatment for Obstructive Sleep Apnea.
81. MILLER, KJ Brain metabolism using FDG-PET among individuals classified with Overt Primary and Subclinical Hypothyroidism.
82. MULLIGAN, RC An FMRI Study of Smokers Performing an Inhibitory Control Task: Neural Correlates of Early Life Stress.
83. PADULA, CB The Influence of Gender and Trauma on Brain Activation to Emotion Processing in Alcoholism.

84. PATEL, K  
 85. PENDERGRASS, C  
 86. SWEET, LH  
 87. SZATKOWSKA, I  
 88. VANNEST, J

An fMRI Investigation of Syntactic Verb Processing in Down Syndrome.  
 Cognitive, Emotion, and Motor Inhibition in Bipolar Disorder.  
 Effects of Nicotine Withdrawal on Verbal Working Memory and Associated Brain Response.  
 Functional MRI of Recognition Memory in the Hippocampus. A Preliminary Study.  
 fMRI of Self-generated versus Passive Memory Encoding.

#### ADHD/Attentional Functions

89. CZARNECKI, R

The Role of the Frontal Operculum in the Implementation of Response Sets.

#### Emotional Processes

90. TELLEZ-ALANIS, B

Impulsivity and Decision-Making: Gender Differences in the Iowa Gambling Task.

#### Learning Disabilities/Academic Skills

91. CIRINO, PT

Kindergarten Precursors of First Grade Academic Skills.

### 9:45–11:15 AM

#### Symposium 7: Cognitive Enhancement: From Physiologic to Behavioural and Virtual Tools.

Chair: Sophie Blanchet, Discussant: Shirley Fecteau

#### Diamante Ballroom III

1. BLANCHET, S  
 2. GAGNON, G  
 3. PIOLINO, P  
 4. FECTEAU, S  
 5. BLANCHET, S

Cognitive enhancement: from physiologic to behavioural and virtual tools.  
 Enhancing memory performance in young and healthy adults: A study with paired-pulse transcranial magnetic stimulation.  
 Cognitive enhancement on components of episodic memory and feature binding via virtual reality: new insight in traumatic brain injury.  
 Modulating decision-making and executive functions with brain stimulation in addiction.  
 Rehabilitation of cognitive disorders in relation to activities of daily living in individuals with vascular cognitive impairment.

### 10:15–11:45 AM

#### Symposium 8: The Non-Mexican Neuropsychologist's Guide to Mexico and Mexicans

Chair: Tedd Judd, Chair: Laura Renteria, Discussant: Feggy Ostrosky-Solis

#### Diamante Ballroom II

1. JUDD, T  
 2. DIAZ-LOVING, R  
 3. RENTERIA, L  
 4. KUCERA-THOMPSON, J  
 5. VILLASENOR, T

The Non-Mexican Neuropsychologist's Guide to Mexico and Mexicans.  
 Mexican Cultures, Languages, Institutions, and Migrations Pertinent to Neuropsychology.  
 Working with Mexican-Origin Clients in the U.S. from the Perspective of a Mexican-American Neuropsychologist.  
 Working with Mexican-Origin Clients in the U.S. as a Monolingual English Solo-Practice Neuropsychologist.  
 The State of Neuropsychology in Mexico.

### 10:45 AM–12:15 PM

#### Paper Session 7: Cognitive Intervention/Rehabilitation

#### Diamante Ballroom I

1. CLARE, L  
 2. THOMAS, KR  
 3. FASOTTI, L  
 4. ZEDLITZ, A  
 5. ELLIS, A

Goal-oriented Cognitive Rehabilitation for People with Early-stage Alzheimer's Disease: a Randomized Controlled Trial of Clinical Efficacy.  
 Supported Employment Plus Cognitive Training for Veterans with Traumatic Brain Injury.  
 Efficacy of a Multifaceted Treatment for Executive Dysfunction after Acquired Brain Injury: A Randomized Controlled Trial.  
 Fatigue after stroke can be treated with Cognitive and Graded Activity Training (COGRAT): Preliminary results of a RCT.  
 To See or Not to See: The Effects of Attention Allocation on Recall of Positive Information in Dysphoria.

### 11:30 AM–1:00 PM

#### Poster Session 6: ADHD/Attentional Functions, Assessment/Psychometrics/Methods (Child), Autism Spectrum Disorders, Learning Disabilities/Academic Skills, Multiple Sclerosis/ALS/Demyelinating Disorders

#### Condesa Ballroom

#### ADHD/Attentional Functions

1. ANDRESEN, E  
 2. BARRIOS, O  
 3. BEDARD, A  
 4. CHRISTOPHER, GB

Connor's Continuous Performance Test in Simulated ADHD.  
 Execution Time in a Planning and Organization Task Differentiates Children with and without ADHD.  
 Perceptual and Motor Inhibition in Adolescents/Young Adults with Childhood-Diagnosed ADHD.  
 Gender Differences in Executive Functioning for Children with ADHD, Predominantly Inattentive Type.

5. ~~ENINGER, LC~~  
 6. FLORES, AL  
 7. GEVA, R  
 8. GLASS, L  
 9. MARGOLIS, A  
 10. MARKS, AS  
 11. MARKS, DJ  
 12. MARKS, D  
 13. MLODNICKA, A  
 14. PARDEY, MC  
 15. RIOJAS, NG  
 16. SHANK, L  
 17. TALAMANTES, J  
 18. WASSERSTEIN, J  
 19. DÉRY, M  
 20. FLORES LÁZARO, JC  
 21. GIOIA, GA  
 22. HILL, J  
 23. HINOJOSA CALVO, E  
 24. ~~HORVATH, J~~  
 25. IVERSON, GL  
 26. JACKSON, A  
 27. KAUFMAN, J  
 28. KELLY, L  
 29. LEFFARD, S  
 30. MCCABE, M  
 31. MCGILL, C  
 32. PEREZ-ARCE, P  
 33. PETHERICK, MA  
 34. PÉPIN, M  
 35. VAURIO, R  
 36. VAN DER FLUIT, F  
 37. AINSWORTH, CR  
 38. BIGLER, ED  
 39. BIGLER, ED  
 40. CRUZ, N  
 41. HOLDNACK, J  
 42. HUNTER, SJ  
 43. LYONS, AM  
 44. PAWLUK, L  
 45. PAZIENZA, SR  
 46. STEPANSKY, M  
 47. TURECK, KK  
 48. VERBALIS, AD
- An Investigation of Risk Profiles of Early Temperament in Relation to Behavioral Problems:**  
 Emotional Dysregulation in Preschoolers Predicts Later ODD but not ADHD Adrienne L. Flores<sup>1</sup>, Anne-Claude V. Bedard, Ph.D., David J. Marks Ph.D., Jeffrey M. Halperin Ph.D. <sup>1</sup>Department of Psychology, Queens College, CUNY, 65-30 Kissena Blvd, Flushing, NY 11367.
- Attention Regulation Deficits in Infants with Brainstem Dysfunction.  
 Comparing WISC-IV Performance in an ADHD Sample.  
 Infant Self-Regulation of Affect vs. Attention Differs with Mother vs. Novel Partner.  
 Familial Aggregation of Inhibitory Control and State Regulation Deficits in Preschool Children with ADHD.  
 Bang for the Buck? The Impact of Early Remedial Interventions on Subsequent Neurocognitive Functioning in Children with ADHD.  
 Relationship of early IQ and parenting to subsequent academic achievement.  
 The Impact of Early Service Utilization on Later Attention Deficit/Hyperactivity Disorder Symptom Severity.  
 Long-term Effects on Cognitive and Neural Development Following Chronic Ritalin Treatment to Non-ADHD Adolescent Rats.  
 Analysis and comparison to the copy of the Rey Osterrieth Complex Figure in students between 12 and 15 with features of ADHD and controls in the state of Nuevo Leon.  
 Sleep Disturbance and Inspection Time in Children with Cerebral Palsy.  
 Analysis of indices of sustained attention on a continuous performance task.  
 Diagnosis of ADHD in Adults: What is the Appropriate DSM Symptom Threshold?
- Assessment/Psychometrics/Methods (Child)**  
 Motor and Cognitive Inhibition in Maltreated Children.  
 Presentation of a Neuropsychological Executive Functions Battery.  
 Parent report of Executive Function and Performance on the Tasks of Executive Control in children with ADHD.  
 Linking Alpha-Interferon and Cognitive Impairment in Pediatric Systemic Lupus Erythematosus.  
 Parent's Scale for Ecological Assessment of Executive Functions in Children.  
~~Distinguishing ADHD from Disorganized Attachment Based on Performance on the Test of Variables of Attention.~~  
 Identifying Cognitive Impairment in Children with Mood Disorders Using Computerized Testing.  
 ADHD Subtypes and Differential Neuropsychological Test Performance.  
 Visual Inspection Time and Graphomotor Processing Speed in Children With Cerebral Palsy.  
 The Impact of Language Processing Skills on Social and Communicative Adaptive Behavior Among Youth with Spina Bifida.  
 Moderators of Standard and Modified Inspection Times in Children with Cerebral Palsy.  
 What Does the Rey-Osterrieth Complex Figure Measure? Association with Ecologically Relevant Outcomes.  
 Psychometric Analysis of a Monitoring Version of the Behavior Rating Inventory of Executive Function (BRIEF-M).  
 Spanish-As-A-Second Language: Assessment Proficiency Training Model For Neuropsychologists.  
 Patterns of Cognitive Functioning in a Combined Normative and Clinical Sample: A Cluster Analytic Study of the WISC-IV.  
 The Development of Attention among 6 to 15 Year-Old Children from Four Different Cultural Backgrounds.  
 A Comparison of Patterns of Performance on Measures of Cognitive and Motor Ability in Children with HFA and ADHD.  
 Socio-Communicative Behaviors and Autism Spectrum Classification in Young Children with Williams Syndrome.
- Autism Spectrum Disorders**  
 Behavioral Profiles in Early versus Late Age of Diagnosis in Aspergers Syndrome.  
 The Profile of Memory Impairment in Autism.  
 Prominent Recency Effect in a List-Learning Task in Autism.  
 Executive Function and Adaptive Functioning in Children with Autistic Spectrum Disorders.  
 Social Perception Deficits in Adolescent and Adult Autism Spectrum Disorders.  
 Utility of the BASC-2 and BRIEF in Discriminating Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and Comorbid ASD/ADHD.  
 Patterns of Performance in Children with ASD and Clinical Controls on the Test of Everyday Attention for Children (TEA-Ch).  
 Parental Psychopathological and Child Cognitive Correlates of Social Functioning in Children with Autism Spectrum Disorders.  
 Social Responsiveness in Agenesis of the Corpus Callosum and High Functioning Autism.  
 Attention Difficulties in Children with Autism Spectrum Disorders.  
 Exergaming and Autism: Effects on Self-stimulatory Behaviors and Cognition.  
 Cognitive and Adaptive Stability in Male and Female Children with ASD.

49. WONG, C  
Head and Body Growth in Infants Later Diagnosed with Autism Spectrum Disorders: A Comparative Study of Optimal Outcome Children.
- Learning Disabilities/Academic Skills**
50. ALTAMIRANO-RIOS, M  
Numerical Distance Effect in Mental Arithmetic Operations.
51. ARMENGOL, CG  
Neuropsychological Correlates of Reading Proficiency in Elementary School Mexican Children from Two Socioeconomic Strata.
52. BOLAÑOS, M  
Neuropsychological Profile Subtypes in Mexican Children with School Failure.
53. CASEY, JE  
The Efficacy of an Advocacy Training Program for Parents of Children with Learning Disabilities.
54. CHAKRAVARTI, P  
Sulcal Variations of the Parietal Opercular Region in Relation to Dyslexia and Linguistic Abilities.
55. GONZÁLEZ REYES, A  
Subtypes of Written Expression in Children and Adolescents.
56. HALE, CR  
Patterns of WISC-IV Performance in Children with Persistent Academic Difficulties.
57. HOOPER, SR  
Neuropsychological Contributions to the Reading-Writing Connection: Written Language Disorder-Only Versus Written Language+Reading Disorder.
58. MESMAN, GR  
Reading Components as Predictors of Different Reading Outcomes.
59. PHAM, A  
Inattention as a Predictor of Rapid Automatized Naming and Higher-Level Reading Skills.
60. POLLOCK, B  
Distinct Memory Profiles in Children with Learning Disabilities: A Neuropsychological Perspective.
61. RACHES, D  
Complex Word Problem Solving Abilities in Children with Math and/or Reading Learning Difficulties.
62. RAGHUBAR, KP  
The Construction of Spatial Situation Models during Reading in Children with Spina Bifida and Their Typically Developing Peers.
63. RODRIGUEZ, E  
Orthographic Knowledge in Spanish in Young Adults.
64. RODRÍGUEZ NIETO, G  
Relationship Between Executive Functions and Mathematical Skills in Preschool Children.
65. RODRÍGUEZ-MALDONADO, DD  
Academic procrastination in students of psychology undergraduate program in a Mexican public University.
66. SEDO, MA  
EXECUTIVE FUNCTION AND THE READING-READINESS OF SCHOOLCHILDREN IN BRASIL.
67. STERN, SK  
The Double Deficit Hypothesis in Reading Disabled College Students.
68. UY, PJ  
Working Memory, Processing Speed, and Performance on the Paced Auditory Serial Addition Test (PASAT) in Adults with Learning Disabilities.
- Multiple Sclerosis/ALS/Demyelinating Disorders**
69. BARROSO, J  
The Association of Clinical Variables, Subjective Self-Reported Cognitive Impairment and Fatigue with Depression and Anxiety in Multiple Sclerosis.
70. BERRIGAN, LI  
An Investigation of the Contributions of Acquisition and Retrieval to Verbal Memory Impairment in Relapsing-Remitting Multiple Sclerosis.
71. BERRIGAN, L  
Longitudinal evaluation of information processing speed in persons with multiple sclerosis.
72. COVEROVER, Y  
Fatigue, Cognitive abilities, and functional performance in MS.
73. COVEROVER, Y  
Applying Self-Generated Learning to Improve Recall of functional Tasks: The Role of Executive Functioning versus Memory Abilities.
74. HOOGS, MM  
Employment Status Influences the Accuracy of Self-Reported Cognitive Impairment in Multiple Sclerosis (MS).
75. HOOGS, MM  
Type D Personality and its Correlates in Multiple Sclerosis Patients.
76. KOSMIDIS, MH  
Evaluating Premorbid Level: Preliminary Findings regarding the Vulnerability of Scores on Cognitive Measures in Patients with MS.
77. LANGILL, MA  
Remediation Efficacy of the Memory Notebook for Patients with Memory Dysfunction in Multiple Sclerosis: Follow-Up after One Year.
78. LEAVITT, VM  
Can Executive Dysfunction in Multiple Sclerosis Be Explained by Processing Speed Deficits?
79. LEAVITT, VM  
Activation Within the Default Network Uniquely Predicts Cognitive Status in Multiple Sclerosis Over and Above Brain Atrophy.
80. OZURA, A  
Personality characteristics, Coping and Self-esteem; a Rorschach Investigation with Multiple Sclerosis Patients.
81. RABINOWITZ, AR  
Depression and Quality of Life in Patients with MS: Unique and Shared Mechanisms.
82. RYAN, KA  
Driving Status and Community Integration in Multiple Sclerosis.
83. STRUTT, AM  
Frontal and Temporal Lobe Involvement on Verbal Fluency measures in ALS.
84. SUMOWSKI, JF  
MRI Evidence for the Primary Learning Deficit hypothesis in Multiple Sclerosis.
85. SWEET, LH  
Subvocal Articulatory Rehearsal during Verbal Working Memory in Multiple Sclerosis.
86. VARGAS, GA  
Performance Variability Predicts Future Disability in MS.
- Forensic Neuropsychology**
87. DENBOER, J  
Children's Performance on Memory for Complex Pictures©.
- Language and Speech Functions/Aphasia**
88. TELLEZ, H  
Differences in the Development of Metacognitive Strategies among School Children.

11:30 AM–1:00 PM

**Navigating Change at NIH/NIDA: Unlock the Mysteries of NIH Research Funding**  
**Diamante Ballroom III**

12:00–1:00 PM

**Invited Address: The Emotional Brain**  
**Speaker: Joseph LeDoux**  
**Diamante Ballroom II**

1. LEDOUX, J

The Emotional Brain.

1:00–4:00 PM

**Friday Afternoon Continuing Education Courses**  
**Refer to CE Schedule for Location**

2:00–3:30 PM

**Symposium 9: Evidence-Based Management of Sport-Related Concussion**  
**Chair: Christopher Randolph, Discussant: Scott Millis**  
**Diamante Ballroom I**

1. RANDOLPH, C

What are the real risks of sport-related concussion, and which are modifiable?

2. BARR, WB

Update on “baseline” testing and symptom checklists in managing sport-related concussion.

3. MCCREA, M

The natural history of recovery from concussion, and the effects of a symptom-free waiting period on recovery.

4. HAMMEKE, TA

Synthesis of available data and suggested rational approach to the management of sport-related concussion.

5. HAMMEKE, T

Evidence-Based Management of Sport-Related Concussion.

3:45–5:15 PM

**Poster Session 7: Dementia (Subcortical, Specific Disorders, MCI, etc.), Emotional Processes, Imaging (Structural), TBI (Child), Visoespatial Functions/Neglect/Agnosia**  
**Condesa Ballroom**

**Dementia (Subcortical, Specific Disorders, MCI, etc.)**

1. BANGEN, KJ

Resting State Cerebral Blood Flow and Brain Activation during Memory Encoding in Mild Cognitive Impairment: An Arterial Spin Labeling Study.

2. BOL, J

Why do Socially Intact Neurodegenerative Disease Patients Fail Cognitive Theory of Mind Tasks?

3. COPELAND, JN

Qualitative Comparison of Clock Drawing Errors in Patients with Parkinson’s Disease Dementia and Alzheimer’s Disease.

4. CORTÉS TORRES, G

Qualitative assesment of the Rey figure in patients with vascular, alzheimer and fronto-temporal dementia.

5. DELANO-WOOD, L

Entorhinal Cortex Thickness Differences by APOE Genotype in MCI and Normal Aging.

6. DELANO-WOOD, L

Elevated Stroke Risk Predicts Lower Hippocampal Volumes in Mild Cognitive Impairment and Normal Aging.

7. EDMONDS, EC

Face Memory Loss and Face Memory Distortion in Frontotemporal Dementia.

8. EPPIG, J

Verbal Serial List-Learning in Mild Cognitive Impairment.

9. EPPIG, J

Extra-List Intrusions in Mild Cognitive Impairment.

10. FUNES, CM

Assessing Daily Living Difficulties in Patients with Mild Cognitive Impairment Using a Performance-based Measure.

11. HIGGINSON, C

Measures of Visuoception Predict Disability in Parkinson’s Disease.

12. HSIEH, S

Recognition of Everyday Sounds and Famous Tunes in Semantic Dementia and Alzheimer’s disease.

13. JEFFERSON, AL

Neuroimaging correlates of instrumental activities of daily living in mild cognitive impairment.

14. JUÁREZ, S

Semantic memory and the evolution of mild cognitive impairment on patients with lacunar infarction.

15. KIRSCH-DARROW, LE

Apathy and Depression: Separate Factors in Parkinson’s Disease.

16. LOPEZ, L

Semantic Fluency: A Helpful Addition to the MMSE in Predicting Mild Cognitive Impairment.

17. LYNCH, W

Emotion Processing and Disinhibition in the Behavioral Variant of Frontotemporal Dementia.

18. MATEVOSYAN, A

Relationship Between Cognitive and Daily Functional Change Over a 1-Year Period in Patients with Dementia.

19. RAO, J

Examining the Semantic Interference Effect in Subtypes of Primary Progressive Aphasia.

20. SCHLICHTING, EG

Performance on the MMSE, MoCA, and Expanded-MoCA in Mild Cognitive Impairment and Dementia.

21. SETER, C

Everyday Action Task Knowledge and Executive Control: A Model for Omission and Commission Errors.

22. TAN, J

Classification of Mild Cognitive Impairment: Contributions of Cognitive and Functional Capacity Components.

23. TOOFANIAN, P

Sensitivity to Social Reward and Punishment in Neurodegenerative Disease.

24. WALLIN, M  
Cognitive and Quality of Life Changes in Neurocysticercosis.
- Emotional Processes**
25. ARMSTRONG, CL  
Emotion and the Cerebellum: A Pediatric Study.
26. AYALA BADGLEY, J  
Ratings of Emotional, Behavioral, and Cognitive Characteristics of Children with Systemic Lupus Erythematosus.
27. BOROD, JC  
Effects of Demographic Factors on the Emotion Perception Tasks from the New York Emotion Battery.
28. ELLIS, A  
Evidence of a Cognitive Priming Effect for Negative Information in Clinical Depression.
29. ~~FREITAS MAGALHÃES, A~~  
~~Facial expression: The recognition of basic emotions happiness and anger. Empirical study with Portuguese babies of aged between 04 and 08 months.~~
30. HARRIS, M  
Manganese Exposure in Welders: A Longitudinal Study of Mood over 3 years.
31. KILLGORE, WD  
Cerebral Correlates of Amygdala Responses to Masked Fear, Anger, and Happiness in Adolescent and Pre-Adolescent Children.
32. LOWE, DA  
Marital Status and Symptoms of Depression in Older Adults.
33. OROZCO, G  
Gender identity disorder affective evaluation.
34. PATERSON, TS  
Modeling Medication Adherence: Depression, Cognition, and Illness Variables as Contributors to Adherence by Renal Transplant Recipients.
35. STRAND, M  
Depression and information processing - is emotional visual search an appropriate paradigm?
36. VEDERMAN, AC  
Emotion Processing and Phase of Psychiatric Illness.
- Imaging (Structural)**
37. BERL, MM  
Differences in Organization of White Matter Associated with Working Memory Performance in Typical Children.
38. BRAHMACHARI, R  
Hippocampus Volumes and Memory: A Structural MRI Study.
39. BRAHMACHARI, R  
Cingulate Gyrus Volumes and Internalizing Disorders: A Structural MRI Study.
40. ~~FREUND, L~~  
~~The NIH MRI Study of normal brain development.~~
41. JOHNSON, CP  
Predicting Attentional Deficits Following Traumatic Brain Injury Through Dissociated White Matter Pathways of Attention: A Diffusion Tensor Tractography Study.
42. KLUTH, JT  
Diffusion Tensor Tractography of Hypoplastic Corpora Callosa in Spina Bifida.
43. LANCASTER, M  
Influence of Risk Factors for Alzheimer's Disease on White Matter Integrity: A Diffusion Tensor Imaging Study.
44. LEE, AK  
Neural Correlates of Impulsivity Factors: A Voxel-Based Morphometry Study.
45. MURPHY, M  
Relationship of Neuropsychological Performance and Brain Region in Patients Diagnosed with Parkinson's Disease.
46. QUITANIA, L  
Structural MRI variables relate to neuropsychological domains and everyday cognitive domains in similar ways.
47. SEIDEL, G  
Neuroimaging Predictors of Everyday Action Errors in Dementia.
48. STAMBROOK, E  
White Matter Lesion Volume and Cognitive Performance among Older Adults with Vascular Risk Factors.
49. SUSMARAS, TM  
Using The Lifetime History of Aggression – Revised Questionnaire and Voxel Based Morphometry to Investigate the Neural Correlates of Aggression.
50. SWAN, AA  
Hippocampus Volume is Related to Spatial Processing and Nonverbal Reasoning in Children.
51. TREBLE, A  
Regions of Increased and Decreased Cortical Complexity in Spina Bifida: An aMRI Study.
52. WILLIAMS, VJ  
Variation in Serum Cholesterol is Associated with Regional Changes in White Matter Tissue Integrity in Healthy Older Adults.
53. WISHART, H  
A novel approach for semi-automated segmentation of MS lesions on FLAIR imaging: Reliability and clinical correlates.
54. YALLAMPALLI, R  
White Matter Changes in Frontal and Temporal Regions Following Traumatic Brain Injury: Correlation with Visual and Verbal Memory.
- TBI (Child)**
55. BLAKELY, A  
Mean Diffusivity of the Orbitofrontal Cortex is Associated with Inhibitory Control in Children with TBI.
56. BROWN, S  
QUALITATIVE RESEARCH: ITS ROLE IN INVESTIGATING ADULT PSYCHOSOCIAL OUTCOMES POST PAEDIATRIC TBI.
57. EWING-COBBS, L  
Theory of Mind after Pediatric TBI: Relation with Microstructure of the Uncinate Fasciculus.
58. GIOIA, GA  
Characterizing Post-Concussion Exertional Effects in the Child and Adolescent.
59. GIOIA, GA  
Serial Assessment of Children and Adolescents with Mild TBI on the Tasks of Executive Control.
60. GIOIA, GA  
Emergency Care System Features in the Treatment of Pediatric Mild TBI.
61. GIOIA, GA  
Post-injury Course of Pediatric Mild TBI Initially Treated in the Emergency Department.
62. GOLD, AB  
Attention Networks in Children with Traumatic Brain Injury (TBI): Relations with Regional Brain Volumetry.
63. GORMAN, SA  
Are Visual-Spatial and Verbal Working Memory Equally Affected by Pediatric TBI?
64. GRACERT, MN  
Posttraumatic Stress Symptoms Following Early Childhood Traumatic Brain Injury.
65. HERNANDEZ, G  
Cognitive Deficits in Spanish-speaking Children with Traumatic Brain Injury.
66. HILLEARY, SM  
Corpus callosum MRI morphology and functional outcomes following pediatric traumatic brain injury.

67. JOHNSON, CP Predicting Behavioral Deficits Following Traumatic Brain Injury Through Damage To The Uncinate Fasciculus: A Diffusion Tensor Tractography Study.
68. KRISHNAMURTHY, V Neuropsychological Outcomes in Children with Head Injury vs. Traumatic Brain Injury.
69. LEE, J Attentional functioning in children following mild closed head injury: The importance of prospective sampling.
70. MORAN, LM Do Post-Concussive Symptoms Discriminate Injury Severity in Pediatric Mild Traumatic Brain Injury?
71. NEMETH, DG Educating Children Who Suffered TBIs prior to Age Three.
72. NEMETH, DG Self-Fulfilling Prophecies Versus Brain Limitations.
73. NOLIN, P Pre- and Post-Injury Executive Dysfunctions in Adolescents with Traumatic Brain Injury.
74. PAPOUTSIS, J Long-term Effects of Complicated Mild Traumatic Brain Injury Sustained in Infancy.
75. PETRAUSKAS, V Comparing BRIEF Parent and Self Profiles in an Acute Pediatric Traumatic Brain Injury Sample.
76. PRASAD, M Behavioral and Cognitive Aspects of Attention in Children with Traumatic Brain Injury One Year Post-Injury.
77. RAGHUBAR, KP Relations Between White Matter Integrity and Mathematical Outcomes in Children with TBI and Typically Developing Children.
78. SCHMIDT, AT Relationship of Family Functioning to Emotional Prosody Following Pediatric Traumatic Brain Injury.
79. TREBLE, A Working Memory and Callosal Integrity following Pediatric Traumatic Brain Injury: A Diffusion Tensor Tractography Study.
80. VAUGHAN, CG Stability and Internal Structure of the Pediatric Version of the ImPACT Battery.
81. WELLS, CT Parent-Report of Sleep Problems Following Mild Traumatic Brain Injury in Children and Adolescents.
82. WOZNAK, JR Inter-hemispheric resting-state fMRI disturbances associated with specific neurocognitive deficits in children with Traumatic Brain Injury.

### Visuospatial Functions/Neglect/Agnosia

83. CHEN, P Perceptual versus Representational Influence on a Motor Walking Task in Spatial Neglect.
84. CALLETTA, EE Visual Distraction: An Altered Aiming Spatial Response in Dementia.
85. HEINRICH, RJ Relationship Between the RBANS Visuospatial Subtests and the MMSE Intersecting Pentagons.

### Genetics/Genetic Disorders

86. JACOBSON, DA Involvement of the Anterior Cingulate Cortex and Insula in the Regulation of Negative Affect in Individuals with VCFS.

### Dementia (Alzheimers)

87. CORONA, R Predicting Psychological Distress in Caregivers from Functional Performance of Dementia Patients.

### 4:00–5:30 PM

### Invited Symposium Presented by ALAN: Neuropsychology of Emotion and the Neural Mechanisms Underlying Emotional Processing Discussant: Mitchell Valdes-Sosa, Speaker: Feggy Ostrosky-Solis Diamante Ballroom I

1. OSTROSKY, F Neuropsychology of Emotion and the Neural Mechanisms Underlying Emotional processing.
2. OSTROSKY, F Moral Emotions: Electrophysiological and Neuropsychological data in Normals and Psychopath Criminal Offenders.
3. VALDES-SOSA, M Neural substrates of unconscious processing of emotional information.
4. NICOLINI, H Neurocognitive Endophenotypes for Bipolar Disorder Identified in Multiplex Multigenerational Families from Latinoamérica.
5. MATUTE, E Recognition of emotional facial expressions in children with three types of neurodevelopmental disorders.

### 4:00–5:30 PM

### Symposium 10: When Should We Consider or Disregard a Person's Background for Neuropsychological Assessment? Chair: David Schretlen, Discussant: George Prigatano Diamante Ballroom II

1. SCHRETLEN, DJ When Should We Consider or Disregard a Person's Background for Neuropsychological Assessment?
2. SILVERBERG, ND When Demographically-Adjusted Norms Can Help and Harm Neuropsychological Prediction of Functional Competence After Traumatic Brain Injury.
3. BENEDICT, RH Regression-Based Norms and the Minimal Assessment of Cognitive Function in Multiple Sclerosis (MACFIMS).
4. TESTA, SM The Impact of Test Score Adjustment in Neuropsychiatric Disorders.
5. MUNRO, CA Demographically-Adjusted vs. Unadjusted Test Scores in the Prediction of Driving Errors by Elderly Drivers.

**5:45–6:15 PM** **INS Business Meeting**  
**Diamante Ballroom I**

**6:15–7:00 PM** **Friday Evening Reception**  
**Plaza Las Fuentes**

**SATURDAY, FEBRUARY 6, 2010**

**7:20–8:50 AM** **Saturday Morning Continuing Education Courses**  
**Refer to CE Schedule for Location**

**9:00–10:00 AM** **Invited Address: Developmental Neuroscience of ADHD: Are We There Yet?**  
**Speaker: F. Xavier Castellanos**  
**Diamante Ballroom II**

1. CASTELLANOS, F Developmental Neuroscience of ADHD: Are We There Yet?

**9:00–10:30 AM** **Symposium 11: Cognitive Remediation for Individuals with Schizophrenia**  
**Chair: Elizabeth Twamley, Discussant: Susan McGurk**  
**Diamante Ballroom I**

1. TWAMLEY, EW Cognitive Remediation for Individuals with Schizophrenia.  
2. KURTZ, MM A Restorative, Drill-and-Practice Approach to Cognitive Remediation in Schizophrenia: How Specific Are Its Effects?  
3. CHOI, J Expectancy Theory and Learning Persistence in Schizophrenia.  
4. TWAMLEY, EW Compensatory Cognitive Training Improves Neuropsychological, Functional, and Clinical Outcomes in Psychosis.  
5. FISZDON, JM Efficacy of a cognitive remediation program combining computerized hierarchical drill and practice training with paper-and-pencil training in the use of compensatory strategies: preliminary results.

**9:00–10:30 AM** **Symposium 12: Primary Progressive Aphasia: Diagnostic, Clinical, and Research Perspectives**  
**Chair: Sandra Weintraub**  
**Diamante Ballroom III**

1. WEINTRAUB, S Primary Progressive Aphasia: Diagnostic, Clinical, and Research Perspectives.  
2. ROGALSKI, E An Overview of Primary Progressive Aphasia: a Language-Based Dementia.  
3. MEDINA, J Neuropsychological Assessment of Patients Diagnosed with Primary Progressive Aphasia.  
4. COBIA, D Neuroimaging in Primary Progressive Aphasia.  
5. JOHNSON, N An International Registry for Primary Progressive Aphasia.

**9:30–11:00 AM** **Poster Session 8: Assessment/Psychometrics/Methods (Adult), Forensic Neuropsychology, Genetics/Genetic Disorders, Hemispheric Asymmetry/Laterality/Callosal Studies**  
**Condesa Ballroom**

**Assessment/Psychometrics/Methods (Adult)**

1. ALTMANN, LJ Comparing Computerized Versions of the Stroop and Cue-Switching Stroop Tasks.  
2. ANDRESEN, E Item Order Effects in the Symptom Validity Add-On Scale for Conner's Adult ADHD Rating Scale.  
3. ANDRESEN, E Symptom Validity Check in Conner's Adult ADHD Rating Scales: A Simulator Study.  
4. ARENIVAS, A Victoria Stroop Performance in Multiple Sclerosis, Parkinson's Disease, and Alzheimer's Disease.  
5. ATKINSON, TM Equivalency of Trail Making Test Scores in Serial Assessment: Halstead-Reitan, Delis-Kaplan Executive Function System, and Comprehensive Trail Making Test.  
6. BARKER, MD Embedded Indices of Effort in the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a Geriatric Sample.  
7. BARRASH, J Predicting Real Life Driving Ability: Demographic Corrections Diminish Predictive Accuracy.  
8. BARRASH, J The Iowa Scales of Personality Change: Sensitivity to Personality Changes Following Ventromedial Prefrontal Lesions.  
9. BAUGHMAN, BC Test of Practical Judgment (TOP-J): Measuring real-world judgment in geriatric veterans.  
10. BERNARDO, KA Longitudinal Texas Card Sorting Test Performance in PD.  
11. CISNEROS, E Choosing rehabilitation goals after brain injury: The Client's Intervention Priorities instrument.

12. CODA, J Test-Retest Equivalence and The Use of Alternate Forms Versions C and D with The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).
13. DOANE, BM Vineland-II Concordance Rates between Adults with Mild Intellectual Disability and Their Caregivers.
14. GLASS, L Discrepancy Score Reliabilities for WAIS-IV/ WMS-IV Composite and Subtest Comparisons.
15. GROSCH, MC Language Screening in Native Americans.
16. ~~HARRIS, K~~ Neuropsychological Constructs Assessed by the WMS-III Family Pictures Subtest.
17. HILL, BD Contribution of Working Memory to Estimated IQ Varies Among Different WAIS-III 4-Subtest Short Forms.
18. ~~HORWITZ, JE~~ Boston Naming Test Performance in a Cognitively Intact College Sample.
19. HUBEL, K Performance of Two WAIS-III Short Forms in a Clinical Veteran Population in Comparison to the WASI.
20. IVERSON, GL Identifying Cognitive Impairment in Adults with Mood Disorders Using Computerized Testing.
21. JOHNSON, CP Relating The Expectancy-Valence Model To Advantageous Performance on the Iowa Gambling Task.
22. LLOYD, KP Test Order Effects: A Memory Test has a Significant Affect on Verbal Fluency.
23. LOSER, N A Comparison of Woodcock-Johnson Reading Scores and Word Memory Test Failures: Malingering Detection in University Accommodation-Seeking Students.
24. LOSER, N Detecting Poor Effort among Accommodation-Seeking University Students: Implications for Psycho-Educational Evaluations.
25. LYON, AC Test-Retest Reliability of a Neuropsychological Protocol in a Sample of Older Adults with Vascular Risk Factors.
26. MILLER, JB Substitution of the CVLT-II for Verbal Paired Associates on the Wechsler Memory Scale - 4th Edition: Correlations between scaled scores in a traumatic brain injury sample.
27. MINTZ, RJ Specificity of Neuropsychological Performance in Electrical Trauma Patients Compared to Trauma Controls.
28. REED, B Computerized Adaptive Testing of Digit Span.
29. RODRIGUEZ, M Using Spain Norms in the Assessment of Spanish Speaking Individuals from Other Countries: Biases on the Spanish WMS-III Working Memory Index.
30. ROSKOS, T Use of the Post-Traumatic Stress Disorder Checklist Civilian Version (PCL-C) with Civilian Mild Traumatic Brain Injury and General Physical Trauma Patients.
31. SALVADOR, J Analysis of qualitative and quantitative properties of Taylor's figure in Mexican population aged between 20 and 60 years. Authors: Judith Salvador Cruz, Ma. Esther Balderas, Gabriela Galindo y Villa Molina. FES ZARAGOZA UNAM.
32. SCHNEIDER, B Impact of Reading Ability and IQ on Neuropsychological Test Performance in Black Older Adults.
33. SELLBOM, M Utility of the Personality Assessment Inventory in Detecting Symptom Validity Test Failure in Neuropsychological Evaluations.
34. ~~SKEEL, R~~ Switching Decks on the ICT as a Behavioral Measure of Anxiety.
35. STANEK, KM Association between Intelligence, Reading, and Executive Functioning on MMPI-2 Validity Scales in a Disability Evaluation Context.
36. STRUTT, AM The Authorized Spanish Translation of the Dementia Rating Scale, 2nd edition.
37. TEAGUE, EB The Cognitive and Emotional Empathy Questionnaire: Factor Structure and Psychometric Properties.
38. ~~TELLEZ, H~~ Execution in Verbal and Spatial Tasks in The Right and Left Handed.
39. ~~TRONTEL, H~~ Early Warning Affects the Face Validity of Effort Tests.
40. VON THOMSEN, C Relationships Among Self-Report Variables and Census-Based Neighborhood Data Used to Estimate Socioeconomic Status.
41. WINGO, J Version Equivalence of a Computerized Neuropsychological Battery.
42. WOON, F Cognitive Screening Tests Predict Functional Outcomes and Quality of Life in Survivors of Critical Illness.
43. WOUTERS, H Measuring global cognitive ability in mild dementia more precisely: a new step.
44. YOUNG, JC Predictive validity of the Henry-Heilbronner Index in Detection of Noncredible Performance and Compensation-Seeking Status in U.S. Veteran Sample.
- Forensic Neuropsychology**
45. BORJA, KC Early trauma and psychopathy in adult male inmates.
46. ~~CONSTANTINO, M~~ Suboptimal Motivation in Children diagnosed with CD or ODD.
47. DAVIS, JJ Use of Digit Symbol-Coding to Assess Effort.
48. DENBOER, J Neuropsychological Profiles of Successful Brain Injury Simulators on the TOMM, WMT, and CARB.
49. DIAZ, KX Frontal Neuropsychological Deficits in Psychopaths.
50. FRANCO, G Detection of Simulated Memory Impairment in a Monolingual Male Spanish-speaking Latino Sample.
51. HOELZLE, J Secondary Gain Context Impacts Neuropsychological Performances Among OEF/OIF Veterans with Histories of Blast-Related Concussion (mTBI).
52. JASINSKI, L Use of the Digit Span Subtest for Malingering Detection: A Meta-Analysis.
53. ~~JURECSKA, DE~~ The Malingered Ignorance of Legal Knowledge (MILK): Initial Development, Validation, and Psychometric Testing of the MILK.
54. KIM, MS The Warrington Recognition Memory Test for Words as a Measure of Response Bias: Total Scores and Response Time Cutoffs Developed on "Real World" Credible and Noncredible Subjects.
55. ~~MADRID, R~~ Increasing the Positive Predictive Power of the Rey Fifteen Item Test in Criminal Defendants through the Use of Alternative Scoring Methods and Cutoff Scores.

56. MILLER, JB  
 57. MOONEY, S  
 58. NEMETH, DG  
 59. ROMERO, C  
 60. SCHROEDER, RW  
 61. ~~SPECTOR, J~~  
 62. TUSSEY, CM  
 63. ZAKZANIS, K
- The Patient Competency Rating Scale as a Measure of Symptom Exaggeration in a Simulator Sample.  
 Cognitive Effort Among Concussed Enlisted Soldiers Following Deployment.  
 The Role of the Treating Neuropsychologist in Forensic Cases.  
 Cognitive Distortions in Psychopath Offenders.  
 Validation of Multiple Effort Indices in Schizophrenic and Non-Psychotic Psychiatric Populations.  
~~Significant rate of SVT failure in a sample of early childhood, low-level lead exposure litigants.~~  
 The Utility of Trial 1 of the TOMM in an Inpatient Population.  
 On the Relationship Between Feigned Cognitive Impairment and Psychological Presentation.

### Genetics/Genetic Disorders

64. ~~ACOSTA PUENTES, M~~  
 65. AXELRAD, ME  
 66. BORDES, V  
 67. CACCAPPOLO, E  
 68. CHANG, JS  
 69. GUNTHER, ML  
 70. HUNTER, SJ  
 71. JANKE, KM  
 72. JANKE, KM  
 73. LANGENECKER, SA  
 74. NAZARIAN, S  
 75. PRICE, J  
 76. ROELTGEN, DP  
 77. SANZ, JH  
 78. ~~SNOW, J~~  
 79. WALSH, KS  
 80. ZADE, DD
- Cognitive Profile in Patients with Neurofibromatosis type 1 (NF1) with and without Minor Brain Malformations: Are Learning Disabilities an Expression of an Early Deficit in Brain Organization?  
 Neurocognitive Functioning in Costello Syndrome.  
 Consequences of Prematurity Confounds Treatment Decisions in Adrenoleukodystrophy.  
 Effect of Parkin Gene Status on the Neuropsychological Performance of Subjects with Early Onset Parkinson's Disease and Unaffected Relatives.  
 Neuropsychological Outcomes and Adaptive Functioning of Children Identified with Mitochondrial Disease.  
 Genetic Risk Factors for Long-Term Cognitive Impairment After Critical Illness.  
 Open-Lip Schizencephaly: Neurobehavioral Presentation Of An 8-Year Old Boy.  
 Cognitive and Early Learning Profile of Preschool Age Children with NF-1.  
 Role of Executive Functioning in Academic Achievement for Adolescents with NF-1.  
 Serotonin Transporter Genotype and Neuropsychological Measures Adversely Affected by Major Depressive Disorder.  
 Neuropsychological Profile of a 7 year-old with Late-Onset Combined Methylmalonic Acidemia and Homocystinuria, Cobalamin-C Type.  
 Serotonin Transporter Gene (5-HTTLPR) Risk Classification and Visual and Verbal Memory: Implications For Future Research.  
 An Extra X or Y Chromosome: Contrasting the Cognitive Phenotype in Childhood in Boys with 47,XYY or 47XXY (Klinefelter Syndrome).  
 Developmental Profile and Trajectory of Neuropsychological Skills in Kabuki Syndrome: A Longitudinal Case Study.  
~~Neurocognitive Features of Very Rare Genetic Disorders.~~  
 The impact of familial versus spontaneous inheritance of Neurofibromatosis type 1 (NF1) on neurocognitive profiles in children.  
 apoE4 Genotype Modifies Relationship of Waist-To-Hip Ratio to Cognition and Brain Morphology.

### Hemispheric Asymmetry/Laterality/Callosal Studies

81. BONDY, M  
 82. ~~HENDRIKS, M~~  
 83. HOLLAND, AK  
 84. KAPLOUN, KA  
 85. LACHNER, N  
 86. MOES, PE  
 87. MOES, PE  
 88. ~~NIKL, C~~  
 89. PARLOW, SE  
 90. SANKAR, JS  
 91. WILLIAMSON, J
- Degree of Handedness and Episodic Memory: Evidence from the California Verbal Learning Test-II.  
~~Language Dominance in Temporal Lobe Epilepsy: Testing the Crowding Hypothesis.~~  
 Differences in Cerebral Lateralization of Time Estimation Abilities and Cardiovascular Reactivity in Diabetic and Non Diabetic Older Adults.  
 Does Handedness Influence Speed of Interhemispheric Transfer?  
 Effect of High- and Low-Frequency Noise on the Perception of Words Presented in Dichotic Competition.  
 The Influence of Menstrual Cycle Phase on Hemisphere Interaction for Emotion and Gender Perception.  
 Gender Differences in Hemisphere Specialization for Non-literal Language ("Jokes") Processing.  
~~Hemispheric differences of the mechanism of the time orientation.~~  
 An Investigation of Self-reported Mirror Movements in Neurologically Intact Adults.  
 Associations Between Handedness and Spatial Reasoning in Men: Possible Influence of Androgen Receptor Gene Polymorphism.  
 Left hemisphere white matter integrity is related to neural regulation of the autonomic nervous system in a stroke population.

### 10:45 AM–12:15 PM

### Symposium 13: Novel Applications of Reliable Change Methodology to Clinical Neuropsychology Research and Practice Chair: Gerard Gioia, Discussant: Gordon Chelune Diamante Ballroom I

1. GIOIA, GA  
 2. HOLDNACK, J  
 3. CHELUNE, G  
 4. BARR, W
- Novel Applications of Reliable Change Methodology to Clinical Neuropsychology Research and Practice.  
 Development of Reliable Change Scores for the WAIS-IV/WMS-IV.  
 Origins and Trends in the Application of Reliable Change (RC) Methods in Neuropsychology.  
 Diagnostic Accuracy of Various Methods of Computing Reliable Change: Findings From the NCAA Concussion Study.

5. GIOIA, GA Detecting Response to Working Memory Load Demands with a Novel Application of SRB Reliable Change Methods in Children.
6. VAUGHAN, C Detecting Cognitive Fatigue via Standardized Regression Based Reliable Change Methodology within a Computerized Cognitive Test Battery.

**10:45 AM–12:15 PM****Invited Symposium Presented by SLAN: The Use Of Magnetic Resonance Imaging For The Study Of Healthy Aging And Diseases Related To The Elderly.****Chair: Oury Monchi, Discussant: Thomas Jubault  
Diamante Ballroom II**

1. JUBAULT, T The use of Magnetic Resonance Imaging for the study of healthy aging and diseases related to the elderly.
2. ANSADO, J Resources mobilization and cognitive reserve to cope with increasing complexity in aging.
3. MARCOTTE1, K Neurobiological correlates of 'Semantic Feature Analysis' in chronic aphasia.
4. GONZÁLEZ, N Parkinson's disease and rTMS: An fMRI longitudinal study.
5. JUBAULT, T The contribution of functional and anatomical MRI in understanding the pathophysiology of Parkinson's disease.

**10:45 AM–12:15 PM****Paper Session 8: Traumatic Brain Injury  
Diamante Ballroom III**

1. MCDONALD, S Loss of automatic mimicry to angry faces following severe traumatic brain injury.
2. ANDERSON, VA Social Functioning in Children With Brain Insult.
3. VANNORSDALL, TD A Morphometric Analysis of Neuroanatomic Correlates of Cognitive Dysfunction Following Traumatic Brain Injury.
4. SORG, S Diffusion Tensor Imaging of Frontal White Matter in Veterans with Traumatic Brain Injury (TBI): Associations with Executive Functioning.
5. ANDERSON, VA Intellectual ability 10 years after traumatic brain injury in infancy and childhood: What predicts outcome? Intellectual ability 10 years after traumatic brain injury in infancy and childhood.

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# Abstracts Presented at the Thirty-Eighth Annual Meeting International Neuropsychological Society

February 3-6, 2010  
Acapulco, Mexico

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WEDNESDAY AFTERNOON, FEBRUARY 3, 2010

**Presidential Address:  
The Asymmetrical Brain**

**INS President: Michael Corballis**

**4:00–5:00 p.m.**

**M.C. CORBALLIS. Presidential address: The asymmetrical brain.**

Most people are right-handed, left-cerebrally dominant for language, and right-cerebrally dominant for the processing of spatial and perhaps emotional information. But not all are. Just what explains variations in asymmetry has been a matter of much speculation, ranging from the view that we are all born ambilateral with asymmetries being culturally imposed, to the opposite notion that we are all born asymmetrical, with environmental influences cancelling or reversing one or more of the asymmetries. In a large-scaled study, we used fMRI to measure asymmetrical brain activity during word generation, spatial judgment, and face processing in left- and right-handers. Our results imply at least two independent influences, one most strongly evident in handedness and left-hemisphere lateralization for language production, and the other in right-hemisphere lateralization for spatial judgment. These and other aspects of our findings suggest that these influences are governed by some lateralizing agent, possibly genetic, that is present in some individuals, but absent in others. When it is absent, lateralization is open to chance influences.

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**Symposium 1:  
Progress in Understanding Executive Functions in  
Clinical Populations Using Neuroimaging  
Techniques**

**Chair: Glenn Wylie**

**Discussant: Frank Hillary**

**5:15–6:45 p.m.**

**G. WYLIE, F. HILLARY, D. JAVITT, J. DELUCA, G. WYLIE & F. GUNNING-DIXON. Progress in Understanding Executive Functions in Clinical Populations Using Neuroimaging Techniques.**

**Symposium Description:** Executive functions, or the ability to translate intentions into actions, lie at the core of human cognition. More-

over, these critical functions are compromised in specific clinical populations, including individuals with Schizophrenia, Multiple Sclerosis (MS), Traumatic Brain Injury (TBI), and in older individuals with depression. In this symposium, the nature of the executive dysfunction in each of these groups will be discussed. One theme that emerges is that while executive ability may indeed be compromised, this is often due to other, “lower-level” deficits. For example, in schizophrenia, findings suggest that impaired stimulus evaluation at the sensory level contributes to impaired executive processing, and that deficits in executive processing are most severe when impaired sensory systems must be engaged. In MS, findings suggest that poor performance on measures of executive functioning may well be attributable to slowed processing speed rather than an independent executive deficit. Another theme that will be discussed is the nature of the abnormalities in frontal regions, associated with executive deficits. In geriatric depression, findings suggest that executive dysfunction is associated with abnormalities in frontolimbic regions that include the dorsal anterior cingulate along with middle and superior frontal cortices. In TBI, hyper-activation of frontal and parietal areas is found during working memory tasks; however, while this activation is abnormally high, it decreases with repeated exposure to the task, thus displaying a normal response to learning. Based on these studies, some of assumptions regarding executive deficits in these clinical populations may need to be re-evaluated, and this will be discussed.

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**D. JAVITT, E. DIAS & G. WYLIE. Executive dysfunction in schizophrenia: Is it all in your frontal lobes?**

**Objective:** Schizophrenia is associated with deficits in executive processing that may reflect frontal dysfunction. Simultaneously, patients show deficits in basic auditory and visual processing, particularly involving the magnocellular visual system that may contribute to abnormal stimulus processing. The relationship between early sensory deficits and executive dyscontrol has not been well studied. We will present findings from 3 experiments exploring sensory/executive interactions in schizophrenia.

**Results:** First, task switching was investigated using a standard letter/color paradigm. Switch costs were assessed across groups, along with congruence and mixing costs. Patients showed no significant increase in switch costs, but increased congruence and mixing costs, suggesting increased susceptibility to competition between stimuli. In addition, patients were differentially impaired in letter vs. color performance. Second, event-related potentials (ERP) were used in association with the AX-type continuous performance task (AX-CPT).

Patients showed impaired encoding of cue-based information. Furthermore, while reduced activation of executive control regions such as cingulate cortex was observed, impairments in performance correlated most with activation at the sensory level. In a final study, we examined task switching using stimulus features specifically designed to activate magnocellular (motion) vs. parvocellular (color) visual systems. Performance deficits were observed only for the speed task, consistent with preferential magnocellular dysfunction.

**Conclusions:** Overall, these findings suggest that impaired stimulus evaluation at the sensory level contribute to impaired executive processing, and that deficits in executive processing are most severe when impaired sensory systems must be engaged.

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### **J. DELUCA, J. SUMOWSKI, V. LEAVITT, N. CHIARAVALLIOTI & G. WYLIE. Is executive dysfunction an independent deficit in multiple sclerosis, or merely a product of slowed processing speed?**

**Objective:** Deficits in executive functioning are prevalent among persons with Multiple Sclerosis (MS). Many MS patients also show deficits in processing speed. It is unclear whether executive dysfunction represents an independent, disease-related cognitive deficit, or whether executive dysfunction is mediated through slow processing speed. To clarify this issue, we investigated the relationship between MS disease severity (brain atrophy) and behavioral measures of processing speed and executive functioning (speeded and non-speeded).

**Participants and Methods:** Thirty-eight persons with MS completed tasks of processing speed (SDMT), speeded executive functioning (D-KEFS: Trailmaking, Color-Word Interference), and non-speeded executive functioning (WCST). Brain atrophy was estimated as third ventricle width. Correlations were performed between brain atrophy and behavioral measures, followed by partial correlations between brain atrophy and speeded executive tasks (e.g., Trails-Switching) controlling for task-specific speed (e.g., Trails-Letter-Sequencing).

**Results:** Brain atrophy was associated with poorer performance on processing speed (SDMT:  $r = -.53$ ,  $p = .001$ ) and speeded executive tasks (Trails-Switching:  $r = .36$ ; Inhibition:  $r = .41$ ,  $ps < .05$ ), but was not associated with non-speeded executive performance on WCST. Importantly, the relationship between brain atrophy and speeded executive task performance disappeared when controlling for the speeded aspect of the task ( $rps = -.18$  to  $.19$ ,  $ps > .10$ ).

**Conclusions:** Although persons with MS may demonstrate poor performance on measures of executive functioning, these deficits may well be attributable to slowed processing speed rather than an independent executive deficit. However, executive dysfunction may emerge as an independent deficit once disease crosses a critical threshold.

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### **G. WYLIE & F. HILLARY. Change is good: brain activity in a working memory task is higher in TBI than in HC, but shows comparable changes across time.**

**Objective:** In executive tasks, such as tasks involving working memory, it is frequently reported that individuals who have sustained a traumatic brain injury (TBI) show greater cerebral activity than healthy controls (HCs) to perform at comparable levels. This increased activity is found in a network of areas including frontal and parietal cortices. While the activity in these regions is abnormally high, it is not known whether this hyper-activity represents a static change, such as reorganization, or a more dynamic change that varies with task demands. We tested this by investigating the activity in this network at two time-points during a critical period of recovery, with the idea that task demands would be

less during the second time-point both because recovery would be more advanced and because of practice effects.

**Participants and Methods:** Seven individuals who had sustained a TBI, and eight age- and education- matched HCs participated. The TBI subjects were scanned 3 months after emerging from post-traumatic amnesia, and then again 3 months later. The HCs were also scanned twice, with a 3-month interval separating the two scans. A non-verbal working memory task was used that required subjects to maintain information about the location and identity of faces. Working memory load was manipulated in a blocked fashion, by increasing the number of faces to be remembered.

**Results:** Individuals with TBI showed the expected increase in activity in the fronto-parietal network, relative to HCs. However, activity in this network decreased across time for both groups, in an additive fashion.

**Conclusions:** The activity in areas associated with working memory appear to respond similarly across time in both TBIs and HCs. Therefore, while there may be increased recruitment of these areas in TBI, the fronto-parietal network appears to respond normally to decreasing task demands.

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### **F. GUNNING-DIXON. Neurobiological Correlates of Executive Dysfunction in Late-Life Depression: Structural and Functional MRI Findings.**

**Objective:** Select deficits in executive functions are present in a substantial number of older individuals with major depression. Observations from treatment trials of geriatric depression suggest that executive dysfunction is a relatively stable clinical trait that is exacerbated during depressed states. Furthermore, the presence of executive dysfunction predicts poor response to antidepressants. Thus, in many elderly depressed patients the presence of executive dysfunction appears to be a core feature of the illness and may help us to better understand the pathophysiology of the illness.

**Participants and Methods:** We used multiple magnetic resonance imaging (MRI) techniques (FLAIR, fractional anisotropy, morphometry, hemodynamic response) to examine the neurobiological correlates of executive dysfunction in late-life depression. We hypothesized that elderly depressed patients (60 to 85 years) would exhibit both structural (e.g., low fractional anisotropy, white matter hyperintensities) and activation abnormalities in select fronto-limbic networks. Furthermore, we expected that abnormalities in these networks would correlate with deficits in inhibition and cognitive control.

**Conclusions:** Findings from these studies suggest that executive dysfunction of late-life depression is associated with abnormalities in fronto-limbic regions that include the dorsal anterior cingulate along with middle and superior frontal cortices. Implications for the diagnosis and treatment of geriatric depression will be discussed.

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**Symposium 2:  
Neurologic Sequelae of Medical Illness:  
Neuroimaging Predictors of Cognitive Outcomes**

**Chair: Max Gunther**

**Discussant: Erin Bigler**

**5:15–6:45 p.m.**

**R.O. HOPKINS, S.C. JOHNSON, M.L. GUNTHER, R.D. STEVENS & E.D. BIGLER. Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.**

**Symposium Description:** Objective

In multiple areas of medicine there is increased awareness that diseases, treatments and events (such as trauma or critical illness) often have significant and persistent neurological morbidity. This symposium will examine emerging research using neuroimaging to investigate associations between brain structure and cognitive function in patients with medical illness, critical illness, and trauma.

**Methods**

Neuroimaging outcomes (e.g. structural quantitative MRI, diffusion tensor imaging or DTI, and functional MRI) and relationships to cognitive outcomes will be presented in medical populations and post-trauma. Data suggest that medical illness, critical illness, and trauma frequently results in neurologic injury and its associated morbidity, including abnormalities on brain imaging and cognitive impairments.

**Results**

This symposium will address cognitive and neuroimaging outcomes following medical illness and trauma. Topics will include: 1) structural and atrophic changes in medical and critically ill patients; 2) frontal lobe functional imaging in critical illness and 3) neuroimaging in trauma patients. Dr. Ramona Hopkins will discuss qMRI and cognitive outcomes in critically ill patients. Dr. Sterling Johnson will present work on DTI and structural neuroimaging in traumatic brain injury. Dr. Max Gunther will discuss the effect of delirium on MRI and cognitive outcomes. Dr. Robert Stevens will discuss brain structural and functional connectivity changes as biomarkers for disease. Dr. Erin Bigler will chair the session and serve as the discussant.

**Conclusions**

This symposium will present new and innovative imaging findings in medical populations. Neuroimaging may be a useful technique for predicting poor cognitive outcomes following medical illness, critical illness, and trauma.

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**S.C. JOHNSON, B.B. BENDLIN & E.K. KASTMAN. Serial Imaging and cognitive outcomes after Traumatic Brain Injury.**

**Objective:** Traumatic brain injury (TBI) is associated with brain volume loss, but there is little information on regional patterns of gray matter (GM) and white matter (WM) changes that contribute to overall loss, nor is there information on the length of the time period in which observable volume loss occurs. In this presentation we will review data from our lab on serial imaging and cognitive testing in patients with moderate TBI. Since axonal injury is a common occurrence in TBI, an imaging method sensitive to WM damage, diffusion-tensor imaging (DTI) will be featured.

**Participants and Methods:** We examined patients at three time points: 2-3 m, 13 m, and 36 m post-injury. High-resolution T1-weighted imaging and DTI were used to evaluate regional changes in the brain and neuropsychological tests were administered to examine cognitive recovery.

**Results:** Neuropsychological function improved over time, while voxel-based analyses of fractional anisotropy (FA), and mean diffusivity (MD)

from the DTI images, and voxel-based analyses of the GM and WM probability maps from the T1-weighted images revealed progressive atrophy over a three year period exceeding the rate of normal aging.

**Conclusions:** TBI affected virtually all of the major fiber bundles in the brain including the corpus callosum, cingulum, the superior and inferior longitudinal fasciculus, the uncinate fasciculus, and brain stem fiber tracts. Relationships between atrophy and cognitive function were also found and will be discussed.

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**M.L. GUNTHER, A. MORANDI, P. PANDHARIPANDE, J.C. JACKSON, A. CANONICO, J.C. GATENBY, J.C. GORE & E.W. ELY. Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.**

**Objective:** ICU delirium is a prevalent & life-threatening acute brain dysfunction that may lead to long-term cognitive impairment following critical illness yet little is known about the neuroradiological sequelae of this syndrome. Only a handful of neuroimaging studies have examined brain changes following ICU delirium. It was hypothesized that patients who experienced delirium while in the ICU would exhibit attenuated activation in the frontal lobe during working memory.

**Participants and Methods:** ICU survivors were scanned at hospital discharge and at 3-month follow-up using multiple magnetic resonance imaging (MRI) modalities including fMRI, VBM, ASL, DTI and functional connectivity. Multiple regression was used to examine the specific variance across brain activity and regions associated with duration of delirium while controlling for relevant covariates.

**Results:** Patients presented with a high severity of illness. Duration of delirium was associated with significantly lower levels of functional activation in the dorsolateral prefrontal cortex during a working memory task and greater activation in the parahippocampal gyrus.

**Conclusions:** These data suggest that critically ill survivors who have experienced delirium exhibit an attenuated neurophysiological response in the frontal lobe and greater activity in the parahippocampal gyrus while attempting to sustain information in working memory. Although larger studies are needed to confirm these results, data provide preliminary evidence from functional neuroimaging that directly support recent clinical findings regarding long-term neurocognitive consequences associated with ICU delirium.

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**R.D. STEVENS. Neurologic Sequelae of Medical Illness: Neuroimaging Predictors of Cognitive Outcomes.**

**Objective:** Patients hospitalized with an acute illness face significant odds of developing a serious neuropsychiatric complication which might take the form of delirium in the acute setting or cognitive impairment in the long term.

**Participants and Methods:** While delirium is frequently attributed to an underlying physiologic or metabolic disturbance, the neurobiological mechanisms of delirium and those leading to post-acute cognitive impairment remain largely unknown.

**Results:** Numerous observations suggest that fundamental aspects of cognition and behavior including attention, vision, memory, language, and motor planning are subserved by large-scale, distributed networks of anatomically or functionally linked neuronal populations. It has been hypothesized that the plasticity associated with development learning, and disease could represent modifications in network anatomy and connectivity. This prediction can be tested with the help of diffusion tensor imaging (DTI) which yields qualitative and quantitative inferences on white matter tracts linking cortical and subcortical structures (structural connectivity analysis), and with fMRI through the analysis of time-dependent correlations in the blood oxygen level dependent (BOLD) signal between anatomically distinct areas (functional connectivity).

**Conclusions:** Recent studies reveal a high degree of convergence between maps of correlated resting state BOLD activity and DTI-defined white matter structures in both healthy controls and in patients with developmental, psychiatric and neurodegenerative illnesses. While the robustness of analytic methods used in functional and structural connectivity needs to be consolidated, the implementation of such an approach is likely to generate important new insight into the pathogenesis and treatment of delirium and cognitive impairment following acute medical illnesses.

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### **R.O. HOPKINS. Quantitative Brain Imaging and Cognitive outcomes in Survivors of Critical Illness.**

**Objective:** Acute Respiratory Distress Syndrome (ARDS) is characterized by severe acute lung injury, hypoxemia, has a high mortality, and is associated with neurological, physical, and cognitive impairments. Radiologic findings and quantitative brain imaging outcomes in survivors of critical illness were assessed.

**Participants and Methods:** Critically ill patients with ARDS patients underwent brain imaging were compared to an age- and sex-matched normal control group. Quantitative image analysis was performed blind to patient identity and group. Volumetric measures included the lateral ventricles, III ventricle, IV ventricle, temporal horns, total brain volume, and cerebral spinal fluid (CSF). Neuropsychological outcomes were for ARDS patients were assessed at hospital discharge and one year.

**Results:** Fifty-three percent of critically ill ARDS patients had clinical abnormalities on radiological report. The ARDS patients had significant brain atrophy and cognitive impairments. The ARDS patients had enlarged lateral ventricles, third ventricle, total ventricular volume, and increased ventricle-to-brain ratio compared to controls. In addition to generalized atrophy there was significant enlargement in the left and right temporal horns, which may reflect temporal lobe atrophy and possibly hippocampal atrophy. There were no differences in fourth ventricle or total brain volumes. ARDS patients with and without brain imaging had significant cognitive impairments in memory, attention, mental processing speed, and executive function at hospital discharge and one year.

**Conclusions:** Critically ill ARDS patients who underwent clinical brain imaging had significant brain atrophy and cognitive impairments. Neuropsychologists should be aware that critically ill patients are at risk to develop brain atrophy and cognitive impairments.

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## **Paper Session 1: Language**

**5:15–6:45 p.m.**

### **E.J. WALDRON & A.E. HERNANDEZ. Second Language Age of Acquisition Effects Across the Lifespan Support the Sensorimotor/Emergentist Model of Language Development.**

**Objective:** Second language (L2) age of acquisition (AoA) is a factor that has been demonstrated to modulate brain activity. What is not well established, however, is the way in which the effects of L2 AoA vary across developmental time. Indeed, previous neuroimaging investigations of L2 AoA have been plagued by participant samples that do not span the range of development for when language acquisition initiated.

**Participants and Methods:** In order to investigate the effects of L2 AoA across the lifespan, 14 monolinguals, 11 early bilinguals and 11 late bilinguals were scanned with fMRI while performing a covert past tense generation task.

**Results:** Analyses revealed a curvilinear relationship between overall brain activity and L2 AoA. More specifically, contrasts revealed that the greatest differences in brain activity were noted between monolinguals and early bilinguals, and early bilinguals and late bilinguals. Very few differences were noted between monolinguals and late bilinguals. Further, similar effects were noted in specific regions of the brain (e.g., left hemisphere Broca's area) that have been noted to be sensitive to L2 AoA and syntax.

**Conclusions:** While seemingly counterintuitive with respect to the behavioral literature, these results align closely with the sensorimotor/emergentist (S/E) model of language development. In the S/E model, language learning in bilinguals takes place in a competitive interplay between the first language (L1) and L2. For early bilinguals, this interplay results in functionally disparate representation of the L2, whereas the L2 of late bilinguals acts in an overlapping and parasitic manner of the L1 due to already established language networks.

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### **P.A. SUAREZ, T. COLLAN, L. ARTIOLA I FORTUNY, I. GRANT, R. HEATON & M. CHERNER. Degree of Bilingualism predicts Interference scores on a Spanish version of the Stroop Test.**

**Objective:** Studies have shown reduced Stroop interference in bilinguals compared to monolinguals defined dichotomously, but no study has explored how varying degree of second language fluency, as may occur in immigrant groups, might affect linguistic inhibitory control. We examined effects of English fluency on the ability to inhibit the automatic reading response on the Golden Stroop Test administered in Spanish.

**Participants and Methods:** Participants were 75 female and 73 male adult native Spanish speakers from the U.S.–Mexico border region. Years of education ranged from 7 to 20 ( $M=12.5$ ,  $SD=3.2$ ), and age ranged from 20 to 63 ( $M=37$ ,  $SD=9.5$ ). Degree of bilingualism was calculated as the ratio of English words to total words produced in both languages using the Controlled Oral Word Association Test with letters PMR in Spanish and FAS in English. Effects of English fluency on the Stroop Test were examined with linear regression including the bilingualism index and years of education as predictors.

**Results:** Bilingualism index, ranging from 0 to .67 (median=0.37), and education were significantly correlated ( $r=.40$ ,  $p<0001$ ). However, stronger bilingualism but not higher education, predicted better speed on the interference trial ( $\beta=16.6$ ,  $p=0.003$ ), and better interference ratio scores ( $\beta=11.22$ ,  $p=0.02$ ). On the other hand, neither variable entered into a regression equation, predicted more simple processing speed, as measured by the word reading and color-naming trials.

**Conclusions:** Consistent with the Inhibitory Control Theory, greater bilingualism was predictive of better inhibition, as measured by the color-word trial and interference ratio. Greater bilingualism resulted in better suppression of the automatic reading response, independently of education. Further studies are needed to determine whether bilingualism improves suppression, or whether people with better suppression are more likely to become bilingual, or both. Possible other background advantages not captured by education should also be examined.

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### **D. COLACO, A. MINEIRO & A. CASTRO-CALDAS. Measuring the impact of literacy in paraphasias of aphasic patients.**

**Objective:** Previous studies suggest that illiterate subjects are unaware of a phonological structure of oral language. This fact may influence the characteristics of aphasic speech, namely the structure of paraphasias.

**Participants and Methods:** Three groups of aphasic patients were included belonging to different educational level: illiterate subjects (group i.) subjects with two levels of schooling (basic school – 4 to 9 years – group ii, and advanced school– graduate to PhD studies – group iii).A

test battery composed by two subtests: (i) a naming test with words that belong to three distinct groups: highly frequent simple words, low frequency simple words and complex low frequent words; and (ii) a word repetition test was used. The naming subtest was established based on morphological criteria and in linguistic corpus frequency criteria. The whole battery was applied to aphasic speakers with Broca, conduction and anomic aphasia and allowed us to establish the comparison between paraphasia types (phonological, morphological and semantic errors).

**Results:** Results showed that there are differences among the groups that can be interpreted as related to the level of literacy. In naming tests, illiterates tend to have problems at the semantic level, in repetition phonological paraphasias are different between groups. These differences concern the semantic level in naming tasks and the phonological level in repetition tasks.

**Conclusions:** The arrangement of the neural substract responsible for language processing is influence by education. Less educated subjects process language primarily through semantics - which is selected in naming tests - and are unaware of phonological structures - which is reflected in repetition tasks.

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**P.T. CIRINO, T.D. TOLAR, M.A. ROMAIN, A.E. BARTH, S. VAUGHN, C.A. DENTON & D.J. FRANCIS. Reading Components and Difficulties in Middle School Students.**

**Objective:** We sought to identify latent factors of decoding, fluency, and comprehension from a variety of reading measures administered to middle school students. We also expected that reading difficulties, where found, would be broad-based, rather than specific to comprehension.

**Participants and Methods:** The sample consisted of 1,728 students from seven middle schools. Multi-group confirmatory factor analysis evaluated ten measures of decoding (WJ-III Letter Word Identification, Word Attack), fluency (TOWRE Sight Words, word lists, passages), and comprehension (WJ-III Passage Comprehension, GRADE Comprehension, experimental assessment, AIMSweb Mazes, Sentence Reading Efficiency (TOSRE)). "Struggling" readers ( $n = 1,016$ ) were defined on the basis the state achievement test; 712 "typical" readers were also assessed. Difficulties in decoding, fluency, and comprehension were identified as performance on index measures of these skills at or below the 25th %ile.

**Results:** Four factors were identified, including the three expected, as well as a fourth that combined reading requirements. Model fit was good when parameters for groups (factor pattern, factor loadings, intercepts, residual variances) were individually estimated,  $\chi^2(59) = 368.27$ , CFI = .97, RMSEA = .078, SRMR = .040, but declined when constrained to be equal across groups,  $\chi^2(84) = 928.546$ , CFI = .91, RMSEA = .108, SRMR = .257, suggesting a lack of measurement invariance. Among struggling readers, the rate of difficulties in decoding, fluency, and comprehension were 65%, 57%, and 58%, respectively. In contrast, rates of difficulties specific to each of these areas were only 1%, 7%, and 21%.

**Conclusions:** The three expected factors were identified, although measures that combine reading requirements comprised their own factor. However, the meanings of these factors may differ in struggling vs. typical reader groups. Reading difficulties in middle school students are generally not specific to comprehension.

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**J. BENNETT & S.P. VERNEY. The Importance of Bilingual History in Assessing Tasks Requiring Cognitive Flexibility.**

**Objective:** Clinicians and researchers often assume that neuropsychological tests are valid for individuals who appear fluent in English regardless of one's bilingual status. However, bilingualism is complex, affecting several cognitive systems including those accessed during neu-

ropsychological testing. Bilingualism may provide advantage in linguistic and cognitive flexibility, yet may prove a disadvantage on performance when tests rely on verbal performance or processing speed. The purpose of this research is to investigate the association between linguistic history and performance on tasks that require cognitive flexibility.

**Participants and Methods:** Hispanic bilingual undergraduate students who reported being fluent in both English and Spanish ( $n=47$ ) completed the General Ability Measure for Adults (GAMA), The Trail Making Test (TMT), the Wide Range Achievement Test 3 (WRAT3) Reading subtest, and the Controlled Oral Word Association Test (COWA).

**Results:** Younger age of second language (L2) acquisition was significantly correlated with better performance on measures of cognitive flexibility (TMT-B), phonemic and semantic verbal fluency (COWA), and English language proficiency (WRAT3-Reading), but not correlated with simple processing speed (TMT-A) or general cognitive ability (GAMA). These findings suggest that the age of L2 acquisition is associated with better cognitive flexibility. In addition, WRAT3-Reading scores were not significantly associated with the other neuropsychological test scores; therefore, earlier age of L2 acquisition better accounts for improved performance than English proficiency on tasks that require cognitive flexibility for bilinguals.

**Conclusions:** Clinicians and researchers will better serve the bilingual population by assessing language history, including the age at which the second language was acquired, during tests requiring cognitive flexibility.

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**Poster Session 1:  
Aging, Dementia(Alzheimer's),  
HIV/AIDS/Infectious Disease,**

**5:15–6:45 p.m.**

**Aging**

**T.J. ARENTSEN, D. YI, S. PANOS, H. SCHROEDER, W.S. BROWN & S.D. MARION. Interhemispheric Transfer Time (IHTT) and Executive Functioning: A Healthy Aging Examination of the Speed of Cortical Communication.**

**Objective:** Research on aging and cognition has led to better understanding of neural pathways underlying executive functioning in older adults. With advancing age, the Corpus Callosum (CC) may decrease in size at a faster rate than the posterior CC, yet few have studied speed of interhemispheric communication in relation to executive functioning. We tested the hypothesis that slower interhemispheric transfer time (IHTT) predicts less efficient executive functioning in older adults.

**Participants and Methods:** Participants were 15 older adults ages 65-85 compared with 16 younger adults ages 23-37. Measures included N1 latency of P3 and P4 visual evoked potentials (EP) from unilateral trials of a pattern-matching task. N1 latencies for left (P3) and right (P4) EP's were subtracted to calculate IHTT. Executive functioning was assessed via the D-KEFS.

**Results:** IHTT was largely unrelated to executive functioning, although faster IHTT predicted better verbal fluency in both groups. Shorter P3 and P4 latencies to lateralized visual patterns, a marker of neuronal efficiency, predicted faster D-KEFS inhibition and semantic fluency performance. Interestingly, LVF (RH) EP latency was correlated with inhibition and semantic fluency for older ( $r$ 's  $>0.54$ ,  $p < 0.05$ ) by not younger adults.

**Conclusions:** Results suggest that early neuronal speed of transferring information across hemispheres may predict fluency performance (or

efficient fluency); however, executive functioning was more strongly predicted by speed of arrival of information to the contralateral hemisphere. These findings are consistent with previous findings that aging affects subregions of the CC in a non-generalized fashion. Future studies need to incorporate measures of frontal functioning in relation to the speed of executive functioning.

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**A.L. AUSTIN, R. ADAMS, J. SCOTT, L.S. MILLER & L.E. BAADE. State Anxiety, Trait Anxiety and Depressive Symptoms minimally affect Global Cognitive Performance in an Elderly Sample.**

**Objective:** This follow-up retrospective study evaluated the size and unique proportion of variance that state anxiety accounted for above and beyond symptoms of depression and trait anxiety. Specific cognitive domains were also examined. It was hypothesized that state anxiety shared variance with global cognitive performance above and beyond symptoms of depression and trait anxiety.

**Participants and Methods:** Participants were 220 adults, between 65 and 89 years ( $M = 73.88$ ,  $SD = 5.40$ ), referred for outpatient neuropsychological assessment at the OU Health Sciences Center Neuropsychology Laboratory. Participants completed the Mini Mental State Examination (MMSE), Repeatable Battery for the Assessment of Neuropsychological Status (RBANS), Geriatric Depression Scale (GDS), and the State-Trait Anxiety Inventory (STAI).

**Results:** Hierarchical regression analyses indicated that education, gender, depression, trait and state anxiety accounted for significant variance in RBANS Total score (Adj  $R^2 = .09$ ,  $F [5, 214] = 5.42$ ,  $p < .001$ ). Depression alone was not significant, ( $\beta = -.09$ ,  $p > .05$ ). State anxiety accounted for marginal variance beyond education, gender, depression and trait anxiety ( $\beta = -.13$ ,  $p = .08$ ; Adj  $R^2$  change =  $.01$ ,  $p = .08$ ). The RBANS Attention Index score also shared variance with depression, trait anxiety and state anxiety (Adj  $R^2 = .14$ ;  $F (5, 214) = 3.09$ ,  $p < .001$ ).

**Conclusions:** Results indicated that state anxiety shared minimal variance with global cognitive performance beyond education and gender, while depression and trait anxiety did not. Further, the variables shared a negative relationship with attention. Clinical meaningfulness of these findings are discussed.

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**L. DRAG, L.A. BIELIAUSKAS, S.A. LANGENECKER & K.E. HAZLETT. Patterns of Brain Activation Associated with Visuospatial Processing in Older and Younger Adults.**

**Objective:** Visuospatial functioning is one domain disproportionately affected by the normal aging process. The current study used fMRI to identify functional changes that may accompany these age-related behavioral declines in visuospatial ability.

**Participants and Methods:** Healthy non-demented older adults (OA; ages 70-85) and younger adults (YA; ages 20-35) completed a Figure-Ground Test in which they made yes/no decisions regarding whether a line-drawn figure was present in complex (experimental condition) and simple (control condition) arrays of figures. Within the experimental condition, figures were either overlapping or embedded. This task was completed twice, once during fMRI scanning and once during a behavioral session. Participants also completed a brief neuropsychological battery.

**Results:** Preliminary ANOVAs with behavioral data from 6 OA and 11 YA showed that OA made more errors in the experimental condition of the Figure-Ground Test (81% accuracy in YA compared to 72% in OA;  $p = .08$ ) but not the control condition. Preliminary fMRI data from seven

participants (five YA, two OA) showed activations in the bilateral pre-cuneus and superior parietal lobule (greater extent on the right) for the embedded condition relative to the control condition as well as for the overlapping condition relative to the control condition (greater extent on the left).

**Conclusions:** These preliminary data demonstrate a trend towards age-related decrements in visuospatial processing and identify anatomical regions that may underlie these age-related differences. Additional behavioral and fMRI data are currently being collected and will allow us to examine the underlying functional correlates associated with age-related changes in visuospatial functioning.

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**A.L. FISCHER, A. COOLIN, R. JAYAKAR, D.M. BERNSTEIN & W.L. THORNTON. Presence of Vascular Illness Negatively Impacts Theory of Mind in Older Adults.**

**Objective:** Age differences in theory of mind (ToM) exist after accounting for age-related differences in traditional neuropsychological performance (memory, executive function, processing speed). Previous research has shown health to impact the relationship between older age and declining cognition. The current study addressed whether health, as measured by vascular illness, may influence ToM reductions observed in late life.

**Participants and Methods:** Seventy-three older adults (aged 51 - 86) completed an interactive false-belief task (measuring ToM). Two groups comparable in age, gender, and education were established based on the presence ( $n = 37$ ) or absence ( $n = 36$ ) of vascular illness (hypertension, diabetes, high cholesterol). Neuropsychological indicators (WAIS Digit Symbol Coding, D-KEFS Color-Word Interference) and depressive symptoms (CES-D) were measured for all participants. Regression analyses were conducted to determine whether neuropsychological or health factors were predictors of ToM performance.

**Results:** The two groups performed similarly on all measures except ToM ( $t (70) = 2.11$ ,  $p < .05$ ), where the illness group exhibited more errors. In the regression model, age and neuropsychological abilities were not significant predictors of ToM performance. The presence of vascular illness uniquely accounted for 6% of the variance in ToM, over and above age, depressive symptoms, and neuropsychological performance ( $\Delta R^2 = .06$ ,  $F (1, 69) = 4.49$ ,  $p < .05$ ).

**Conclusions:** Age differences in ToM may be independent of differences in traditional neuropsychological abilities. The current findings suggest that the presence of vascular illness may be an important and previously unrecognized predictor of ToM performance in later life.

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**H.M. GONZÁLEZ, M. JOHNSON-JENNINGS & W. TARRAF. What do parents have to do with my cognitive reserve?**

**Objective:** To examine if the association between individual-level educational achievement and cognitive functioning in later life is explained by early childhood influences.

**Participants and Methods:** Design: Prospective cohort study data (Health and Retirement Study HRS: 1998-2004), a multistage probability sample of adults 51 years and over in 1998, were analyzed.

Setting: Contiguous 48 United States.  
Participants: Nationally representative sample of older adults (N=18,465)  
Main Outcome: Telephone Interview of Cognitive Status.

Main Predictors: Individual-level achievement (i.e., educational and occupational) and childhood SEP (i.e., paternal education and profession).

**Results:** In model 1 individual-level achievement was significantly associated with global cognitive function ( $B=0.560$ ,  $z=32.07$ ,  $p<0.001$ ; controlling for age, sex and race). Parental SEP was added to model 1; was significantly associated with global cognitive function and substantially attenuated (moderated?) the association between individual-level achievement and cognition.

**Conclusions:** Individual-level achievement and early childhood environment contribute to one's cognitive reserve in later life. Further, childhood deprivation is associated with increased risk for cognitive decline. Parental SEP and individual-level achievements are proxies for many environmental, emotional and nutritional factors that are influential throughout life, perhaps including non-specific protective factors against cognitive decline in later life.

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**L. GUIDOTTI, M. SEIDENBERG, K. NIELSON, J. WOODARD, S. DURGERIAN, P. ANTUONO & S. RAO. Semantic Knowledge and Recognition Accuracy for Famous Names from Different Time Epochs Predicts Memory Decline in Asymptomatic Elderly.**

**Objective:** Episodic memory is the most common area of cognitive decline across the spectrum from normal cognitive aging to Alzheimer's Dementia (AD). Prediction of episodic memory decline has important clinical and theoretical implications. This study examined if semantic knowledge of famous people from different time epochs (recent, remote, and enduring) was associated with episodic memory decline among asymptomatic older subjects.

**Participants and Methods:** 78 asymptomatic subjects (Age=73 years) were administered a recognition test for Recent (Angelina Jolie), Remote (Phil Silvers), and Enduring (Paul Newman) famous names. Measures of semantic knowledge, recognition accuracy, and recognition reaction time for the famous names were collected. The Rey Auditory Verbal Learning Test (RAVLT) and Dementia Rating Scale (DRS-II) was used to evaluate episodic memory at baseline and 18 months later. After 18 months, 27% of the sample declined at least 1 SD (Decliners, n=20) while the remainder scored within 1 SD of their previous performance (Non-Decliners, n=20). Age and education did not differ between groups.

**Results:** At baseline, decliners were less accurate than non-decliners in accuracy of recognizing famous names only in the Recent time epoch ( $p=.02$ ), and also showed poorer performance than non-decliners in semantic knowledge for famous names only from the Enduring time epoch ( $p=.04$ ). There were no differences between groups in reaction time across time epochs.

**Conclusions:** Findings are consistent with the notion that the ability to acquire recent information and update previously acquired semantic knowledge may be important markers for subsequent memory decline in the asymptomatic elderly.

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**J. GURCZYNSKI & M. DANIEL. Association Between Verbal "Intelligence" and Verbal Memory in the Elderly.**

**Objective:** Research has demonstrated an association between IQ and memory test performance for all levels of intelligence, but the nature of the relationship varies between studies. Clinically, discrepancies between intelligence level and memory performance are suggestive of possible neuropsychological deficit. The research in this area with older adults is scant and therefore the purpose of this study was to determine if there is an association between verbal "intelligence" and verbal memory and learning in elderly adults.

**Participants and Methods:** Volunteer participants were 17 men and 31 women age 80-89. All subjects were screened and had no significant history of, or current medical / psychological problems or substance use. Subjects were administered WAIS-3 Vocabulary and the Rey Auditory Verbal Learning Test (AVLT) as part of a larger neuropsychological battery.

**Results:** The correlation between Vocabulary scaled scores and AVLT Total Recall raw scores was significant ( $r(46) = .38, p < .007$ ). Subjects were divided into two groups based on Vocabulary scaled score: 7-10 ( $n = 15$ ) and 11-18 ( $n = 33$ ). The groups' mean (standard deviation)

Total Recall scores were significantly different: 7-10 = 26.67 (4.85); 11-18 = 34.06 (9.55) ( $F = 8.0, p < .007$ ). The correlation between Vocabulary and AVLT Delayed Recall scores was not significant ( $r(46) = .26, p = .090$ ). The difference between the two groups' mean Delayed Recall score also was not significant ( $F = 2.99, p = .090$ ).

**Conclusions:** For patients in their 80's, overall verbal ability is significantly associated with efficiency of learning verbal information. In contrast, verbal ability is not significantly associated with delayed verbal memory.

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**J. GURCZYNSKI, M. DANIEL & P. MICHAEL. Association Between Verbal and Visual-Graphic Memory Change in the Elderly.**

**Objective:** Normative data for many tests indicate age-related declines are more pronounced for visual-graphic than for verbal memory tests. The purposes of this study were to determine: 1.) if there is a significant decline in verbal and visual-graphic learning and memory during the 8th decade and; 2.) if the extent of decline is different for verbal and visual-graphic learning and memory.

**Participants and Methods:** Volunteer participants were 17 men and 32 women age 80-89. All subjects were screened and had no significant medical / psychological problems or substance use. Subjects were administered the Rey Auditory Verbal Learning Test (AVLT) and the Brief Visuospatial Memory Test-Revised (BVMTR) as part of a larger neuropsychological battery.

**Results:** The correlations between age and AVLT Total Recall and Delayed raw scores were not significant ( $r(47) = -.083, p = .572$ ;  $r(47) = -.143, p = .328$ ). The correlation was significant for age and BVMTR Total raw score ( $r(47) = -.328, p = .021$ ) but not for age and BVMTR Delayed raw score ( $r(47) = -.185, p = .204$ ). The differences in correlations for age and AVLT vs. BVMTR Total raw scores were not significant ( $Z = 1.23, p = .108$ ); neither were the differences in correlations for age and AVLT vs. BVMTR Delayed raw scores significant ( $Z = .21, p = .417$ ).

**Conclusions:** These findings suggest there is not a significant decline in verbal learning or delayed recall during the 8th decade. There is a significant decline in visual-graphic learning efficiency but not delayed recall. Although the extent of decline in learning efficiency is somewhat greater for visual-graphic than verbal material, the difference was only marginally statistically significant.

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**C.I. HIRSHSON, Y. GOLDIN-LAURETTA & R. HOLTZER. Using robust sampling procedures to examine gender differences in Neuropsychological test performance in older adults.**

**Objective:** Examine the effect of gender on neuropsychological test performance in a large community-based cohort of older adults using robust (i.e., longitudinal) sampling procedures (Holtzer et al 2008). Provide robust norms for neuropsychological tests stratified by gender.

**Participants and Methods:** Participants were non-demented individuals age 70 years and older ( $N=305$ ) enrolled in the Einstein Aging Study (EAS). As previously described, dementia free status in the robust sample was ascertained based on baseline performance and two consecutive yearly follow-up visits.

Individual neuropsychological tests served as the dependent measures in three separate MANOVAs that assessed the cognitive domains of attention/executive function, verbal IQ and memory. Gender served as the two-level quasi independent variable. Analyses controlled for age, education, ethnicity, medical comorbidity, and general cognitive status.

**Results:** MANOVAs showed significant gender effects on attention/executive function [Wilks's  $L=.95, F(5, 224)=2.36, p=0.004$ ], verbal IQ [Wilks's  $L=.91, F(4, 252)=6.13, p<0.001$ ], and memory [Wilks's  $L=.96,$

$F(2, 294)=5.60, p=0.004]$ . ANOVAs, conducted as follow-up tests with Bonferroni correction, showed that men performed better than women on the Block Design [ $F(1, 228)=5.43, p=0.021$ ] and Information subtests [ $F(1, 255)=18.20, p<0.001$ ] and on the Boston Naming test [ $F(1, 255)=3.92, p=0.049$ ]. Women performed better on the Free and Cued Selective Reminding Test [ $F(1, 295)=4.93, p=0.027$ ] and on the Category Fluency test [ $F(1, 295)=8.18, p=0.005$ ]. Gender differences on Trails A & B, FAS and the Digit Span and Vocabulary subtests were not significant.

**Conclusions:** These findings suggest that normative neuropsychological data for older adults should be stratified by gender.

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#### **A.B. INSCORE, N.E. SILVERMAN, J.D. SORKIN, L.W. FORRESTER & A.P. GOLDBERG. Yoga Improves Cognitive Functioning in Postmenopausal Women: A Preliminary Study.**

**Objective:** Obesity in postmenopausal women increases risk for cardiovascular disease and is associated with cognitive dysfunction. We hypothesized that yoga, which has been associated with health and cognitive benefits, would improve cognitive functioning in healthy postmenopausal women.

**Participants and Methods:** Nine healthy postmenopausal women ranging in age from 49-60 years, with BMI between 23-34 kg/m<sup>2</sup> participated in 3 months of yoga training. Attention/working memory, learning and memory, processing speed, executive functioning, visuospatial ability, and psychomotor speed were assessed with a number of traditional (paper and pencil) neuropsychological assessment instruments as well as computerized measures (ANAM). A dual task involving walking and mental arithmetic assessed multitasking.

**Results:** There were significant improvements in performance on measures of processing speed across sessions (Stroop word baseline raw = 93.0, post-test raw = 100.8,  $p<0.005$ ; ANAM Stroop color baseline throughput = 74.2, post-test throughput = 82.8,  $p<0.007$ ). The processing speed findings were reinforced by the observed increase in number of serial 7 calculations completed during dual task at post-testing ( $p<0.002$ ). Additionally, there was a trend towards improved verbal learning (CVLT-II Trials 1-5 baseline total = 51.6, post-test total = 55.9,  $p<0.065$ ). Performance in other neurocognitive domains, including reaction time, attention, motor speed, and executive functioning was unchanged.

**Conclusions:** A three-month yoga intervention improves processing speed and has a tendency to improve verbal memory in healthy lean and obese postmenopausal women. Our findings suggest that the mind-body training achieved by yoga improves cognitive functioning and may have broader health benefits than more traditional exercise programs.

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#### **A. KAUNG, J. HIMALI, A. BEISER, S. DEVINE, E. KAPLAN, S. SE-SHADRI, P.A. WOLF & R. AU. Relationship between Framingham Stroke Risk Profile and Clock Drawing Performance.**

**Objective:** Previous epidemiologic studies have demonstrated strong associations between stroke risk factors and cognitive impairment. This project examines the relationship of Framingham Stroke Risk profile (FSRP), a composite index of cardiovascular risk factors that measures 10 year probability of stroke to performance on the Clock Drawing Test (CDT).

**Participants and Methods:** Clock drawings from 1544 Framingham Heart Study Offspring participants (M age =60, 54% female, stroke and dementia free) were examined using a 24-point error scoring system for both command and copy conditions. We analyzed the CDT summary score and a binary subscore for time setting (using a cutoff of >0.5). Age, sex and education adjusted linear and logistic regression models were used.

**Results:** The association between the FSRP components and the CDT summary score was not significant under either command or copy conditions. Under the command condition, among participants aged > 60 years, FSRP was associated with an increased chance of making time setting errors (OR associated with 1 unit increase in log FSRP, OR=1.44;  $p=0.022$ ). Current smokers were 64% more likely to make time-setting errors (OR=1.64;  $p=0.019$ ); among smokers > 60 years, it was twice as likely (OR=2.01;  $p=0.033$ ). In patients >60 years, a significant association was found between history of diabetes and time-setting errors (OR=1.63,  $p=0.049$ ).

**Conclusions:** CDT performance under the copy condition was not associated with the FSRP or its components. Under the command condition, CDT time-setting errors were associated with smoking; and, in those >60 years, with FSRP, smoking and diabetes. Hypoperfusion of the frontal regions may underlie these executive function impairments.

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#### **M. KRAYBILL, Y. SUCHY & K. PARRY. The Utility of a Motor Programming Task in the Prediction of Functional Independence Over Time.**

**Objective:** Age-related declines in cognitive functioning are known to be associated with changes in instrumental activities of daily living (IADLs). However, it can be difficult to determine whether subtle cognitive changes in relatively high-functioning individuals will be relevant to real-world functional problems. There may also be a discrepancy between self-reported versus actual functional abilities. The purpose of this study was to examine the utility of a brief motor programming (MP) task in the prediction of IADL errors one year after an initial evaluation.

**Participants and Methods:** 50 older adults (age 60 to 87) completed an initial battery of neuropsychological tests and returned for a follow-up evaluation approximately one year later. Testing included a computerized MP task (i.e., Push-Turn-Taptap task from the Behavioral Dyscontrol Scale-electronic version), Mattis Dementia Rating Scale (DRS), self-reported IADLs, and a performance-based IADL measure.

**Results:** Components of MP (i.e. motor-planning, motor-learning, and motor-control) were a) correlated with both initial and follow-up DRS scores ( $r$  values ranged from  $-.30$  to  $-.58$  with all  $p$  values  $<.05$ ), and b) significant predictors of both self-reported and performance-based IADLs at the time of follow-up, even after controlling for demographic variables and initial IADL performance (Self Report: R square change=.155,  $p<.05$ , Performance: R square change=.150,  $p<.05$ ).

**Conclusions:** MP tasks are associated with global cognitive functioning and may provide a useful way of assessing individuals' risk for developing future IADL problems. Such tasks may be uniquely advantageous for assessing subtle functional changes since they are less confounded by visuospatial, language, or memory abilities.

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#### **J.L. KUBIK & W.L. THORNTON. Medical Illness Burden and Self-rated Health in Relation to Older Adults' Everyday Problem Solving.**

**Objective:** Everyday problem solving (EPS) is predictive of real world functioning, and is related to objective as well as subjective measures of health (i.e. medical illness burden and self-rated health; SRH). We extended previous findings by comparing how well specific types of illness burden, (vascular versus non-vascular), as well as self-rated physical functioning (SRPF) and self-rated mental health (SRMH) predict EPS performance.

**Participants and Methods:** Participants were 93 community-dwelling adults aged 55 and over. Vascular and non-vascular burden were each defined as 0-1 versus 2 or more of the respective types of illnesses. Self-rated physical and mental health scales were derived from the Short-Form 36. EPS performance was based on the number of participants' solutions to 16 everyday problems that were: 1) unique and 2) safe and effective.

**Results:** Demographic and predictor variables determined to be significantly correlated with EPS performance were entered into a hierarchical regression analysis; age, education, and gender on step one, and vascular burden and SRPF on step two. After taking into account demographic variables, only SRPF was a significant predictor of EPS performance, with the final model predicting 40.4% of the total variance in EPS performance.

**Conclusions:** Results suggest that regardless of the number or type of medical diagnoses, individuals' subjective perception of their physical health is directly related to EPS performance. Specifically, the extent to which individuals feel limited by their physical condition may provide information regarding their real-world problem solving; highlighting the utility of SRPF as a potential indicator of the EPS ability of community-dwelling older adults.

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**E.M. LANE, T.E. CONTURO, D.F. TATE, J. PRICE, A.R. MCMICHAEL, D. ROMO, J. HEAPS & R.H. PAUL. The Role of IQ as a Protective Measure Against Age-Related Decline in Frontal White Matter and Cognition.**

**Objective:** Previous research has noted correlations between declines in cognitive function and decreases in frontal white matter volumes in aging. Additionally, research in diseased populations shows that IQ, a proxy measure of cognitive reserve (CR), has a protective effect on cognition. The purpose of the present study is to determine whether individuals with age-related reductions in frontal white matter volume perform better on measures of executive function if they have a higher CR value.

**Participants and Methods:** Fifty-six healthy individuals aged 51 to 85 (mean=63.52, SD=8.01) underwent 3T MRI and executive function tests (Trail Making B, Letter-Number Sequencing, FAS letter fluency, RBANS Digit Span, DKEFS Stroop Task, and Maze Completion). Estimated IQ, an indicator of CR, was derived from the reading recognition portion of the Wide Range Achievement Test (WRAT).

**Results:** RBANS Digit Span ( $r=0.27$ ), Letter-Number Sequencing ( $r=0.30$ ), and FAS ( $r=0.47$ ) correlated with frontal white matter volume. Individual regression analyses with these variables were also significant. However, when WRAT scores were added to each regression as a moderator, only Letter-Number Sequencing remained significant ( $F(1, 53)=4.47$ ;  $p=0.04$ ).

**Conclusions:** Despite relationships between select measures of executive function and frontal white matter volume, only Letter-Number Sequencing remained significant when a CR variable was added into the regression model as a moderator. These findings suggest that CR may act as a buffer against performance decline on tasks involving working memory and attention as associated with age-related decreases in frontal white matter volume, though the effect may be limited in scope.

Grant Support: U.S. NIH R01 grants NS52470 and NS39538.

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**E.C. LERITZ, W.P. MILBERG, D.H. SALAT, M. VALMAS, C.E. BARBER, V.J. WILLIAMS, J.L. RUDOLPH, L. LIPSITZ & R.E. MCGLINCHEY. The Relation of Source Memory and Item Memory to Brain Structure in Cerebrovascular Risk.**

**Objective:** This study examined how source memory (SM) and item memory (IM) differentially relate to brain structure in individuals with varying degrees of risk for cerebrovascular disease (CVD).

**Participants and Methods:** Thirty-eight older adults with no history of CVD diagnosis underwent high-resolution T1-weighted magnetic resonance imaging (MRI) for automated segmentation of brain structures as well as for estimation of cortical thickness. Each participant also completed a memory experiment designed to assess item and source memory (Glisky et al. 1995). Measures of blood pressure, serum cholesterol and glucose were also obtained.

**Results:** Better source memory performance was associated larger volume of both the left and right hippocampus, while item memory was only associated with left hippocampal volume. However, these relationships were only significant for those participants with lower ranges of CVD risk. There was a trend such that higher scores on indexes of SM were associated with greater thickness of the medial frontal cortex, but this association did not appear to be impacted by risk for CVD.

**Conclusions:** These data support previous studies suggesting that SM and IM are related to hippocampal integrity, and that SM may be additionally supported by the frontal lobes. However, these results provide additional insight into the fact that these relationships may be influenced by the degree of risk for cerebrovascular disease. Finally, these data highlight the important role of including such risk factors when examining memory function in what is currently conceptualized as the "normal aging" process.

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**J. LINCK, J. SCOTT, M. HOLLIMON & R. ADAMS. Classification Rates in a Group of Outpatients with Neurologic Illness and a Group of Healthy Controls Using the RBANS.**

**Objective:** The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a measure designed to assess cognitive functioning in both older and younger neurologic and psychiatric patient populations. However, no paper reviewed to date has searched to identify the instrument's ability to classify a heterogeneous patient population made up of individuals with various neurologic and/or psychiatric conditions.

**Participants and Methods:** Using 60 individuals seen in a large Midwestern outpatient neuropsychology clinic, the RBANS was examined using discriminant analysis among a group of healthy controls, a group of patients diagnosed with Parkinson's disease, and a group of patients diagnosed with probable Alzheimer's disease.

**Results:** The results of a discriminant analysis were significant and revealed one function accounting for 65% of the variance in the sample. Results suggest that the RBANS Delayed Memory Index accounted for 77% of the variance in scores on the function, but that the Attention, Immediate Memory, and Language Indices contributed to a lesser degree. 70% of the original cases were classified correctly.

**Conclusions:** The RBANS was shown to correctly classify 77% of a sample of healthy controls, Parkinson's patients, and probable Alzheimer's patients and is a useful instrument in differentiating between different neurologic and non-neurologic populations. The Delayed Memory Index appeared to be the most useful index in differentiating this group of individuals.

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**D.R. MORGAN, J. LINCK, J. SCOTT & R. ADAMS. Assessment of the RBANS Visual and Verbal Indices in a Sample of Neurologically Impaired Elderly Subjects.**

**Objective:** Neuropsychological assessment is necessary to effectively measure cognitive decline. Commonly, fatigue complicates testing while working with older adults, and briefer assessments sensitive to dementia are essential. The RBANS's (Randolph et al.) is one such measure, but the original factor structure was not entirely supported (Duff et al., 2006). Duff et al. (2009) proposed the use of visual and verbal indices, and this study assessed the effectiveness of these indices to differentiate participants with neurological disorders (i.e., MCI, AD, and PD).

**Participants and Methods:** Subjects were referred for neuropsychological evaluations and given the RBANS. Groups included individuals diagnosed with MCI, AD, or PD, with ages ranging from 65-93 years. Ethnic background was predominantly Caucasian.

**Results:** ANCOVA and Bonferonni posthoc analyses identified that groups were significantly different on the RBANS Verbal and Visual Indices. The AD group was significantly different from the MCI and PD groups for the Verbal Index, while the MCI and PD groups were not significantly different. The PD group was not significantly different from the MCI group on the RBANS Visual Index, but the AD group was significantly different from the MCI and PD groups. PDA assessed classification rates of the MCI, AD, and PD groups. AD groups were classified more accurately than either other group.

**Conclusions:** This study revealed that utilization of RBANS Verbal and Visual Indices provide additional benefit when working with neurologically impaired older adults. Clinicians will benefit from additional research looking more closely at the use of these new factor indices within neurologically impaired individuals.

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#### **D.R. MORGAN, J. LINCK, J. SCOTT & R. ADAMS. Classification Rates of the RBANS Verbal and Visual Indices versus RBANS Original Indices Across Neurologically Impaired Older Adults.**

**Objective:** The assessment of neuropsychological functioning is essential when working with geriatric individuals. Particularly, brief and comprehensive measures are needed to assess older adults, given their propensity to fatigue. The RBANS is one such measure whose factor structure was recently challenged (Duff et al., 2006), and Duff et al. (2009) proposed the use of visual and verbal indices. The present study assessed if these new indices are effective in accurately classifying groups of individuals with neurological diseases.

**Participants and Methods:** Subjects were referred for neuropsychological evaluations and given the RBANS. Groups included individuals diagnosed with MCI or AD, with ages ranging from 66-93 years. Ethnic background was predominantly Caucasian.

**Results:** This study found that the MCI and AD groups are significantly different on each of the traditional RBANS indices, as well as the two factor model of the RBANS. Although groups were different, PDA did not reveal that the two factor model classified the groups better than traditional RBANS measures.

**Conclusions:** This study revealed that the two factor model does yield differences for MCI and AD groups; however, their classification rates do not add much more to the original RBANS indices. Continued research on the two factor model is needed assessing neurologically impaired groups.

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#### **D.A. LOWE & S.A. ROGERS. How Do Gender and Marital Status Impact Older Adults' Language and Visuospatial Skills?**

**Objective:** There is growing evidence of gender differences in older adults' language and visuospatial functioning, but little has been done to examine if and how these gender differences vary according to marital status. This study examines potential differences in older adults' language and visuospatial skills according to gender and marital status.

**Participants and Methods:** 148 older adults (56 to 104) voluntarily completed language tests that included the Boston Naming Test (BNT), FAS, Animals, and an overall language score (mean of subtest z-scores). Visuospatial skills were measured by the Rey-Osterrieth Complex Figure Copy, WAIS-III Picture Completion and Block Design, and a total visuospatial score (mean of subtest z-scores). Participants' marital status was categorized into married and unmarried groups.

**Results:** Men performed better than women on Picture Completion, and those who were married performed better than those unmarried on BNT, Picture Completion, Block Design, and overall language and visuospatial scores ( $p < .05$ ). There was a significant interaction between gender and marital status on BNT ( $p < .01$ ), with unmarried women per-

forming worse than all other groups. Married women performed significantly better on FAS than married men, although married men performed better on this test than unmarried men ( $p < .05$ ). Unmarried women performed significantly worse than their married counterparts on Block Design, Picture Completion, and the composite language and visuospatial scores ( $p < .02$ ).

**Conclusions:** Older adults' language and visuospatial abilities appear to vary according to gender and marital status. The only gender difference was in visual perception, where men performed better. Marriage may contribute to stronger phonemic fluency for men, and to stronger visual perception, visual construction, object naming, and overall language and visuospatial functioning for women. These results argue for greater attention to marital status and gender when examining older adults' language and visuospatial abilities.

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#### **K.F. MCINERNEY, J. HAMMOND & J.A. SUHR. Relationship Between Cognitive Activity and Cognitive Functioning in Older Adults Without Dementia.**

**Objective:** Cognitive activity (CA) has been positively correlated to cognitive functioning in older adults (Wilson et al., 2005) and negatively correlated to the risk of developing dementia (Wilson, Scherr, Schneider, Tang & Bennett, 2007). The current study evaluated the relationship between CA and cognitive performance measured by a variety of neuropsychological tasks.

**Participants and Methods:** Data was collected as part of a community memory screening of independently living adults without dementia. Participants were 30 (23 female) adults between 65 and 87 (Mean=74.53, SD=5.374) with between 10 and 20 years of education (Mean=15.78, SD=3.123). Level of CA was measured during a biographical and health status interview. Neuropsychological measures were administered in the following order: The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1994), Controlled Oral Word Association (COWA; Benton, Hamsher, & Sivan, 1994), the Trail-Making Test (TMT; Reitan, 1958), selected subtests of the Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV; Pearson, 2008), the National Adult Reading Test (NART; Nelson & O'Connell, 1978), and the Contingency Naming Test (CNT; Taylor 1988).

**Results:** Level of current CA was not related to participant age or educational level. Level of current CA was related to better learning and memory (list learning ( $r=.51$ ,  $p=.004$ ); story recall  $r=.37$ ,  $p=.04$ ); better semantic ( $r=.38$ ,  $p=.04$ ) and verbal fluency ( $r=.57$ ,  $p=.001$ ), and better working memory skills (Letter-Number Sequencing  $r=.36$ ,  $p=.05$ ; Arithmetic  $r=.36$ ,  $p=.05$ ). The same pattern emerged when controlling for educational level.

**Conclusions:** These findings provide further evidence of a positive correlation between CA and cognitive performance in older adults without dementia.

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#### **C.S. MOORE, R.L. ANDERSEN, I.N. MILLER, W.G. HAYNES, S. ARNDT & D.J. MOSER. Gender and Neuropsychological Performance in Atherosclerotic Vascular Disease.**

**Objective:** Gender differences in cognition have been established across the lifespan, but findings are mixed on such differences in older age. Biological and sociocultural explanations have been offered for such differences. One possible factor, which has received less research, is the difference in vascular health between men and women. Men typically have poorer vascular health and vascular disease has been consistently linked to cognitive dysfunction. This study was conducted to assess gender differences in cognition in a sample of older individuals with atherosclerotic vascular disease (AVD), and determine whether these differences could be accounted for by differences in severity of illness.

**Participants and Methods:** Participants were 90 individuals (age 55–88) with AVD, with no history of stroke, cardiac surgery, or dementia. Vascular dilator function, the degree to which vessels dilate in response to vasoactive agents, was assessed using forearm venous occlusion plethysmography and was used as an indicator of overall vascular health. Neuropsychological assessment included the RBANS, WRAT-3 Word Reading, the Stroop Color-Word Interference Test, and subtests from the WAIS-III.

**Results:** Women had significantly better vascular function [ $t(88)=2.39, p=.019$ ] and less education than men [ $t(87.51)=-3.72, p<.001$ ]. Women also showed significantly better global neuropsychological function, memory, language, and selective attention. All of these gender differences in cognition remained when controlling for vascular function and education, with exception of the difference in selective attention.

**Conclusions:** In this sample of individuals with AVD, women significantly outperformed men on a range of tests. These differences were not generally accounted for by gender differences in vascular health or education.

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#### D.A. NATION, A.J. JAK, L. DELANO-WOOD, D.C. DELIS & M.W. BONDI. Pulse Pressure and Cognitive Functioning in Older Adults.

**Objective:** Recent research suggests that increased pulse pressure (PP) may be associated with brain microvascular damage and age-related cognitive decline. The present study sought to further examine the relationship between PP and cognitive functioning in cognitively intact older adults.

**Participants and Methods:** Sixty-one older adults were screened for neurological illness and cognitive impairment through neurological and neuropsychological evaluation. Regression analyses were used to examine the relationships among pulse pressure (PP) [systolic blood pressure (SBP) – diastolic blood pressure (DBP)], age, cognition, and Framingham Stroke Risk Profile (FSRP) scores.

**Results:** Participants were 44.3% male, 46.6% taking anti-hypertensive medications, average age, 74.5 yrs (SD=9.6), SBP, 126.2 (SD=11.2), PP, 52.7 (SD=11.0), and FSRP score, 14.2% (SD=13.0%). PP was not significantly related to gender, anti-hypertensive medications, or FSRP, but was correlated with age,  $R=0.367, P<0.01$ . PP was inversely correlated with a composite measure of language function (category fluency and naming),  $R=-0.451, P<0.001$ , but was unrelated to measures of attention, processing speed, visuospatial, executive, or memory abilities. This correlation remained significant after controlling for age and FSRP score,  $\beta=-0.375, P<0.01$ . There was also an inverse correlation between age and language function,  $R=-0.347, P<0.01$ , which was no longer significant after controlling for PP,  $\beta=-0.209, P=0.094$ .

**Conclusions:** Findings indicate that PP is inversely related to language function in cognitively intact older adults, an association that is independent of age and stroke risk. This suggests that increased PP may convey risk of language impairment beyond that of traditional risk factors and may account for age-related declines in language abilities.

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#### C.M. NGUYEN, J. BARRASH, A. LALOGGIA, D. TRANEL, A. BECHARA & N.L. DENBURG. Personality Characteristics Associated With Poor Decision-Making In Normal Elderly.

**Objective:** Some older adults show deficits in complex decision-making. The contribution of personality characteristics to that deficit in otherwise normal healthy adults was investigated. It was hypothesized that poor decision-making would be associated with personality ratings suggesting weak executive functioning (e.g., lack of planning, indecisiveness).

**Participants and Methods:** Decision-making in 63 healthy older adults (mean age, 74.3±7.9 years) was assessed with the Iowa Gambling Task (IGT). Subsets of decision-makers – 28 Normal and 30 Impaired – were identified. Thirty personality characteristics were assessed with Iowa Scales of Personality Change (ISPC), on which family and friends made behaviorally-anchored ratings of participants' personality: "BEFORE" (over their middle-aged years) and "NOW" (current). Change was calculated by subtracting "BEFORE" from "NOW" ratings. Ratings were dichotomized to reflect the presence/absence of personality difficulties now or before, and weakening of a personality characteristic (i.e., more than slight change in the adverse direction). Executive dysfunction scales included lack of planning, indecisiveness, lack of initiative, dependency, impulsivity and poor judgment.

**Results:** Hierarchical regression analyses in which the presence of disturbances in individual executive functions, and composite variables (tallying the number of such disturbances, BEFORE or NOW), were allowed to compete for entry into a model to predict IGT status. The number of disturbances BEFORE and the number NOW were both significantly and equally predictive (for both:  $R^2 = .10, P<.05$ ).

**Conclusions:** Personality characteristics suggesting weak executive functions contributed to impaired decision-making in healthy, independent elderly. Findings suggest this contribution may be related more to longstanding personality characteristics than to disturbances acquired in later years.

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#### X. ORTIZ, T. HERNANDEZ, A. GARCIA, A. FLORES, C. RAMÍREZ & P. VALDEZ. Changes on Behavioral Inhibition in Elderly People.

**Objective:** Behavioral inhibition is the ability to focus behaviour on activities that are necessary to achieve a goal, thus refraining actions that are irrelevant to the goal. Behavioral inhibition change as people get older, these changes are attributed to a deterioration of the frontal area, specifically the prefrontal area. Furthermore, it has been documented that schooling affects the performance on neuropsychological tests. The objective of this study was to determine the changes that occur with age on behavioral inhibition and to analyze the influence of schooling in elderly people.

**Participants and Methods:** A total sample of 305 elderly persons participated, 120 men and 185 women, between 60 and 87 years old, with no history of neurological disease or sensory deficit. All participants signed an informed consent and then performed a Stroop task. The test required the participants to read 48 words written in incongruent colors, and then to name the color of the ink of the same words. Time required to name the color of the ink and errors were taken as a measure of behavioral inhibition.

**Results:** Participants older than 77 years and with low education (0–5 years of schooling) needed more time and made more mistakes while naming the color of the ink, compared to younger participants (age: 60 to 76 years) and with higher education (6+ years of schooling).

**Conclusions:** These results are consistent with the frontal lobe deterioration hypothesis that suggests greater difficulties on behavioral inhibition. This study also demonstrates that behavioral inhibition is additionally impaired in elderly people with lower levels of education.

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#### S.Y. PATWARDHAN, P.J. MASSMAN & A. SOVANI. Effects Of Semantic Versus Phonemic Cues In The Episodic Memory Performances Of "Young-Old" Versus "Old-Old" Normal Elderly Adults.

**Objective:** The extent and pattern of decline in episodic memory (EM) abilities with normal aging is unclear. To investigate if there

are aging related changes in EM among normal elderly adults, we conducted a cross-sectional study comparing “young-old” (65–75 years) and “old-old” (>75 years) elderly adults. We particularly wanted to evaluate the usefulness of semantic versus phonemic cueing in enhancing EM in these two groups. It was hypothesized that young-olds would be faster and exhibit better overall EM performance than old-olds, but that both groups would exhibit similar magnitude of superiority of recall in response to semantic versus phonemic cues.

**Participants and Methods:** Thirty normally aging older adults (15 young-olds and 15 old-olds) participated (mean ageyoung-olds=69.20±2.78, mean ageold-olds=79.07±4.17). The groups were similar in sex distribution, years of education, and MMSE scores. EM was assessed using a paired associate verbal learning task consisting of 20 target words taken from the AVLT, paired with either semantically or phonemically related cues.

**Results:** Young-olds and old-olds required equivalent times to complete the task. A 2x2 Mixed Factor ANOVA revealed that the groups did not differ significantly in total words recalled and that semantic cueing was associated with better recall performance. The AgeXCue type interaction was insignificant.

**Conclusions:** Contrary to expectations, the old-olds performed as well as the young-olds on this EM task. However, consistent with hypotheses, old-olds showed as large an advantage as young-olds for recall in response to semantic cues versus phonemic cues. Thus, associative semantic networks continue to aid episodic memory performance even in the “old-old” age range.

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#### **R. PAUL, E. LANE, T. CONTURO, D. TATE, E. AKBUDAK, J. PRICE & J. HEAPS. Brain MRI Correlates of the Montreal Cognitive Assessment in a Non-Clinical Older Population.**

**Objective:** The Montreal Cognitive Assessment (MoCA) was recently introduced as a brief screening instrument to detect mild cognitive impairment (MCI). To our knowledge no study has examined the neuroimaging signatures of performances on the MoCA in a nonclinical sample.

**Participants and Methods:** All individuals in the present study (N=45, ages 51–85) were administered the MoCA and underwent 3T structural MRI. Volumes of total frontal gray matter, total frontal white matter, total hippocampus, and T2-weighted subcortical hyperintensities (SH) were determined. Correlations were computed to examine the shared variance between MoCA scores and the neuroimaging indices. In addition, the sample was subdivided by performance above (n= 21) and below (n=24) recommended cutoff scores on the MoCA (total score < 26) to determine if these groups differed on the neuroimaging variables.

**Results:** Total hippocampal volume correlated modestly with several individual subscales of the MoCA (Visuospatial/Executive, Naming, Learning, and Attention;  $r_s$  .28–.43,  $p_s$  <.05). In addition, total frontal gray matter correlated with Visuospatial/Executive, Naming, Attention, and Language;  $r_s$  .27–.32,  $p_s$  <.05). Neither SH volume nor total frontal white matter volume correlated with any performances on the MoCA. There were no statistically-significant differences on any of the imaging variables between individuals with performances below vs. above the recommended cutoff to define MCI.

**Conclusions:** There are modest correlations between performances on the MoCA and traditional neuroimaging signatures of cognitive aging, consistent with known brain functions, but no defined pattern of neuroimaging abnormalities was revealed among a sample of individuals with scores below recommended cutoffs for MCI.

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#### **A.M. RAYMER, C. FRAZIER, M. HAGA, G. MORDICA & M. SKILLEN. Effects of Aging on Gesture Recognition and Production.**

**Objective:** Studies indicate gesture production may decline with aging. Less is known about gesture recognition abilities and aging. Models of gesture processing distinguish praxis conceptual and movement knowledge represented within left hemisphere cortex. We examined this distinction for gesture production and recognition tasks in two age groups. **Participants and Methods:** The 24 participants, 12 young (40–55yrs) and 12 old (70–81 yrs), completed four tasks incorporating transitive tool gestures (n=20), symbolic gestures (n=10), and meaningless gestures (n=20): gesture concept yes/no verification (n=60; Is this brushing teeth?), gesture movement yes/no verification (n=50; Is this exactly how to use a toothbrush?), gesture to command (n=30; Show me how to...), and gesture imitation (n=50). We calculated percent accuracy in each task and coded production errors.

**Results:** Performance was significantly poorer in the older group than in the younger group ( $F=21.68$ ,  $p=.007$ ) for all gesture tasks. Performance was better for gesture concept verification than gesture movement verification ( $t=.3.80$ ,  $p=.001$ ) and for gesture to command than gesture imitation ( $t=.3.39$ ,  $p=.003$ ). Significant correlations were evident for gesture production tests and gesture recognition tests. Spatial errors (internal hand configuration errors, external limb orientation, joint movements) accounted for 80% of all gesture production errors for both groups across tasks. Body part as tool errors were rare in both groups.

**Conclusions:** A decline in praxis processing skills may be observed as part of healthy aging. Because decline was evident in all production and verification tasks, this speaks to a decline in mechanisms for both praxis conceptual and movement knowledge.

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#### **E.L. RISHER, S.A. ROGERS & D.A. LOWE. The Impact of Marital Status on Memory Among Older Adults.**

**Objective:** Many studies provide evidence for the psychological, social, and physical benefits of marriage; however, few studies have explored the effect of marital status on cognitive impairment among older adults. This study examines the impact of marital status on memory performance in older adults.

**Participants and Methods:** 148 older adults (M age = 78.73) completed a comprehensive neuropsychological battery that included the California Verbal Learning Test (CVLT-II), Rey-Osterreith Complex Figure (Rey-O), and Wechsler Memory Scale (WMS-III) subtests of Logical Memory (LM I and II) and Visual Reproduction (VR I and II). Participants were divided into two marital status groups: married and not married (i.e., single, widowed, and divorced).

**Results:** ANCOVAs controlling for age revealed significant differences in Logical Memory I and II,  $F_s(1, 51) > 7.85$ ,  $p_s < .01$ ; CVLT-II Totals 1–5 and Long Delay Free Recall,  $F_s(1, 50) > 5.33$ ,  $p_s < .03$ ; VR I,  $F(1, 50) > 7.51$ ,  $p < .01$ ; and Rey-O Immediate and Delayed Recall,  $F_s(1, 52) > 5.86$ ,  $p_s < .02$ . In each of these cases, post-hoc analyses showed that individuals who were married had significantly higher memory scores than those who were divorced, widowed, or single.

**Conclusions:** These results suggest that marriage may be beneficial for the verbal and visual memory functioning of older adults. These findings add memory performance to the areas of functioning that marriage seems to promote, including social support, greater subjective well-being, and better physical and emotional health. Perhaps married individuals exercise their memory more often through interactions with their spouse. Their memory may also be buffered by the reduced emotional and health problems experienced by married individuals. These findings have implications for evaluating memory and treating memory decline among older adults.

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**C. RODRIGUEZ-ARANDA & M.K. JAKOBSEN. Contribution of cognitive and psychomotor mechanisms to the age-related slowing of verbal processing.**

**Objective:** Age-related slowing affects cognitive and psychomotor mechanisms. Based on this consideration, the present study aims to evaluate to which extent the cognitive and psychomotor components required for verbal processing are compromised in normal aging individuals.

**Participants and Methods:** Thirty healthy subjects divided into three age groups (young, middle aged and older) participated in the study. Proper screening for dementia and depression was performed. A battery of tests comprising the Stroop test, the Vocabulary subtest of the WAIS-III, Logical Memory I and II as well as Digits Span of the WMS-III was used for cognitive evaluation. Furthermore, psychomotor mechanisms associated to verbal production were evaluated on four verbal tasks: phonemic and semantic fluency, naming and reading. The parameters examined were respiratory function and sound analysis of word articulation. All verbal tasks were adapted to be presented on a computer screen. During task performance subjects were instructed to speak through a face mask connected to a phonatory aerodynamic system that registered airflow, waveform and sound pressure levels. Additionally, the subject's answers were recorded and analyzed with spectrographic techniques. Analyses included reaction times for speech production, duration of word articulation and in-between intervals.

**Results:** In addition to confirm age-related cognitive decline, results showed a marked age-related reduction on the psychomotor parameters examined. Consistent with our prior data, declines in word production and phonatory capacity proved to be important elements determining performance in verbal tasks.

**Conclusions:** Slowing of cognitive and psychomotor elements necessary for speech production should be taken conjointly into account in order to understand normal age-related declines in verbal processing. Correspondence: *Claudia Rodriguez-Aranda, Ph.D., Dept. of psychology, University of Tromsø, University of Tromsø, Tromsø 9037, Norway. E-mail: claudia.rodriguez-aranda@uit.no*

**A.J. SHEFFER, S.A. ROGERS & D.A. LOWE. Does Anxiety Impact Older Adults' Memory? A Pilot Study.**

**Objective:** Previous research has examined the adverse influence of depression on the learning and memory of older adults, but there is insufficient research exploring the potential impact of anxiety on cognitive functioning among older adults. This preliminary analysis of an ongoing project looks at the effects of anxiety on the learning and memory of older adults who are experiencing normal aging.

**Participants and Methods:** Seventeen older adults (ages 63-90) who met clinical criteria for normal aging completed a comprehensive neuropsychological battery, including the Beck Anxiety Inventory (BAI), California Verbal Learning Test—2nd edition (CVLT-II), Rey Osterrieth Complex Figure, and WMS-III Logical Memory and Visual Reproduction subtests. Participants were also divided into those with minimal anxiety (BAI score = 0-7) and those with mild-to-moderate anxiety (BAI score of 8+).

**Results:** Anxiety was negatively correlated with CVLT-II Trial 5, Trials 1-5 total, and Short-Delay Free Recall,  $ps < .05$ . Those with mild-to-moderate levels of anxiety had significantly lower scores than those with minimal anxiety on CVLT-II Trial 5, Trials 1-5, and Short-Delay Free Recall,  $ps < .04$ . There were also meaningful trends for those with mild-to-moderate levels of anxiety to perform lower on Logical Memory I and II, CVLT-II Long-Delay Free Recall, and Visual Reproduction II,  $ps < .10$ .

**Conclusions:** The results of this preliminary analysis suggest that older adults who are experiencing normal aging and who have higher levels of anxiety may experience difficulty learning and encoding, particularly an unstructured list of words. There were trends for anxiety to also interfere with the learning and delayed recall of other verbal and nonverbal memory measures, but anxiety may especially complicate the learning of more difficult verbal tests. Anxiety may therefore have an impact on the learning and memory of older adults experiencing normal aging. These findings have direct implications for older adults and the clinicians who work with them.

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**S.A. ROGERS & D.A. LOWE. Predicting Older Adults' Functional Status from Executive Measures.**

**Objective:** Previous research has highlighted an association between executive dysfunction and the ability to perform instrumental activities of daily living (IADLs) among older adults. This study seeks to determine which executive functioning measures best discriminate between those with and without deficits in IADLs.

**Participants and Methods:** 148 older adults (ages 56-104) completed a comprehensive neuropsychological battery that included Stroop Color-Word Interference, Trails B, FAS, Rey-Osterrieth (Rey-O) Copy, and WAIS-III Arithmetic, Similarities, and Letter-Number Sequencing subtests. All raw scores were converted to z-scores. Participants' drawing strategy on the Rey-O was coded into one of seven organizational categories.

**Results:** A discriminant analysis was conducted using a forward stepwise approach for entering variables, with a minimum tolerance of .01 and an F to enter of 1.0 and F to remove of 0.0. The final model had significant discrimination between the two IADL groups (Wilk's  $\Lambda = .91$ ,  $p < .05$ ) and was composed of two variables, namely Stroop Color-Word Interference (partial  $\Lambda = .91$ ,  $R^2 = .21$ ) and Arithmetic (partial  $\Lambda = .96$ ,  $R^2 = .21$ ).

**Conclusions:** These results suggest that a strong model for predicting older adults' functional status from executive measures involves examining their performance on tests of arithmetic and response inhibition. Arithmetic and response inhibition appear to be the strongest predictors for differentiating between those older adults who can and those who cannot successfully complete instrumental activities of daily living. Caregivers and clinicians may therefore want to attend to these two executive measures, either independently or conjointly with other IADL assessments, to predict older adults' success with IADLs.

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**H. ROSSETTI, K. BERNARDO, D. PALMER, R. DIAZ-ARRASTIA, B. LEVINE, R. ZHANG & M. CULLUM. Impact of Life-Long Exercise Training on Cognitive Functioning: A Neuropsychological Investigation of Master Athletes.**

**Objective:** Previous studies have demonstrated the benefits of physical activity on brain health, but the impact of life-long exercise on cognitive functioning has not been examined. We compared the cognitive performance of Masters athletes (MA) to healthy sedentary (HS) individuals. The MA group was expected to perform significantly better on cognitive testing than the HS group.

**Participants and Methods:** Thirteen healthy MA [M-age 72.2; M-education 16.2], who actively exercise and participated in regular endurance-exercise training ( $\geq 15$  years) and U.S. Masters Athletic Association competitions, were compared to 9 HS controls [M-age 74.4; M-education 16.1], who were highly screened to exclude even subclinical cardiovascular disease. Group performances on standard measures of global cognition, executive functioning, processing-speed, verbal fluency, and memory were compared using ANCOVAs.

**Results:** Groups differed by estimated IQ [WTAR MA-M=114 vs. HS-M=104;  $F(22)=7.67$ ,  $p=.01$ ] which was co-varied in subsequent ANCOVA. The MA group performed significantly better ( $p \leq .03$ ) on Trails-A [M=53.6 vs. M=43.4;  $F(1,19)=5.22$ ], FAS [M=57.2 vs. M=39.1;  $F(1,19)=6.45$ ], and Stroop Color-Word [M=52.9 vs. M=44.4;  $F(1,19)=4.30$ ]. Group means did not differ ( $p \geq .06$ ) on the MoCA [M=25.9 vs. M=24.7;  $F(1,19)=0.45$ ], Trails-B [56.2 vs. 51.1;  $F(1,19)=0.91$ ], CVLT-II [M=57.9 vs. M=59.9;  $F(1,19)=.13$ ], or Animals [M=54.3 vs. M=41.9;  $F(1,19)=3.26$ ].

**Conclusions:** After controlling for estimated intelligence, Masters athletes outperformed healthy sedentary individuals on processing-speed,

letter fluency, and attention tasks. They obtained slightly higher scores on global cognition, set-shifting, and category fluency, while verbal memory performance between groups was very close. Based on this small sample, life-long exercise may benefit processing speed and executive control processes, but did not improve memory function in the elderly. Correspondence: *Heidi Rossetti, MS, Clinical Psychology, UTSW, 5323 Harry Hines Blvd, Dallas, TX 75390, United States. E-mail: hcrossetti@gmail.com*

#### **A.L. RUIZ-RIZZO. Qualitative measures including grammar types of words in Controlled Oral Word Association Test (COWAT) for healthy older adults. Preliminary.**

**Objective:** The number of total correct generated words is the typical scoring in COWAT. Nonetheless, this score itself does not completely capture relevant aspects of a subject's performance. For that reason, qualitative measures, as semantic or phonological clusters among words (clustering) and switches between one word and the next (switching) have also been explored. In spite of these measures, whether grammar types of generated words may inform about test performance has not been explored yet. That is why the objective is to provide descriptive data, quantitative and qualitative measures, including grammar types of words, of healthy older adults from Maracaibo Aging Study (MAS) in COWAT. **Participants and Methods:** 141 from 244 COWAT protocols (letters P, A and F in Spanish) have been reported until now (20.6% corresponding to male and 79.4% to female. Mean age of subjects: 66.43 SD 7.32; mean education: 6.98 years). Inclusion criteria were: being older than 55 years and being participating in this study; exclusion criteria were: antipsychotic medication, MCI or dementia, neurological disease (epilepsy, Traumatic Brain Injury or Nervous System Infections), psychiatric antecedents, history of substance abuse and systemic disease interfering with cognitive functioning.

**Results:** In a two by three matrix, relating education (two groups) and age (three groups), several quantitative (i.e., total number of correct words and total errors) and qualitative measures (i.e., average size cluster, total switches, and percentages of substantives, verbs, adverbs, adjectives and others) have been obtained.

**Conclusions:** Quantitative data relative to COWAT performance have could be obtained for Venezuelan healthy older adults; furthermore, it could be observed in this sample a strong tendency to generate a greater percentage of substantives than any other kind of words, as expected. Correspondence: *Adriana L. Ruiz-Rizzo, Bachelor, University of Antioquia, Calle 62 # 52-59 SIU Lab. Neurociencias cognitivas, Medellin 574, Colombia. E-mail: adrizzo@gmail.com*

#### **R. HOLTZER & M.J. SHUMAN. Cognitive Fatigue Effects on Attention Networks in Aging.**

**Objective:** We examined cognitive fatigue in the context of the alerting, orienting and executive attention networks of the ANT.

**Participants and Methods:** Methods: Participants were non-demented, 70 years and older (N=227), and enrolled in the Einstein Aging Study. Conceptually, cognitive fatigue was defined as a failure to sustain attention during task performance. Operationally, we defined cognitive fatigue as a decrement in performance over the course (i.e., 3 blocks) of the ANT.

**Statistical analyses:** Three separate repeated-measures ANOVA's used alerting, orienting and executive attention as the three-level dependent measures. The difference in millisecond reaction time between the first and last block, using 0 as an empirical cutoffscore, separated those whose performance declined over time and those whose performance improved. This served as a two-level between-subject factor.

**Results:** There was a time by group interaction,  $[F(2,442)=4.496, p=0.012]$  for the executive attention network, revealing a significant decline in performance consistent with cognitive fatigue. There were no significant cognitive fatigue effects for the orienting and alerting networks.

**Conclusions:** Individual differences in cognitive fatigue were observed in the executive

attention but not in the alerting or orienting networks. These findings are consistent with recent models that implicate the frontal basal circuitry as a core substrate of cognitive fatigue.

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#### **R. HOLTZER & J. SPAT. Effect of Age on Attention Demands.**

**Objective:** Research suggests that attentional control is reduced in aging. We examined age-related effects in the context of the alerting, orienting and executive attention networks of the ANT.

**Participants and Methods:** Participants were cognitively normal young (N=12, mean age years= 22.8) and old (N=12, mean age years= 77.3) adults. Participants completed a 6 block ANT paradigm.

Repeated measures ANOVA with two-level flanker (congruent vs. incongruent) and three-level cue (no, alerting and orienting) examined the effect of age (young vs. old) on attention network performance.

**Results:** As expected, old age was associated with an overall slower reaction time  $[F(1,22)=22.565, p < .001]$ . The flanker (i.e., executive attention) effect revealed a significant reaction time cost in incongruent compared to congruent trials  $[F(1,22)= 52.416, p < .001]$ . Alerting  $[F(1,22)=21.800, p < .001]$  and orienting  $[F(1,22)=8.174, p < .01]$  cues enhanced reaction time performance. There was a significant age x flanker interaction  $[F(1,22)= 5.115, p < .05]$  indicating that conflict resolution, as measured by the flanker effect, was slower in old compared to young subjects. The interactions of age with alerting and orienting cues were not significant.

**Conclusions:** These findings suggest that aging has a specific negative effect on executive attention, but not on alerting or orienting. This is consistent with the frontal lobe hypothesis suggesting that performance on tasks mediated by frontal cortex is disproportionately compromised in older adults.

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#### **P. DEMIREVA, J. SUHR, C. REESE & M. BRAASCH. Perceived Threat of Alzheimer's Disease (AD) in Young-Old and Old-Old Participants in Dementia Screening.**

**Objective:** Perceptions of personal risk for AD are salient for older adults and may lead to presentation for evaluation/treatment, which may be inappropriate if perceived risk is not related to actual cognitive impairment. Previous research suggests that perceived AD risk is related to depression, personal experience with AD (whether biologically related or not) and younger age. No studies have examined whether perceived AD risk is related to engagement in behaviors important for maintaining cognitive health.

**Participants and Methods:** We examined correlates of perceived AD threat in young old (19 50- to 70-year-olds) and old old (26 70- to 90-year-olds) individuals participating in a free community wide dementia screening (not demented, living independently).

**Results:** As expected from prior literature, perceived AD threat was not related to cognitive performance in either group. In the young old, perceived AD threat was related to higher belief in negative aging stereotypes ( $p = .005$ ), higher self-reported memory problems ( $p = .04$ ), and increased likelihood of having a first degree relative with AD ( $p = .03$ ). In addition, those who reported higher perceived threat engaged in less weekly physical activity ( $p = .04$ ) and reported less engagement in cognitively stimulating activities ( $p = .03$ ). In contrast, in the old old participants, perceived threat was only related to belief in negative aging stereotypes ( $p = .05$ ), but not any other variables (all  $p > .20$ ).

**Conclusions:** Results emphasize the importance of psychological factors that contribute to perceptions of AD risk, particularly when they are outside the normative ages for development of AD.

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**M.M. VALMAS, E.C. LERITZ, R.E. MCGLINCHEY, C.E. BARBER, J.L. RUDOLPH, L.A. LIPSITZ & W.P. MILBERG. Source Memory and Item Memory are Differentially Related to Neuropsychological Test Performance and Cerebrovascular Risk.**

**Objective:** This study examined the extent to which cerebrovascular risk impacts performance on source memory (SM) and item memory (IM) tests, and how SM and IM relate to neuropsychological measures of memory and executive function.

**Participants and Methods:** Thirty-eight older adults with no history of CVD diagnosis were recruited for participation in this study. Participants completed a memory experiment designed to assess item and source memory (Glisky et al. 1995), as well as a battery of neuropsychological measures to assess memory and executive function. Physiological measures of blood pressure, serum cholesterol and glucose were also obtained.

**Results:** Better performance on all source memory variables were associated with higher scores on the CVLT, as well as with scores on the WMS-III Logical Memory (LM) subtest. Item memory variables, in contrast, were only associated with performance on LM. Glucose levels were the only physiological variable to be significantly associated with item memory and there were no significant relationships between any CVD risk variable and source memory.

**Conclusions:** These results provide evidence that SM is a more complex memory task, evidenced by its association with a standardized measure that has been tied to both hippocampal and frontal lobe function (CVLT). Item memory, in contrast, was only related to a standardized test that is thought to rely more on the hippocampus. However, while no SM index was associated with CVD risk, the relationship between IM and glucose levels is consistent with recent findings that conditions with elevated glucose, such as diabetes, primarily affect hippocampally-mediated memory processes. Finally, these data shed light on the fact that risk factors for CVD should be considered when evaluating cognitive changes associated with aging.

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**J.G. WESTHAFFER, H. KUWABARA, L.A. MORROW & M.W. HAUT. Aging, Cognitive Reserve, and PET.**

**Objective:** The purpose of this study was to understand how cognitive reserve (CR) may affect the relationship between the normal aging process and cerebral blood flow, and by extension, cognitive functioning.

**Participants and Methods:** PET imaging using H2150 was used to assess cerebral blood flow in 30 healthy Caucasian men during a frequency memory task. Participants ranged in age from 40-65. The experimental condition involved determination of the frequency with which words from a previously presented list had occurred. A control task consisted of the participants saying the word "three." Using SPM, PET scans from the control condition were "subtracted" from the experimental task to examine activation patterns. These results were then correlated with age, CR, and an interaction variable that was created by multiplying age and CR (AgeXCR).

**Results:** Task performance was not correlated with age, CR, or AgeXCR. As age increased, an increase in blood flow was observed in frontal and temporal regions. There was no relationship between CR and blood flow. However, as AgeXCR increased, greater parietal activation was observed, while as AgeXCR decreased, there was greater frontal activation.

**Conclusions:** During frequency memory performance, differences in blood flow patterns were observed based on age and AgeXCR. As age increased, greater frontal lobe activation was observed suggesting older participants utilized additional cognitive resources to perform the task. A discrepancy in blood flow patterns was observed between high AgeXCR and low AgeXCR suggesting that CR moderates the relationship between age and blood flow patterns during frequency memory.

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**S.E. YEUNG & W.L. THORNTON. The Utility of Blood Pressure in Predicting Traditional and Everyday Cognition in Older Women.**

**Objective:** Blood pressure (BP) is an important indicator of vascular health that is associated with cognitive performance. While literature has predominantly focused on severe hypertension, we explored the association between BP and cognitive performance in women with low BP to mild hypertension. In addition to traditional cognitive tasks, we examined the relationship between BP and everyday problem solving (EPS), a form of everyday cognition that may better predict future functioning in older adults.

**Participants and Methods:** Non-demented community-dwelling women ( $n = 74$ ; age: 51-91) were recruited from senior centres throughout metro Vancouver. Systolic (SBP), diastolic (DBP), and pulse pressure (PP) readings taken during assessment were used as predictors. EPS was determined by the number of safe/effective solutions generated for eight everyday problems taken from extant literature ( $r = .85$ ). Executive functioning and perceptual speed were examined as a composite measure of traditional cognitive abilities.

**Results:** Findings from regression analyses demonstrated that while a hypertensive diagnosis did not significantly predict cognitive performance, lower SBP ( $\beta = .298$ ,  $p < .05$ ) and lower PP ( $\beta = .243$ ,  $p < .05$ ) were associated with worse EPS performance beyond age and education. Lower DBP predicted worse performance on traditional cognitive measures ( $\beta = .328$ ,  $p < .01$ ).

**Conclusions:** Findings extend previous literature by demonstrating that BP at the time of assessment predicts both traditional and everyday cognition. Lower BP is not necessarily favourable for cognitive performance in community-dwelling older women. Such findings support the notion that reaching a certain BP level may be required to ensure adequate cerebral perfusion and maintain optimal cognitive function.

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**D. YI, S.D. MARION, T. ARENTSEN, S. PANOS, H. SCHROEDER & W.S. BROWN. Interhemispheric transfer predicts error monitoring disruption in executive functioning and bimanual coordination tasks for younger but not older adults: Implications for healthy aging of white matter pathways.**

**Objective:** Evoked potential interhemispheric transfer time (EP-IHTT) has been used as a marker of white matter integrity and efficiency. It is known that the size of the anterior Corpus Callosum (CC) declines with age but little is known about the functional implications of these structural changes. The current study investigated the relationship between IHTT and error monitoring on frontally-mediated tasks in healthy younger and older adults.

**Participants and Methods:** 36 adults (18 younger,  $M_{age} = 27.9$ ; 18 older,  $M_{age} = 72.1$ ) were administered standardized tasks of executive functioning from the D-KEFS and the computerized Bimanual Coordination Task (cBCT). EP-IHTT was calculated by identifying peak latencies from event-related potentials obtained during unilateral trials of a bilateral field advantage task.

**Results:** Results indicated that older adults made significantly more errors than younger adults on D-KEFS tasks. Poorer error management was significantly correlated with EP-IHTT for younger ( $r = .54$ ,  $p < .05$ ) but not older adults. Similarly, older adults were more biased when completing cBCT trials requiring interhemispheric control, yet EP-IHTT was related to increased cBCT directional error bias only in younger adults ( $r = .55$ ,  $p < .05$ ).

**Conclusions:** These data suggest that older adults are less likely to monitor errors when completing executive functioning and bimanual coordination tasks, the latter of which indicates at least subtle anterior CC dysfunction. The fact that speed of sensorimotor transfer was predictive of error management for younger but not older adults is consistent with previous literature showing that the anterior CC may decline more rapidly than the posterior CC in healthy older adults.

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**R.F. ZEC, S. FRITZ, S. KOHLRUS, S. MARKWELL & T. ALA. Effects of Age, Education, and Gender on Animal Fluency in Older Adults.**

**Objective:** The objective was to study the effects of age, education, and gender on animal fluency in a large sample of “non-demented” older adults.

**Participants and Methods:** Animal fluency was administered to 1070 “normal” older adults (age 50–89) as part of a comprehensive neuropsychological battery in a study of cognitive aging. The mean age for the total sample was 68.4 years, percent female=69.5%, mean MMSE=28.9, and mean education=14.6 years. There were 177 participants in their 50s, 408 in their 60s, 370 in their 70s, and 115 in their 80s. Mean MMSE scores for the four age groups were 29.1, 29.1, 28.9, and 28.4; mean ages were 55, 65, 74, 83 years; and mean education were 15.0, 14.5, 14.5, 14.4 years.

**Results:** The mean (+/- SD) animal fluency score for the entire sample was 18.3 (+/-4.9 SD). Significantly poorer mean animal fluency scores were found with successively older age groups: mean score for each of the four age decades (50s, 60s, 70s, 80s) were 20.49+/-5.09, 18.97+/-4.93, 17.26+/-4.36, and 15.87+/-4.56. Significantly poorer mean animal fluency scores were found with successively decreasing educational level (>12, =12, <12 years), i.e., 19.06+/-4.96, 17.41+/-4.49, 14.62+/-14.14 words, respectively. Mean animal fluency was 18.42+/-4.98 for women and 18.02+/-4.79 for men.

**Conclusions:** Significantly poorer mean animal fluency scores were found with successively older age groups and decreasing educational levels. There was a non-significant trend for women to score slightly higher than men. The significant effects of age and education on animal fluency demonstrate the importance of using normative data to determine an individual’s impairment level.

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## Dementia (Alzheimers)

**L. CLARK, E.M. FINE, M.L. LESUER-MANDERNACK, G.H. WEISSBERGER, D.C. DELIS & M.W. BONDI. Cognitive Discrepancies Predict Cognitive Decline Whereas APOE Genotype Does Not.**

**Objective:** Declines in executive function are often implicated in early stages of dementia. Specifically, set-shifting tasks may be particularly effective at capturing subtle deficits associated with prodromal Alzheimer’s disease. We sought to determine if set-shifting abilities would successfully distinguish older adults who later displayed significant declines in global cognition from those who did not decline.

**Participants and Methods:** Participants involved in a longitudinal study were characterized as decliners (N = 17) if they demonstrated Reliable Change Indices (RCI) of decline in Dementia Rating Scale (DRS) scores over a one-year period or non-decliners if no such decline occurred (N = 34). The discrepancy between completion time on the Trail Making Test Parts’ A and B was compared between groups one year prior to DRS decline.

**Results:** A mixed-model ANOVA revealed an interaction effect between group (decliner, non-decliner) and Trail Making Test (F = 16.2; p < 0.001), indicating a significantly larger discrepancy between completion time in Parts’ A and B in the decliner group. Further, linear regression results demonstrated that amount of discrepancy between Trail Making Test Parts’ A and B significantly predicted DRS decline (F = 7.58; p < 0.01), whereas APOE genotype did not (F = 1.45; p > 0.05).

**Conclusions:** Results provide evidence that analysis of cognitive discrepancies between complex higher-order functions, such as set-shifting abilities, and lower-level fundamental cognitive abilities may help detect subtle cognitive changes over time. Results further support its relative utility vis-à-vis APOE genotype in predicting cognitive declines possibly related to prodromal Alzheimer’s disease.

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**S.E. COOK, C. PERSAD, G. RAMIREZ, K. TALTON, A. BHAUMIK, A. NATHAN, N. BARBAS, J. HEIDEBRINK & B. GIORDANI. Health Factors in the Reversion from Mild Cognitive Impairment to Normal.**

**Objective:** Many longitudinal studies of outcomes of cognitive impairment and dementia have reported substantial numbers of individuals originally diagnosed with mild cognitive impairment (MCI) who receive a diagnosis of normal on follow-up examination. The goal of this study was to examine if certain health factors were related to reversion to normal in those who were classified with MCI at baseline.

**Participants and Methods:** Participants were from the Michigan Alzheimer Disease Research Center registry. Participants received a baseline evaluation, including neuropsychological testing. Participants are then followed annually to track outcome. A consensus panel diagnosis was determined following each evaluation. Participants in the present analyses were diagnosed with (any sub-type of) MCI at baseline and had at least one follow-up evaluation.

**Results:** While data collection is ongoing, analyses with current participants meeting study inclusion criteria were used in analyses. Compared to those with a stable MCI diagnosis (N = 10) and those that converted to dementia (N = 12), those that reverted to normal on follow-up (N = 6) were more likely to have a diagnosis of hypertension at baseline ( $\chi^2 = 0.026$ ). No other baseline medical condition was related to outcome.

**Conclusions:** Findings are consistent with the hypothesis that cardiovascular health factors may contribute to the longitudinal course of cognitive impairment. It is of clinical importance to understand what factors contribute to the transient nature of cognitive impairment in older adults.

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**P.F. CORNETT & J.R. HALL. Depression in Geriatric Patients with Cognitive Impairment: The Effects that Staging of Disease has on Depression.**

**Objective:** The purpose of the current study was to compare cognitive diagnostic group GDS subscale scores at different severity levels.

**Participants and Methods:** Participants in this study consisted of 256 patients 65 and older, 76 male, 180 female, and include 131 with Alzheimer’s disease, 74 with vascular dementia, and 51 with mild cognitive impairment. Diagnoses were based on a consensus diagnosis given by a team of geriatricians and neuropsychologists.

**Results:** Results indicate that DAT patients endorsed fewer items on all subscales than the other diagnostic groups. DAT patients differed from VaD and MCI patients on the dysphoria subscale.

**Conclusions:** Though the GDS subscales do not provide dementia diagnosis, the subjective information obtained from them can be very useful for clinicians in validating their diagnoses and tracking disease progression.

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**J. EPPIG, T. GIOVANNETTI, L. BRENNAN, B. BETTCHER, K. DUEY & D.J. LIBON. Time of Day Effects on Everyday Action Impairment in Alzheimer’s Disease.**

**Objective:** Alzheimer’s disease (AD) increasingly impairs a person’s ability to live independently. Caregiver reports indicate many AD patients

experience the phenomenon of “sundowning,” with more confusion and agitation in the afternoon and evening hours as opposed to the morning. Recent cognitive studies show support for this effect on episodic memory. This study examined time of day (TOD) effects on a standardized measure of everyday action performance in AD.

**Participants and Methods:** Participants diagnosed with AD ( $n=44$ ) were administered the Naturalistic Action Test (NAT) and neuropsychological tests assessing executive control and episodic memory in the morning (AM;  $n=22$ ) or in the afternoon (PM;  $n=22$ ). Everyday action variables included overall level of performance (NAT score), percent of steps accomplished, total errors, and error types (omission, substitution, etc.).

**Results:** The groups did not differ on MMSE, age, education, or depressive symptoms (all  $p$ 's  $> .61$ ). Between group  $t$ -tests showed a trend suggesting that the AM group was less impaired than the PM group on the NAT (NAT Score:  $p < .07$ ; Accomplishment Score:  $p < .07$ ). Specifically, the AM group exhibited fewer omission errors on the NAT (Omission Errors:  $p < .05$ ). On neuropsychological tests, the AM group also demonstrated better delayed recognition memory ability ( $p < .05$ ).

**Conclusions:** This pilot study provides preliminary evidence that TOD effects influence everyday action performance. The specific effect on omissive behaviors and neuropsychological tests suggest episodic memory may be especially vulnerable to this effect. Patients with AD, clinicians, and caregivers should consider the decline in functioning in afternoon and evening hours when planning assistance and supervision for important functional tasks.

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**B.E. GAVETT, V. DOKTOR, A. OZONOFF, J. PALMISANO, N. JOFFE, E. COOK, A.L. JEFFERSON, A.K. NAIR, R.C. GREEN & R.A. STERN. Validation of the NAB List Learning Test in the Prediction of Cognitive Decline in Older Adults.**

**Objective:** The NAB List Learning test (NAB-LL) accurately differentiates between cognitively normal individuals and those clinically diagnosed with mild cognitive impairment (MCI) and Alzheimer's disease (AD) cross-sectionally, using a regression-based algorithm (Gavett et al., 2009). The present study examined the validity of NAB-LL in predicting longitudinal cognitive changes in older adults. It was hypothesized that the three groups (Control, MCI, and AD) derived from the NAB-LL algorithm would decline at different rates (AD>MCI>Control), in multiple cognitive domains, over time.

**Participants and Methods:** Participants completing three annual evaluations from 2005-2009 were selected from the Boston University Alzheimer's Disease Center's longitudinal aging research registry; those diagnosed with a non-AD dementia at baseline were excluded. The 251 participants (60% women) ranged in age from 55-93 years ( $M=73.2$ ,  $SD=7.6$  years), and from 7-21 years of education ( $M=15.9$ ,  $SD=2.9$  years). Baseline NAB-LL scores were entered into the NAB-LL algorithm to classify participants as Control, MCI, or AD, independent of clinical consensus diagnosis. Longitudinal regression models were used to examine group differences in linear rate of cognitive decline over three visits, controlling for age and education. Outcome variables included the MMSE, animal fluency, CERAD Word List Recall Trial 3, WAIS-R Digit Symbol Coding, Hooper Visual Organization Test, and Trail Making Test-Part B.

**Results:** Significant group differences were found in linear rate of decline on MMSE ( $p < .01$ ; AD>MCI=Control), animal fluency ( $p < .01$ ; AD>MCI>Control), CERAD Trial 3 ( $p = .02$ ; MCI>AD=Control), and Digit Symbol ( $p = .01$ ; AD>MCI=Control).

**Conclusions:** The results indicate that the NAB-LL algorithm was predictive of differential rate of change across several cognitive domains.

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**J.J. RYAN, A. DEVAUL, L. GLASS & A. PAOLO. Neuropsychological Differences between Men and Women with Alzheimer's Disease.**

**Objective:** It has been suggested that that women and men with Alzheimer's disease (AD) and comparable levels of overall cognitive impairment perform differently on neuropsychological tests. The present investigation compares the scores of women and men with AD on tests of episodic memory, semantic memory, and language and hypothesizes test scores of women will be more impaired.

**Participants and Methods:** Participants were 86 women and 96 men with AD selected from an archival database. The groups did not differ in age, educational level, duration of illness, age at onset of illness, or overall cognitive impairment measured by the Mattis Dementia Rating Scale. The tests administered were the WAIS-R Information subtest, Verbal Fluency (FAS and Animal Names), Boston Naming Test, and WMS-R Logical Memory subtests. Independent  $t$ -tests were used to compare the groups. Because this is an archival data set, some tests were not administered to all participants. However, the smallest  $n$  for any comparison was 42 women and 37 men.

**Results:** Means and SDs for all variables are presented in Table 1. Males performed significantly better than females on the Information subtest ( $p = .03$ ), Animal Naming Test ( $p = .005$ ), Boston Naming Test ( $p = .001$ ), and Logical Memory I ( $p = .01$ ). There was a nonsignificant trend for men to perform better than women on the Logical Memory II subtest. The sexes did not differ on FAS verbal fluency.

**Conclusions:** This study supports the hypothesis that women with AD evidence greater impairment than men with AD on measures of episodic memory, semantic memory, and language.

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**C.E. GLOSCH & P.J. MASSMAN. Prediction of Conversion to Alzheimer's Disease from Mild Cognitive Impairment.**

**Objective:** To examine the relationship of MCI to AD and determine what variables 1) differentiate converters (those who decline from MCI to a diagnosis of AD) from non-converters, 2) best predict group membership, and 3) distinguish between “fast” and “slow” converters.

**Participants and Methods:** Archival data from 67 patients enrolled in a longitudinal study in the Alzheimer's Disease and Memory Disorders Center at Baylor College of Medicine were analyzed on demographic, neuropsychological, and medical variables. All participants were diagnosed with amnesic MCI: 29 with Possible Dementia Prodrome (CDR = 0.5), 21 with Atypical MCI ( $\geq 1.5$  SD impairment on delayed recall of the ADAS-Cog Word Recall list and/or the WMS-R Visual Reproduction figures), and 17 with Progressive Amnesic Disorder (Petersen's criteria- impaired WMS-R Logical Memory delayed recall). Over a mean follow-up period of 3.42 years, 29 MCI patients converted to a diagnosis of probable AD.

**Results:** Converters tended to be female, have at least one APOE  $\epsilon 4$  allele, and perform more poorly on measures of general cognitive functioning, verbal and nonverbal learning and memory, attention, verbal fluency, and motor inhibition. Of these differences, sex, number of APOE  $\epsilon 4$  alleles, and measures of general cognitive functioning, verbal and nonverbal memory, semantic verbal fluency, and motor inhibition predicted group membership with 78% accuracy (73.91% sensitivity and 82.14% specificity). No variables differentiated between “fast” and “slow” converters.

**Conclusions:** This study further demonstrate that MCI is a precursor to AD in many cases and that differences can be found between those who will go on to develop AD and those who will remain stable.

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**L. HANE, N. KIEWEL & P. MASSMAN. Block Design Performance in Alzheimer's Patients: Differential Relationships with other Neuropsychological Measures in Men and Women.**

**Objective:** WAIS Block Design (BD) is primarily a task of visuo-perceptual ability and spatial reasoning, but requires both global (configural) processing and local (detail) processing. The former has been linked

with right hemisphere functioning and spatial abilities and the latter with left hemisphere functioning and verbal abilities (Robertson & Ivry, 2000). Normal men and women may differ somewhat in their relative reliance on global versus local processing on a task like BD. In the present study, we investigated this issue in a large sample of Alzheimer's patients.

**Participants and Methods:** Participants were 978 patients with probable AD enrolled in the Baylor College of Medicine AD and Memory Disorders Center (668 women and 310 men). Mean age was 74.3 (SD = 8.1), mean years of education was 13.5 (SD = 3.5), and mean MMSE score was 20.6 (SD = 5.3). As part of a larger neuropsychological test battery, in their baseline evaluation, patients were administered WAIS-R BD, copy of the Rey-Osterrieth Complex Figure, the Boston Naming Test (BNT), and verbal fluency tasks (FAS and Animal fluency).

**Results:** BD scores did not differ significantly between the male and female AD patients ( $p > 0.55$ ). Fisher  $r$ -to- $Z$  transformations revealed that BD scores were more strongly correlated with Rey-O scores in men ( $r = 0.60$ ) than in women ( $r = 0.47$ ). In contrast, BD scores were more strongly associated with BNT and Animals scores in women ( $r$ 's = 0.50 and 0.51) than in men ( $r$ 's = 0.38 and 0.36). The BD-FAS correlation was also higher in women ( $r = 0.53$ ) than in men ( $r = 0.46$ ), but not significantly so.

**Conclusions:** BD scores were more highly associated with visuospatial (Rey-O) performance in male AD patients and more strongly related to verbal performances in female AD patients, suggesting that global (and putatively right hemisphere) processing contributed more to male patients' BD performance and local (and putatively left hemisphere) processing contributed more to female patients' performance.

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**N. HANTKE, K.A. NIELSON, A. BUTTS, L. GUIDOTTI, J.L. WOODARD, M. SEIDENBERG, S. DURGERIAN, P. ANTUONO, M. LANCASTER & S.M. RAO. Event-Related fMRI of Episodic and Semantic Memory in Cognitively Intact Elders: Patterns of Activation as a Function of Risk Factors for Alzheimer's Disease.**

**Objective:** Asymptomatic older individuals with an increased risk for Alzheimer's disease (AD) show differences in fMRI activation compared to older not-at-risk individuals during performance of either semantic or episodic memory tasks. However, little research has compared both types of memory tasks during the same scan session. In this event-related fMRI study of healthy older subjects with and without AD risk factors, a fame discrimination paradigm was used to assess semantic memory followed by a recognition test of episodic memory.

**Participants and Methods:** Three subgroups of participants were studied: (1) positive family history (+FH) of dementia/positive APOE  $\epsilon 4$  (+ $\epsilon 4$ ), (2) +FH/- $\epsilon 4$ , and (3) -FH/- $\epsilon 4$ . The task stimuli consisted of 30 names of easily recognized famous persons and 30 names of unfamiliar individuals. Participants were asked to indicate if the name was famous or unfamiliar. Twenty minutes later, participants were presented with the 60 previously seen names, 30 novel famous names, and 30 novel unfamiliar names and asked to indicate if he or she had seen the name earlier or not.

**Results:** During the fame discrimination task, the +FH/- $\epsilon 4$  group showed the greatest amount of activation, followed by the +FH/+  $\epsilon 4$  group, and the least amount of activation by the low risk group (-FH/- $\epsilon 4$ ). During retrieval, the + $\epsilon 4$  groups displayed less activation than the low-risk group.

**Conclusions:** Asymptomatic individuals at risk for AD display increased activation during fame discrimination, suggesting compensatory recruitment during semantic retrieval. The same at risk groups display decreased activation during episodic retrieval, suggesting problems with decreased memory traces.

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**N.A. HAUGRUD, M. CROSSLEY, M. VRBANCIC & S. JODOUIN. Comparing Qualitative Verbal Fluency Scoring Procedures in Healthy Aging and Early Stage Alzheimer's Disease.**

**Objective:** The two component model of verbal fluency production was examined in healthy aging and Alzheimer's disease (AD) using clustering (i.e. the generation of words within a subcategory) and switching strategies (i.e. the ability to shift to a new category; Troyer et al., 1997).

**Participants and Methods:** The scoring methods of Abwender et al. (2001), Lanting et al. (2009) and Troyer et al. (1997) were compared using a computer program with 90 young, middle-aged or older adults (20 to 82 years) and 26 individuals diagnosed with probable AD.

**Results:** The older age group, compared to younger groups, produced fewer total words on phonemic and semantic fluency, due to a decline in switching rates. Older adults generated fewer novel and repeated clusters compared to younger age groups. Compared to healthy older adults, the AD group produced fewer total words, fewer switches, smaller average cluster sizes, and fewer novel and repeated clusters. Interestingly, the AD group also used fewer overlapping words (i.e. words that end one cluster and prompt the start of a second).

**Conclusions:** Older adults and individuals diagnosed with AD both showed a decline in total word production, however, this effect was mediated by different processes. In healthy aging a decrease in total word production was related to decreased executive functioning (i.e. decreased switching rate), while in AD decreased total word production was related both to a decline in effective strategy use (i.e. search and retrieval of words; the use of prior words to cue new responses) and to a decline in the content of semantic memory.

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**N. KIEWEL, L. HANE & P. MASSMAN. Apolipoprotein E Genotype and Neuropsychiatric Features in Alzheimer's Disease.**

**Objective:** The apolipoprotein E  $\epsilon 4$  allele (APOE  $\epsilon 4$ ) has been associated with an increased risk of Alzheimer's Disease (AD) development. However, the findings related to the association between APOE  $\epsilon 4$  and the development of neuropsychiatric symptomatology are limited. The goal of the present study was to examine differences in prevalence, severity, and distress of neuropsychiatric symptoms in individuals with probable AD according to their APOE genotype.

**Participants and Methods:** Participants included 242 patients with probable AD enrolled in the Baylor College of Medicine AD and Memory Disorders Centers (147 females; 95 males). Mean age was 74.4 (SD = 8.8), mean years of education was 14.4 (SD = 3.6), and mean MMSE score was 20.9 (SD = 5.8). In order to evaluate neuropsychiatric symptoms, caregivers were administered the Neuropsychiatric Inventory Questionnaire (NPI-Q) and patients were given the Geriatric Depression Scale (GDS).

**Results:** One-hundred participants were non-carriers of the APOE  $\epsilon 4$  allele, 108 were heterozygous carriers, and 34 were homozygous carriers. Total prevalence, severity, and distress levels of neuropsychiatric features did not differ significantly between carriers and non-carriers ( $p$ 's  $> .40$ ). Analyses based on the four NPI-Q factors revealed a trend toward higher prevalence of psychosis for carriers versus non-carriers ( $p = .072$ ). At the item level, the presence of delusions and hallucinations were not significantly different for carriers vs non-carriers ( $p > .05$ ). However, homozygotes had a significantly higher prevalence of hallucinations compared to heterozygotes ( $p < .05$ ). Also, there were trends toward levels of distress associated with depression to be higher in non-carriers ( $p = .065$ ) and for heterozygotes to have higher levels of distress due to depression than homozygotes ( $p = .056$ ).

**Conclusions:** While APOE  $\epsilon 4$  is associated with an increased risk of AD development, it does not appear to be a strong risk factor for the subsequent development of neuropsychiatric symptoms over the course of AD. Correspondence: *Nicole A. Kiewel, MS, Psychology, University of Houston, 126 Heyne Building, University of Houston, Houston, TX 77204-5022, United States. E-mail: nicole.kiewel@gmail.com*

**A.W. LEMAIRE, K.L. MAESTAS, S.M. WOOD & R.L. COLLINS. The Dementia Severity Rating Scale: Factor Structure and Neuropsychological Correlates.**

**Objective:** The Dementia Severity Rating Scale (DSRS; Xie et al., in press), a previously validated caregiver-based measure assessing dementia severity, was recently revised to improve clarity. Items differentially assess major cognitive and functional domains, suggesting the DSRS consists of two factors. Study aims included: 1) identifying the factor structure of the DSRS, 2) examining relationships between neuropsychological measures and DSRS identified factor scores.

**Participants and Methods:** Study included 258 Veterans (men = 96.5%; mean age = 71 years) referred to a cognitive disorders clinic at a VA medical center and their caregivers. Caregivers completed the DSRS, and patients completed standardized neuropsychological instruments of memory, executive functioning, language, attention/processing speed, and depression.

**Results:** Principal components analysis with oblique rotation of the DSRS identified a two factor solution. Factor 1 (45.4% variance), labeled 'Cognitive,' was composed of items that include assessment of memory, language, and decision making. Factor 2 (11.2% variance), labeled 'Self-Care,' was composed of items that assess areas of personal care (i.e., eating, bathing). After controlling for Veteran age, education, and depression, measures of verbal memory and language were significantly associated with the Cognitive factor, and measures of attention/processing speed and executive functioning were significantly associated with both the Cognitive and Self-Care factors.

**Conclusions:** This study suggests that the DSRS has a two factor structure. Furthermore, caregiver perceived ADL functioning may be more closely associated with patient performance on executive functioning and attention/processing speed measures than performance on other cognitive measures.

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**K.L. MAESTAS, A.W. LEMAIRE, S.M. WOOD & R.L. COLLINS. Veterans with Dementia and their Caregivers: Neuropsychological Correlates of Caregiver Burden.**

**Objective:** Despite increased attention to the assessment of caregiver burden in research and clinical contexts, it is surprising that existing studies have reported weak associations between caregiver burden and patients' cognitive functioning. We propose this lack of association is partly due to the fact that caregiver burden has been measured as a global score despite evidence that caregiver burden is a multidimensional construct. We sought to clarify the multi-factorial structure of the widely used Zarit Burden Interview (ZBI; Zarit et al., 1980), with the goal of demonstrating differential associations among factor scores with patients' neurocognitive performance.

**Participants and Methods:** The sample included 243 dyads of Veterans (97% men; mean age = 71.2) referred to a cognitive disorders clinic at a VA medical center, and their caregivers. Caregivers completed the ZBI to assess caregiver burden. Patients completed a battery of neuropsychological tests measuring: attention/processing speed, memory, language, and executive functioning.

**Results:** Principal components analysis with oblique rotation of the ZBI revealed three factors, Psychosocial Burden, Dependency Burden, and Guilt, with factors accounting for 42.4%, 8.6%, and 5.9% of the variance respectively. Higher scores on the Dependency Burden factor were significantly associated with worse performance on measures of memory, attention/processing speed, and executive functioning, controlling for patient age, education, and depression. In contrast, the Psychosocial Burden and Guilt factors were not significantly associated with neurocognitive performance.

**Conclusions:** Results suggest caregiver burden, as measured by the ZBI, has a multi-factorial structure, and factors are differentially related to patients' neurocognitive performance.

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**A. MARTYR, S.M. NELIS, L. CLARE, I.S. MARKOVÁ, R.G. MORRIS, I. ROTH & R.T. WOODS. Verbal fluency and impaired functional ability in people with dementia.**

**Objective:** Executive functioning (EF) is an umbrella term for a number of distinct cognitive processes that control everyday actions and thoughts. Impairments in aspects of EF such as verbal fluency and working memory are known to impact daily functioning. There has been little research concerning EF and activities of daily living (ADL) abilities in people with dementia (PwD), though EF impairments have recently been linked with declining skills and abilities in ADL.

**Participants and Methods:** The sample consisted of 96 early-stage PwD participating in the MIDAS study (48 Alzheimer's disease, 30 vascular dementia, 18 mixed Alzheimer's disease and vascular dementia; mean age 78.68 years; mean MMSE score 24.26). A test of verbal fluency (D-KEFS: FAS) was administered as well as a modified 11-item self- and informant-rated Functional Activities Questionnaire (FAQ) concerning instrumental ADL ability.

**Results:** Self-rated but not informant-rated total FAQ score was found to be significantly negatively correlated with verbal fluency ability. Therefore those who performed better on the test of verbal fluency reported fewer ADL impairments. Additionally, self-reported telephone use, financial ability and keeping appointments were the most strongly related to verbal executive ability. Verbal fluency was unrelated to overall cognitive decline (MMSE), premorbid IQ, age, gender and diagnosis.

**Conclusions:** The findings suggest that deficits in the verbal fluency sub-domain of EF are present in the earliest stages of dementia, and that those with executive dysfunction show greater everyday functional difficulties. Correspondence: *Anthony Martyr, School of Psychology, Bangor University, Bangor LL57 2AS, United Kingdom. E-mail: a.martyr@bangor.ac.uk*

**A. MARTYR, S.M. NELIS, L. CLARE, I.S. MARKOVÁ, R.G. MORRIS, I. ROTH & R.T. WOODS. The emotional Stroop effect for memory related words in people with dementia and their caregivers: investigating the implicit awareness system.**

**Objective:** The emotional Stroop paradigm concerns the observation that individuals respond more slowly to words that are salient to their condition than to neutral words, even when these are not explicitly processed for meaning. This approach has been reported in other clinical groups that show significant slowing to condition-related words, but this paradigm has yet to be tried with people with dementia (PwD). It was hypothesised that implicit awareness of memory difficulties would lead to a slowing of response to emotionally salient dementia-related words.

**Participants and Methods:** This study investigated whether people with dementia were slower to respond to dementia-related words than to frequency-matched neutral words. The sample consisted of 79 PwD (39 Alzheimer's disease, 25 vascular dementia, 15 mixed Alzheimer's disease and vascular dementia; mean age 78.16 years; mean MMSE score 24.43), and 85 normal controls (mean age 67.81 years), who were caregivers of the PwD, participating in the MIDAS study.

**Results:** It was found that both PwD and their carers were slower to respond to emotionally salient words compared to emotionally neutral words. The size of the effect between PwD and their caregivers did not differ significantly.

**Conclusions:** The findings suggest that PwD demonstrate an implicit awareness of their memory impairments. Therefore, awareness of memory difficulties seems to be retained at an implicit level in early-stage dementia. The emotional Stroop task is a useful method for directly investigating the robustness of the implicit awareness system.

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**M. MIMURA, B. YAMAGATA, H. TOMIOKA, H. KOBAYASHI & H. YAMAMOTO. Effect of high dose donepezil on cognitive function and serum insulin-like growth factor-I (IGF-I) level in Alzheimer's disease.**

**Objective:** In addition to the effect of increasing cortical acetylcholine by inhibiting acetylcholinesterase, donepezil is known to have an anti-aging effect by increasing serum insulin-like growth factor-I (IGF-I) level. IGF-I level has recently been shown to be decreased in Alzheimer's disease (AD). We previously demonstrated that donepezil increases serum IGF-I level and that the pre-treatment IGF-I level predicts effectiveness of donepezil in AD (Tei et al., 2008). Here, we further pursued the relationship between cognitive function and serum IGF-I level in AD by increasing the dose of donepezil.

**Participants and Methods:** Twenty patients with AD (seven male, mean age 79.5 years) participated in the present study. Their Mini-Mental State Examination (MMSE) and Alzheimer's Disease Assessment Scale Japanese version (ADAS-JCog) scores as well as serum IGF-I level were measured twice; while they were taking low dose (5 mg/day) of donepezil and after the dose was increased to 10 mg/day (high dose). The study was approved by the Ethics Committee of Showa University School of Medicine.

**Results:** There were significant correlations between serum IGF-I level and MMSE or ADAS-JCog (both  $p < .03$ ). AD patients were divided into 9 responders and 11 non-responders based on their changes in MMSE and ADAS-JCog scores. Serum IGF-I level of the responders were lower (88.2 ng/mL) than non-responders (107.7 ng/mL) ( $p < 0.02$ ).

**Conclusions:** The results suggest that AD individuals whose serum IGF-I level was low on low dose of donepezil may respond well to high dose of donepezil. Beneficial role of high dose donepezil was specifically implicated for those whose IGF-I level remains low on regular dosage.

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**B. REED, V. CHAND, K. BAYNES, L. BONNICI & S. FARIAS. Is Idea Density a Marker of Cognitive Reserve? Effects on Cognitive Decline.**

**Objective:** Idea density (ID) measures how efficiently people communicate. Prior reports from the Nun study (Snowdon, JAMA, 1996) show high ID reduces the risk of Alzheimer's disease (AD). This study uses a different cohort and asks whether ID slows cognitive decline in older adults.

**Participants and Methods:** Participants were 88 members of the UC Davis aging diversity cohort. Thirty Eight were cognitively normal, 35 were MCI, and 14 were demented at baseline; mean age was 74 and mean education was 14.5 years.

ID was measured by coding a standardized speech sample according to an explicit set of rules.

Cognitive function was measured at baseline and at annual follow-ups (82% had 3 or more evaluations) using four psychometrically matched composite scales: Episodic Memory, Semantic Memory, Spatial Reasoning, and Executive Function.

Separate random effects models tested the effect of ID on longitudinal change in each domain. Each model included age, sex and education as covariates.

**Results:** ID had a positive effect on baseline Semantic Memory, and significantly reduced the rate of change in Semantic Memory. Education had a marginal effect on baseline and did not affect change. Neither education nor ID had a significant effect on change in any other cognitive domain. ID had significant positive effects on baseline Executive Function and Spatial Reasoning. Education had a significant positive effect on baseline Executive Function.

**Conclusions:** ID was selectively associated with slower decline in Semantic Memory, independently of education. This suggests that ID, which can be measured late in life, is a useful indicator of cognitive reserve.

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**K.A. RYAN, A. DE LEON, T. COULAS, C. PERSAD, K. FREY, R. ALBIN, J. BURKE, S. GILMAN & B. GIORDANI. Resolving Diagnostic Inaccuracies in Frontotemporal Dementia: A Role for [11C]PiB Scanning.**

**Objective:** Alzheimer's disease (AD) and Frontotemporal dementia (FTD) are difficult to distinguish on a clinical basis alone. Ongoing breakthroughs in the development of pharmacological treatments for these disorders make early and accurate diagnosis of these conditions important. The PiB scan offers a new method of identifying AD based on the detection of amyloid deposits. However, it is unclear if and how much more accurate this is as compared with clinical judgment. Our study investigated whether there was an agreement between neuropsychological and behavioral data and PiB findings in the diagnosis of FTD.

**Participants and Methods:** Participants were 12 patients clinically diagnosed with FTD by their neurologists seen through the University of Michigan's Alzheimer's Disease Research Center. All patients underwent a PiB scan, neuropsychological testing, and caregivers completed behavioral ratings.

**Results:** PiB scan results yielded positive findings for six patients. Results of testing demonstrated that although the groups reflected similar severity of dementia, PiB positive patients performed lower on some memory measures and were rated as having more memory-related deficits by their caregivers than PiB negative patients. There were no significant differences between the groups on cognitive or behavioral measures of executive/frontal impairment.

**Conclusions:** These findings provide evidence for the utility of the PiB scan in distinguishing between AD and FTD early in the diagnostic process, with neuropsychological tests at clinical diagnosis serving as a valuable indicator of the presence of AD. Our results would support the hypothesis that many patients presented with primary behavioral or executive dysfunction may actually have AD, rather than FTD.

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**C. STRAUSS, N. HAUGRUD, M. CROSSLEY & D. MORGAN. Delayed Memory, but not Executive Skills, Predicts Functional Impairment in Newly Diagnosed Alzheimer's Disease.**

**Objective:** The current study investigated executive skills and delayed memory as cognitive predictors of daily functioning in individuals newly diagnosed with probable Alzheimer's disease (AD) in an interprofessional clinic.

**Participants and Methods:** The participant sample consisted of 55 individuals (36 female) with a mean age of 75.7 years. An executive skills composite was created using scores from Trail Making Test (Part B), phonemic verbal fluency, and coding from the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS: Randolph et al., 1998). A delayed memory composite consisted of list and story recall subtests from the RBANS. Finally, a functional ability composite was created using a self-reported activities of daily living scale and two caregiver report measures.

**Results:** Modified Mini-Mental State (3MS) scores were entered in step 1 of a multiple regression analysis to control for dementia severity. When executive skills and delayed memory composites were entered in separate analyses in step 2, with the functional ability composite as the dependent measure, there was a significant relationship between the delayed memory composite and functional ability ( $p = .021$ ). The relationship between the executive skills composite and functional ability was nonsignificant.

**Conclusions:** In conclusion, when compared to executive skills, delayed memory was found to be a better predictor of daily functioning in individuals with early-stage AD. This is consistent with the early impact of AD on the mesial temporal lobes. At later stages of AD executive skills might be a better predictor of functional ability as the disease begins to affect the prefrontal cortex.

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**M.L. ALOSCO & C. TREMONT. Relationship Between Cognition and Awareness Deficits in Mild Cognitive Impairment.**

**Objective:** Anosognosia is common in Alzheimer's disease (AD) and has been associated with executive impairment and right hemisphere dysfunction. Limited research has investigated awareness among patients with Mild Cognitive Impairment (MCI). The current study examined cognitive performance differences between MCI patients who were aware or unaware of their deficits.

**Participants and Methods:** Participants were 58 patients (26 Males and 32 Females; M age = 74.90, SD = 6.07) who underwent a comprehensive neuropsychological evaluation and diagnosed with MCI according to Petersen's criteria (amnestic plus n = 47, amnestic only n = 6, non-amnestic n = 5). Participants were divided into groups based on clinician rating of awareness (aware n = 28 or unaware n = 30), which was determined following interview with the patient and family member. Neuropsychological measures were converted into z-scores based on sample mean and standard deviation and averaged across cognitive domains (i.e., attention, visuospatial, executive functioning, language, immediate memory and delayed memory).

**Results:** No significant differences were found between awareness groups for age, education, gender, Dementia Rating Scale – II total score, or MMSE score. Individuals rated as unaware performed significantly worse in immediate ( $p < .001$ ) and delayed memory ( $p = .005$ ) domains than those rated as aware. None of the other cognitive domains differed between the groups.

**Conclusions:** Awareness deficits are common in MCI patients. Our results argue against the most common etiologic hypotheses in AD (i.e., executive and right hemisphere) and suggest that severity of encoding and memory storage deficits underlie anosognosia in MCI.

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**J.T. WONG, C.M. FLORES, M. ROBINSON & J. RAZANI. Patterns of Deficits in Daily Functioning and Cognitive Performance of Patients with Alzheimer's Disease.**

**Objective:** Previous research has identified patterns of cognitive deficits in patients with Alzheimer's disease (AD), but little is known about their pattern of daily functional impairment.

**Participants and Methods:** Forty-nine patients with AD and 52 healthy elderly controls were administered neuropsychological tests as well as the Direct Assessment of Functional Status (DAFS) test, an observation-based test of activities of daily living. The DAFS produced scores for five subscales: Orientation, Communication, Financial, Transportation, and Shopping. To analyze the data, four cognitive domains were created using neuropsychological composite z-scores (means and standard deviation obtained from control data) for the AD patients.

**Results:** Results revealed that AD patients performed worse on the memory and visual-spatial relative to the executive and language domains. Additionally, the AD patients performed poorer than the controls on all 5 subscales of the ADL task, with their worse performance being on the Shopping subscale which, in part, requires memory skills. Stepwise regression analyses indicated that cognitive domains predicted specific aspects of functional abilities, lending ecological validity to the neuropsychological domains assessed.

**Conclusions:** These findings suggest that AD patients display a distinct pattern of performance on ADL tasks and traditional neuropsychological tests are useful in predicting daily functioning in AD.

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**HIV/AIDS/Infectious Disease**

**J. BADIEE, D.J. MOORE, M. GERARD, F. VAIDA, D. FRANKLIN, B. GOUAUX, J.A. MCCUTCHAN, J.H. ATKINSON, R.K. HEATON, J. MCARTHUR, S. MORCELLO, D. SIMPSON, A. COLLIER, C. MARRA, B. GELMAN, D. CLIFFORD & I. GRANT. Suicidality and Neuropsychological Impairment in HIV-Infected Persons.**

**Objective:** Neuropsychological (NP) impairment is common among HIV-infected individuals. NP deficits also exist among individuals with suicidal ideation and those who have attempted suicide. To date, no study has examined suicidal ideation and NP impairment in the context of HIV infection. The purpose of this cross-sectional study was to determine whether increased rates of NP impairment would be observed in individuals reporting prior suicidal ideation and suicidal behavior in the CNS HIV Antiretroviral Therapy Effects Research (CHARTER) cohort.

**Participants and Methods:** 1560 participants completed baseline evaluations. Of these, 981 participants endorsed some depressive symptoms on the Composite International Diagnostic Interview (CIDI) and were evaluated with suicide-related questions from the CIDI. Based on this assessment, participants were placed into the following 5 categories: No suicidal ideation, thoughts of death, suicidal ideation, made suicide plan, and made suicide attempt. Participants were characterized as NP impaired or unimpaired based on a comprehensive NP battery covering seven domains. These groups were also compared on neuromedical, psychiatric, and demographic characteristics.

**Results:** The overall NP impairment rate for the cohort was 39% (380/981), however rates of NP impairment did not significantly differ across the 5 suicide categories. Individuals in the more severe 3 suicide categories reported higher scores on the Beck Depression Inventory II ( $p < 0.0001$ ) and higher rates of current major depressive disorder ( $p = 0.01$ ) than individuals in the less severe 2 groups. Individuals in the attempt category also reported higher rates of lifetime substance abuse ( $p = 0.02$ ) and current use of psychotropic medications ( $p = 0.01$ ).

**Conclusions:** Contrary to expectations, rates of NP impairment did not significantly differ across the 5 suicide categories. These findings suggest that the presence of suicidal ideation and behavior may not confer additional risk for NP impairment among HIV+ persons.

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**Y. BOGDANOVA, M. DÍAZ-SANTOS & A. CRONIN-GOLOMB. Apathy, Alexithymia and Their Relation to Cognition in Asymptomatic HIV.**

**Objective:** Previous HIV studies documented associations between the presence of apathy and poor performance on measures of executive function, suggesting that apathy and HIV-related cognitive dysfunction may share common neurophysiological substrates. Likewise, alexithymia has been related to cognitive dysfunction in HIV. Specifically, in our earlier study of asymptomatic HIV+ individuals, we found an association between alexithymia and performance on tasks of visuospatial and executive function, consistent with dysfunction of the fronto-striatal circuits and their cortical projections. These separate findings raise the question of the effect of the cognitive, emotional, and behavioral symptoms of apathy on cognition, and their relation to alexithymia, in asymptomatic HIV+ individuals.

**Participants and Methods:** 27 asymptomatic HIV+ participants and 27 matched healthy HIV- volunteers were administered rating scales assessing apathy and alexithymia, and a series of neuropsychological tests.

**Results:** The HIV+ participants showed greater apathy and alexithymia than the HIV- group. There was a significant association between apathy and alexithymia ratings in the asymptomatic HIV+ sample, in particular between behavioral and emotional symptoms of apathy and alexithymia. Whereas apathy correlated significantly with only one cognitive measure (spatial working memory), alexithymia correlated with measures of attention and working memory, category fluency, spatial reasoning, and visuospatial organization, suggesting differential contribution of apathy and alexithymia to cognition in HIV.

**Conclusions:** Our findings demonstrated that while apathy and alexithymia may share common neurophysiological substrates, they can be dissociated in this population, indicating overlapping but distinct neural substrates within frontostriatal circuits.

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**A. EASTVOLD & E.B. FENNELL. Herpes simplex virus encephalitis: Serial neuropsychological assessments characterize memory, language and executive impairments.**

**Objective:** Herpes simplex virus encephalitis (HSVE) is a viral infection of the central nervous system that typically targets the medial temporal and basal forebrain regions. Learning, memory and language deficits are most commonly documented among HSVE patients, however little is known about the course of neurocognitive recovery.

**Participants and Methods:** The following presents serial neuropsychological assessments of a young Caucasian, right-handed male (age 15 at onset) with HSVE, complicated by a subcortical hemorrhage in the left anterior temporal and basal frontal lobes, progressing to the right basal frontal and insular cortices.

**Results:** Acute evaluation revealed severely compromised mental status, severe amnesia and aphasia. Assessment two months status post revealed significant focal verbal and visual memory deficits and marked anomia, in the context of remarkable recovery of general cognition. Follow-up at one year revealed persistent verbal and visual memory impairments, significant anomia, and the emergence of greater attention and executive difficulties, including personality and emotional changes. Follow-up MRI revealed residual lesions in the left temporal lobe, left insular cortex, bilateral cingulate gyri, and general atrophy of the cortex with resolution of previous abnormalities in right basal frontal and insular cortices.

**Conclusions:** This case characterizes the course of recovery and the persistence of focal memory and language deficits, consistent with the literature. The emergence of significant executive difficulties, specifically with behavioral and emotional regulation, one year following onset of illness highlights the need for greater attention to long-term follow-up in order to maximize recovery and ultimate level of functioning in patients with HSVE. Correspondence: *Angela Eastvold, PhD, Mental Health & Behavioral Science, James A. Haley VA, 13000 Bruce B. Downs Blvd, Tampa, FL 33606, United States. E-mail: aeastvold@gmail.com*

**J.M. HEAPS, B. ANCES, N. PARKER, D. CLIFFORD & R. PAUL. Cognitive dysfunction in HIV/HCV co-infection and the relationship with APRI.**

**Objective:** To determine if a pattern of increased cognitive dysfunction exists in a group of HIV/HCV co-infected patients compared to HIV mono-infected patients, and to examine the relationship between a non-invasive marker of liver fibrosis (APRI) and neuropsychological performance among co-infected individuals.

**Participants and Methods:** Twenty-nine HIV patients and 27 HIV/HCV patients (age 27-57) with a history of substance use were examined. Detailed information about alcohol and drug use was collected as well as blood samples, and a battery of neuropsychological tests was administered to each of the participants.

**Results:** Co-infected individuals were significantly older than mono-infected individuals but the two groups did not differ in terms of education, or substance use severity. Using MANCOVA covaried for age, results revealed that the HIV/HCV group performed significantly worse on select tests of memory (list recognition  $p=.049$ , RBANS figure recall  $p=.014$ ) and executive function (Trails B  $p=.013$ ) compared to the HIV mono-infected group. Correlational analyses revealed a significant relationship, non-specific to co-infection status, between APRI and performance on one measure of visuospatial ability (RBANS figure copy  $r=-.405$   $p=.002$ ).

**Conclusions:** Results from the study reveal a modest degree of cognitive impairment associated with co-infection status compared to HIV mono-infection. However, there was no strong relationship between liver fibrosis and cognitive performance among co-infected individuals. The

results suggest liver damage may not mediate the relationship between cognitive performance and HIV co-infection status. Future studies that incorporate a comprehensive memory and executive battery as well as neuroimaging to help define the neuropsychological impact of HIV/HCV co-infection.

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**L.J. HINES, J.M. FOLEY, A.D. THAMES, A. RAMEZANI, S. MILLER, T. MARCOTTE & C.H. HINKIN. Reaction Time Variability and Driving Ability in HIV+ Individuals.**

**Objective:** HIV-infection is associated with neuropsychological (NP) dysfunction reflecting frontal-subcortical pathogenesis, including reaction time (RT) slowing and attentional difficulties. Despite this understanding, the relationship of these deficits on real world outcomes such as driving ability has received less empirical scrutiny. This study examined the predictive validity of RT latency, and RT variability, on variability in lane position on a driving simulator task.

**Participants and Methods:** Participants included 44 HIV-infected adults who completed a detailed NP battery and a PC-based driving simulator task in which they were to navigate through city streets while avoiding real-world obstacles, such as pedestrians and other vehicles. CPT-II measures used to evaluate variability and reaction time and attention included Hit Standard Error (SE), Hit SE Variability, Hit RT Block Change, Hit SE Block Change, Hit RT Inter Stimulus Interval (ISI) Change, Hit SE ISI Change. The outcome variable was variation in mean lane position during simulated driving.

**Results:** Measures of RT and RT variability were entered into a multiple regression simultaneously. The full model significantly predicted variability in mean lane position ( $p=.04$ ). The overall variability (standard error) of the participant's Hit RT across all test trials significantly predicted variability in mean lane position ( $p=.03$ ), even when controlling for the effects of other sustained attentional measures as assessed by the CPT-II.

**Conclusions:** Findings provide preliminary support that increased RT variability in HIV may result in basic problems with driving ability, as individuals with increased RT variability may be more likely to diverge from mean lane position while driving.

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**J.E. IUDICELLO, S. WOODS, P.D. ROMAN, R. DEUTSCH, D.J. MOORE, I. GRANT & T. GROUP. Additive effects of HIV infection and aging on neuropsychological functioning.**

**Objective:** The advent of more effective treatment for HIV infection has resulted in a growing population of older adults living with HIV. While both HIV and aging are associated with cognitive impairment and share some common neural mechanisms, questions remain regarding their combined effects on brain structure and function.

**Participants and Methods:** Participants included 209 patients across 4 demographically matched groups: Younger (i.e.,  $\leq 40$  years) Healthy Adults ( $n=82$ ), Younger HIV-infected Adults ( $n=40$ ), Older (i.e.,  $>50$  years) Healthy Adults ( $n=37$ ), and Older HIV-infected Adults ( $n=49$ ). Participants underwent a neuropsychological evaluation assessing domains sensitive to both HIV and aging. Raw scores were converted to demographically-corrected T-scores, which were used to derive domain and global T-scores.

**Results:** A series of Jonckheere-Terpstra tests for ordered monotonic trends were used to examine additivity effects, with cognitive performance predicted to decrease from groups high on the primary criterion (i.e., Younger Healthy Adults) to samples low on the criterion (i.e., Older HIV-infected Adults). Results showed significant additive effects of HIV and aging on global cognitive functioning, and individual domains including executive functions, speed of information processing, episodic learning and memory, working memory, and motor skills (all  $p's < 0.05$ ), with greatest deficits evident in the older, HIV-infected participants.

**Conclusions:** Results suggest that the independent adverse effects of HIV infection and aging on cognitive functioning are amplified in older HIV-infected individuals, which is consistent with research demonstrating an increased neuropathological burden of HIV and aging on frontal and temporal systems. Future research should examine predictors of cognitive impairment in older HIV-infected individuals and the relationship between cognitive impairment and everyday functioning in this cohort. Correspondence: *Jennifer E. Judicello, M.S., Psychiatry, HIV Neurobehavioral Research Center, 150 W Washington St, 2nd Floor, San Diego, CA 92103, United States. E-mail: judicello@ucsd.edu*

**A. LEVINE & E. SINGER. Dopamine-related genes affect cognitive functioning and risk for HIV-associated neurocognitive disorders.**

**Objective:** Research indicates that dopaminergic system dysfunction underlies the neuropathogenesis of HIV-associated neurocognitive disorders (HAND). Specific factors implicated include dopamine transporter (DAT), brain derived neurotrophic factor (BDNF), and monoamine oxidase (MAO). Although not yet examined in relation to HAND, catechol-O-methyltransferase (COMT) has previously been shown to affect dopaminergic and neurocognitive functioning in other populations. A polymorphism within the COMT gene also confers risk for neurologic disorders including Parkinson's disease and ADHD. We conducted candidate gene analysis to determine whether genetic polymorphisms within dopamine-related genes affect neurocognitive functioning and risk for HAND in HIV+ adults.

**Participants and Methods:** 343 HIV+ adults were included in the analysis. Participants underwent comprehensive neuropsychological testing, neuromedical examination, CSF/blood analysis, and psychiatric/substance use interview. Diagnosis of either neurocognitively normal or HAND was arrived at via multidisciplinary conference. Genotype was determined via Applied Biosystems Taqman and SNPlex assays. Statistical analysis involved 1) ANOVA with genotype as grouping variable and individual cognitive domain T-scores as outcome variables, 2) logistic regression to determine the contribution of genotype to risk of HAND.

**Results:** Five of seven cognitive domains for COMT and one of seven for both DAT and MAO were found to have significant allele group differences. Logistic regression considering length of infection, age, education, ethnicity, and genotype found that level of education and COMT genotype were predictive of HAND.

**Conclusions:** Allelic group differences in neurocognitive functioning were found for three dopaminergic factors. COMT genotype and education level confer significant risk for HAND. This suggests that cognitive and brain reserve theories are applicable to HAND.

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**M. PALOMO, A. LEVINE, M. VALDES-SUEIRAS, C. HINKIN & E.J. SINGER. Assessment of the NEUROPSI in Detecting Neurocognitive Deficits in HIV+ Spanish Speakers.**

**Objective:** The problem of detecting cognitive impairment in HIV+ Spanish speakers has emerged as the demographics of HIV have shifted. In the United States alone, there are an estimated 90,000 Hispanics infection with HIV, many of whom are recent immigrants with little English ability. However, ability to detect cognitive deficit in such individuals is limited by lack of culturally appropriate neuropsychological tests. In the current study, we assess the psychometric properties of a Spanish neuropsychological screening battery among a cohort of HIV positive, Spanish-speaking individuals whom are relatively recent immigrants from Mexico and Central America.

**Participants and Methods:** Eighteen subjects enrolled in the National Neurological AIDS Bank (NNAAB) study at UCLA were examined. Subjects were administered the NEUROPSI, a Spanish version of the HIV Dementia Scale (HDS), and a comprehensive neuropsychological battery consisting of Spanish translations of English tests. Pearson correlations were conducted between the overall HDS and NEUROPSI scores, and Global T-score from the neuropsychological battery. Accuracy in detecting neurocognitive impairment was compared between the measures among nine subjects using consensus diagnosis as the criterion variable.

**Results:** Significant correlations were seen between the NEUROPSI and Global T-score ( $r = .81, p < .001$ ) and HDS ( $r = .67, p = .002$ ). The HDS was also correlated with Global T-score ( $r = .81, p < .001$ ). NEUROPSI and HDS accuracy was identical: sensitivity = 60%, specificity = 25%. Global T-score sensitivity was 80%, specificity was 50%.

**Conclusions:** The NEUROPSI has similar psychometric properties as the Spanish HDS in this sample of HIV+ Mexican and Central American Spanish speakers.

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**K. LIN, M. TAYLOR, R. HEATON, F. DONALD, T. JERNIGAN, C.F. NOTESTINE, A. MCCUTCHAN, J. ATKINSON, R. ELLIS, J. MCARTHUR, S. MORGELLO, D. SIMPSON, A. COLLIER, C. MARRA, B. GELMAN, D. CLIFFORD, T. ALEXANDER & I. GRANT. Effects of Traumatic Brain Injury on Cognitive Functioning and Cerebral Metabolites in HIV+ Individuals.**

**Objective:** HIV is associated with significant impairments in higher order brain functions leading to HIV associated neurocognitive disturbance (HAND). People with a traumatic brain injury (TBI) have cognitive profiles similar to HAND patients. HIV and TBI are each associated with cerebral metabolite changes as well. We hypothesize that in combination, TBI may lead to additional neuropsychological and cerebral metabolic impairment beyond the effects of HIV alone.

**Participants and Methods:** HIV infected participants with self-reported history of definite TBI ( $n=116$ ) were compared with those without history of TBI ( $n=590$ ) from the multi-site CNS HIV Anti-Retroviral Therapy Effects Research (CHARTER) study. Groups were matched for relevant demographics such as age, education and ethnicity as well as HIV associated characteristics such as nadir CD4 and plasma HIV viral load. Cerebral metabolites, assessed using magnetic resonance spectroscopy (MRS), were compared in a subset of TBI ( $n=17$ ) and non-TBI ( $n=84$ ) participants.

**Results:** The TBI group evidenced significantly greater deficits in executive functioning and working memory ability areas. N-acetylaspartate, an accepted marker of neuronal integrity, was significantly lower in the frontal gray matter and basal ganglia brain regions of the TBI group. In contrast, no significant differences were found between the groups in myo-Inositol and choline levels, metabolites indicative of inflammation.

**Conclusions:** Together, these results suggest an additional impact of TBI over that from HIV alone. One clinical implication of these results is that HIV patients with a history of head injury may need to receive more detailed neurological evaluations and be monitored closely for the onset of HAND symptoms.

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**L.M. MARTIN, R. GONZALEZ & E. MARTIN-THORMEYER. Deficits in Response Inhibition are Associated with Poor Medication Adherence Among HIV+ Drug Users.**

**Objective:** Deficits in executive function, memory, and attention have been correlated with poor adherence with antiretroviral therapy in HIV+ patients (Hinkin 2002). However, very few studies have examined possible cognitive mechanisms underlying medication adherence. In this study, we explored how performance on a measure of response inhibition is associated with adherence to antiretroviral therapy.

**Participants and Methods:** Participants were 119 HIV+ individuals with a history of drug dependence who were currently prescribed antiretroviral therapy. Participants were classified as "Good" or "Poor" adherers based on their self-report of correct doses taken on schedule during the previous four days as measured by the Abbreviated AIDS Clinical Trials Group (AACTG) adherence questionnaire. All subjects completed the Go Stop task, a computerized measure of inhibitory control requiring the subject to respond over varying time delays to a specific cue but withhold responding on some trials after they have initiated a response.

**Results:** The two groups were well-matched on demographic, drug use, and comorbid characteristics. We compared Go Stop performance for the two adherence groups using repeated measures ANOVA. Poor adherers' inhibitory control showed a significantly greater decline with increased task difficulty compared with Good adherers ( $p < .05$ ), indicating a greater level of inhibitory control.

**Conclusions:** We found that HIV+ subjects with good antiretroviral adherence showed evidence of greater inhibitory control compared to those with lower levels of adherence. Conclusions regarding the direction of this relationship are dependent on future studies with non drug using HIV+ subjects; however, these findings raise the possibility that individuals who are not able to inhibit certain behaviors may not be able to adhere as effectively to their medication regimens.

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#### **E. MARTIN-THORMEYER, J. VASSILEVA, L. MARTIN & R. GON-ZALEZ. Possible Additive Effects of HIV and Drug Use on Impaired Response Inhibition.**

**Objective:** Impulsivity is a core deficit in drug addiction. We compared the performance of HIV- and HIV+ drug users on a computerized measure of behavioral inhibition typically performed abnormally by drug users, to address how HIV may affect inhibitory control in this population

**Participants and Methods:** We tested 173 HIV- and 79 HIV+ individuals with history of cocaine or opioid abuse or dependence, abstinent at testing and well matched on a series of demographic, substance abuse and comorbid characteristics. All subjects completed the Go Stop task, which indexes capacity for inhibitory control by requiring subjects to initiate a keypress in response to a "go" signal; on some trials a "stop" cue follows after a varying time delay and the subject must actively inhibit the response

**Results:** We compared groups by HIV serostatus and severity of past addiction, indexed by history of DSM-IV drug dependence (higher severity) vs. drug abuse only (lower severity) using mixed model ANOVA. Overall, HIV+ subjects showed significantly poorer performance on the Go Stop compared to HIV- subjects ( $p < .005$ ). Additionally, there was a systematic decline in task performance when substance users with no (HIV-, drug abuse only), one (HIV+ or drug dependent), or two (HIV+ and drug dependent) risk factors were compared ( $p < .05$ )

**Conclusions:** Impulsivity is characteristic of addiction but increased with a positive HIV serostatus or greater addiction severity, raising the question if impulsivity levels could decrease following successful antiretroviral therapy or addiction treatment.

Supported by National Institute on Drug Abuse R01 DA12828 to Eileen Martin-Thormeyer

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#### **D.J. MOORE, S.L. LETENDRE, R. DEUTSCH, S. LITTLE, D.M. SMITH, S. MORRIS, D.R. FRANKLIN, B. GOUAUX, S. LEBLANC, D. ROSARIO, R.K. HEATON, R.J. ELLIS, J. ATKINSON & I. GRANT. Acute and early HIV-infected persons evidence learning impairments.**

**Objective:** The present study examined the level of neuropsychological (NP) functioning among persons with acute and early HIV (AEH) infection as compared to HIV seronegative (HIV-) controls and assessed the association between HIV disease and treatment characteristics associated with NP functioning in AEH individuals.

**Participants and Methods:** We examined 77 AEH participants as compared to 52 demographically matched HIV- comparison participants. All AEH participants were determined to be HIV+ for less than one year with a mean duration of infection of 20.2 (14.6) weeks. Seventy-seven

percent of AEH participants were treatment naïve. All study participants were evaluated with a comprehensive neuropsychological battery assessing seven domains of functioning. We examined group differences on NP functioning and assessed associations between HIV disease and treatment characteristics and NP functioning.

**Results:** Using a global deficit score, AEH persons had significantly worse NP performance as compared to HIV- individuals ( $p=0.04$ ); 26% of AEH participants were classified as NP impaired as compared to 13% among HIV- controls. AEH participants also performed significantly worse in the domain of learning as compared to HIV- controls ( $p<0.025$ ). Among AEH participants, those with worse NP functioning showed higher peak plasma viral loads ( $p=0.04$ ,  $\rho=0.25$ ).

**Conclusions:** AEH individuals showed NP impairment, which was associated with higher peak plasma viral loads. AEH individuals also evidenced significantly more deficits in learning as compared to HIV- participants. Findings point to possible early disruptions of frontal-subcortical systems typically involved in learning abilities. If confirmed, the results indicate that early antiviral treatment (ART), perhaps including ART with good CNS penetration, may be indicated to suppress viral replication and prevent or ameliorate possible neurocognitive complications.

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#### **E.E. MORGAN, S.P. WOODS, D.J. MOORE, I. GRANT, R.J. ELLIS, S. LETENDRE & H.N. R. C. GROUP. CSF Amyloid Beta and Tau Do Not Predict Mild HIV-associated Neurocognitive Disorders.**

**Objective:** Detection of HIV-associated neurocognitive disorders (HAND) is increasingly important in the aging HIV infected population. Altered levels of cerebrospinal fluid (CSF) biomarkers traditionally used to detect the hallmarks of Alzheimer's disease (AD), namely amyloid beta and total tau, have been observed neuropathologically in demented HIV+ individuals. However, it is unclear whether these biomarkers are also predictive of the highly prevalent milder forms of HIV-associated neurocognitive impairment. The current study examined selected biomarkers as predictors of global HIV-associated neurocognitive impairment.

**Participants and Methods:** 75 HIV+ individuals (mean age = 45.1, SD = 9.0, range = 18-79) were administered a comprehensive neuropsychological (NP) battery and a panel of biomarkers was collected, including CSF amyloid beta and total tau, and plasma monocyte chemoattractant protein-1 (MCP-1), an established biomarker of neuroAIDS. All analyses utilized a dichotomous outcome variable representing global cognition (impaired vs unimpaired). Thirty percent of the sample was NP impaired, and no participant met criteria for HIV-associated dementia based on case conference diagnoses.

**Results:** Separate logistic regression analyses were conducted to examine each biomarker as a predictor of global impairment with age, HAART status, current CD4 count, and the interaction of age and each biomarker concurrently modeled. Only plasma MCP-1 emerged as a significant predictor of global impairment ( $p = .01$ ), and no interactions between age and the biomarkers were observed.

**Conclusions:** A marker of macrophage activation (i.e., MCP-1) predicted global neurocognitive impairment whereas traditional cortical dementia markers did not. Established neuroAIDS biomarkers such as MCP-1 may be more strongly associated with milder forms of HAND that are increasingly prevalent in the aging HIV+ population.

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#### **J.A. NIEHOFF, B.M. ANCES, D.B. CLIFFORD, N.L. PARKER & R.H. PAUL. Relationship Between Subjective Memory Reports and Performance on Objective Measures of Memory in HIV Mono-infection or HIV/HCV Co-infection.**

**Objective:** The current study evaluated the relationship between subjective (self-reported) memory complaints and performance on objec-

tive memory tests among individuals with HIV mono-infection or HIV/HCV co-infection. We administered the Prospective and Retrospective Memory Questionnaire (PRMQ) to assess reported memory errors and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) for objective measures of cognition. To our knowledge previous studies have not examined these relationships among individuals co-infected with HIV and HCV. Since co-infected individuals often exhibit more cognitive dysfunction compared with mono-infected we hypothesized that co-infected individuals would report and experience more memory errors than mono-infected individuals.

**Participants and Methods:** 18 HIV mono-infected and 19 co-infected participants completed the PRMQ, RBANS, a fatigue questionnaire, and executive functioning tasks as part of a larger neuropsychological battery. CD4 count was similar for mono-infected ( $M=423.89$ ) and co-infected ( $M=428.16$ ).

**Results:** An independent samples t-test revealed that co-infected participants performed significantly more poorly on list recall ( $p=.038$ ). Poorer performance on list recognition also approached significance ( $p=.058$ ); no other comparisons on the RBANS differed by group. Correlational analyses revealed no significant relationships between PRMQ scores and story recall, list recall and recognition, or executive functioning. Interestingly, fatigue ratings did correlate with PRMQ scores in co-infection ( $r=.548$ ,  $p=.018$ ), but not in mono-infection. The co-infected group reported more difficulties on the PRMQ ( $M=7.37$ ) compared to the mono-infected group ( $M=5.50$ ), but the difference was not statistically significant ( $p=.220$ ).

**Conclusions:** These preliminary results suggest self-reported memory errors may not be reflective of objective memory status among HIV mono-infected or co-infected individuals.

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#### **I. PALTIN, D. BYRD, S. MORGELLO & M. RIVERA MINDT. The Functional Impact of HIV-Related Neuropsychological Impairment & Depression: A Longitudinal Study.**

**Objective:** Cross-sectional research indicates a significant association between HIV-related neuropsychological (NP) impairment & depression with Independent Activities of Daily Living (IADLs; Heaton et al., 2004). However, no research has examined how these factors predict future IADL abilities. This study evaluated how NP function & depression relate to concurrent and future (6 month follow-up) IADL abilities in HIV+ adults.

**Participants and Methods:** 176 adults with advanced HIV-infection completed neuromedical, NP, psychiatric, and IADL evaluations. Demographically corrected average T-scores were used for Global NP & NP domains (Executive Functioning, Motor, Processing Speed, & Attention/Working Memory); the Beck Depression Inventory-II (BDI-II Total Score) for depressive symptoms; and a standardized, self-report scale (IADL Total Score) assessed IADLs (IADL Dependence = impairment in 2 domains; Heaton et al., 2004).

**Results:** Bivariate analyses revealed that lower baseline (BL) Global NP; lower domain performance of Executive Functioning, Motor, & Processing Speed; and higher BDI-II were each significantly associated with worse BL IADL Total Score (all  $p's < .01$ ). Lower BL Global NP & higher BDI-II were also significantly associated with worse follow-up IADL Total Score (all  $p's < .05$ ). Logistic regression, with only participants who were IADL independent at BL ( $n=30$ ), revealed that a model including BL Global NP & BDI-II significantly predicted IADL dependence at follow-up ( $\chi^2(2)=8.06$ ,  $p=.02$ ), but only Global NP was significant ( $p=.02$ ).

**Conclusions:** These findings point to the importance of assessing both NP function & depression in the prediction of functional abilities in an advanced HIV+ population.

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#### **S.E. PANOS, M.S. KIM, S. MILLER, J.H. FOLEY, S.A. CASTELLON, R.K. HEATON, J. SADEK & C.H. HINKIN. Cross-Sectional and Longitudinal Studies of Medication Adherence and Cognition among HIV+ Adults: Comparison between Optimal Adherers, Sub-Optimal Adherers, and Poor Adherers.**

**Objective:** The advent of antiretroviral medications has resulted in significant declines in HIV-related morbidity and mortality. Near-perfect adherence, however, is needed for such medication to work effectively. Cross-sectional studies have shown that medication adherence is associated with neurocognitive functioning. The present study extends this line of research by examining neurocognition in three select groups of adherers both cross-sectionally and longitudinally.

**Participants and Methods:** Participants included 276 HIV-positive individuals who underwent neurocognitive testing at study entry and 215 HIV-positive individuals who underwent repeated neurocognitive testing six months later. Medication adherence was assessed continuously over the course of the six months using electronic monitoring devices. Based upon overall adherence rates, participants were grouped as 1) optimal (90-100%;  $N = 49$ ), 2) sub-optimal (60-89%;  $N = 69$ ) and 3) poor (0-59%;  $N = 158$ ) adherers.

**Results:** At baseline, significant differences between groups were found on learning ( $p < .01$ ), executive functioning ( $p < .05$ ), motor ( $p < .05$ ), and global functioning ( $p < .05$ ). Post hoc analyses showed that both the optimal and sub-optimal adherence groups had better learning than poor adherers. The sub-optimal adherers also had better global cognitive functioning than poor adherers. There were no differences between the optimal and sub-optimal adherers. There was a significant group by time interaction on global functioning such that the poor-adherers failed to demonstrate cognitive improvement over time.

**Conclusions:** From both a cross-sectional and longitudinal perspective, medication adherence levels are associated with cognition over time. This underscores the importance of monitoring neuropsychological functioning among HIV+ patients.

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#### **C. POSADA, D.J. MOORE, M. PARIKH, B. GOUAUX, A. TOBIN, S.L. LETENDRE, R. DEUTSCH, H. ATKINSON & I. GRANT. Visual Recall Difficulties among HIV Infected Individuals with Comorbid Bipolar Disorder Are Associated with Worse Medication Adherence.**

**Objective:** Learning and recall difficulties are found in both HIV and bipolar disorder (BD). In BD, learning and memory problems are some of the most significant neuropsychological deficits. Impairments in these domains may have daily functioning consequences.

**Participants and Methods:** HIV infected individuals with comorbid bipolar disorder (HIV+/BD+,  $n=29$ ) and without bipolar disorder (HIV+/BD-,  $n=29$ ) were administered the Hopkins Verbal Learning Test-Revised (HVLT-R) and the Brief Visuospatial Memory Test-Revised (BVMT-R). Groups were comparable on demographic, HIV disease, and substance use factors, with the exception of a greater proportion of males in the HIV+/BD+ group. The outcome variables for both tests were t-scores for total learning and delayed recall. Medication adherence to both antiretroviral and psychotropic medications was tracked for 30-days using Medication Event Monitoring Systems (MEMS).

**Results:** HIV+/BD+ individuals performed significantly worse than HIV+/BD- individuals on verbal and visual learning and recall (all  $ps < 0.05$ ). The proportion of individuals impaired on visual learning and recall measures was significantly higher in the HIV+/BD+ group than in the HIV+/BD- group (both  $ps < 0.05$ ). No significant differences were found in the proportion of individuals impaired on verbal learning and recall between the groups. Within HIV+/BD+ individuals, visual recall t-scores were significantly correlated with percent adherence to psychotropic medications ( $r = .42$ ,  $p < 0.05$ ). No other associations were observed between medication adherence and verbal and visual learning and recall.

**Conclusions:** Verbal and visual learning and recall impairments are common among HIV+/BD+ individuals, and visual recall is associated with poorer medication adherence. Future studies should seek to understand the component processes of learning and memory deficits among HIV+/BD+ individuals, as well as the association of these deficits with other aspects of daily functioning.

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**A. RAMEZANI, L. HINES, A. THAMES, J. FOLEY, M. ETTEHOFER, S. CASTELLON, M. KIM & C. HINKIN. Longitudinal Study of Neurocognition in Aging HIV+ Adults.**

**Objective:** The current study assesses cross-sectional and longitudinal effects of aging on neuropsychological functioning (NP Fx) in HIV+ patients.

**Participants and Methods:** Participants included 123 HIV+ adults (>50 years, N=96, <40 years, N= 27) recruited from Los Angeles community agencies and medical clinics. All participants were administered a comprehensive battery of neuropsychological tests assessing Attention/Working Memory, Information Processing Speed, Learning/Memory, Language, Motor Functioning, Visuospatial Abilities, and Executive Functioning. Longitudinal data (1 year follow-up) from the sample were also analyzed (N=75).

**Results:** Despite controlling for normal age effects on cognition using demographically corrected norms, ANOVA revealed that the older HIV+ group nonetheless performed worse than the younger HIV+ group on Learning/Memory ( $p=.006$ ) and Visuospatial Ability ( $p=.01$ ). Trend significance was noted for Executive Functioning ( $p=.09$ ). Repeated-Measures ANOVA of Age (young vs old) and Time (Year 1 vs. Year 2) on NP scores again revealed a main effect for age on Learning and Memory ( $p=0.01$ ) and Spatial abilities ( $p=.03$ ). However, the Age X Time interaction effect remained non-significant though inspection of group means revealed the participants, as a group, tended to perform better at Time 2, likely due to the beneficial effects of practice on performance.

**Conclusions:** Despite controlling for normal age effects, the older HIV+ group demonstrated neuropsychological deficits in excess of that seen among the younger participants. When examined across time, results indicated that this aging effect remain stable after one year.

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**R.A. ROMERO, M. BOIVIN, J. WONG, P. BANGIRANA & E. SHAPIRO. The Effects of HIV on Attention, Memory, and Cognition of Ugandan Preschool-aged Children.**

**Objective:** The effects of HIV on early childhood development has focused primarily on cognitive ability. In this study we examine effects of HIV on attention and memory, using two relatively new measures. The purpose of this study was to investigate the effects of HIV on the neurodevelopment of Ugandan children by comparing attention, memory, and cognition in HIV-positive and HIV-negative preschool children.

**Participants and Methods:** Participants included 16 HIV-positive and 14 HIV-negative preschool-aged children recruited at Mulago Hospital in Kampala, Uganda, all of whom are also monitored for malaria. Participants completed the Early Childhood Vigilance Test (ECVT), Color Object Association Test (COAT), and the Mullen Scales of Early Learning (Mullen). Regression analysis, using age as a covariate, was used to examine the relationship of group and each domain.

**Results:** We found significant differences between HIV-positive and HIV-negative groups on measures of memory (immediate and learning ability), cognitive abilities (expressive and receptive language, visual reception, gross and fine motor) but not attention using age as a covariate.

**Conclusions:** HIV impedes neurodevelopment of preschool children in language, visual spatial functioning, fine and gross motor and memory abilities, but not attention. As previous studies have found effects on attention in school-age children, we can hypothesize that the effect size may be smaller in younger children or the effect on attention emerges later.

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**D. SCHEINER, A. ARENTOFT, D. BYRD, M. RIVERA MINDT & S. MORGELLO. Triple Diagnosis: The Combined Roles of Comorbid Antisocial Personality Disorder and Substance Use upon Neurocognitive Functioning in HIV Infection.**

**Objective:** Although substance use (SUD) and Antisocial Personality Disorders (APD) exist within HIV populations, the potential neurocognitive (NC) impact of comorbid SUD and APD (triple diagnosis) has not been investigated. This study investigated potential incremental contributions of SUD and APD on NC functioning in HIV-infected adults.

**Participants and Methods:** 87 adults with advanced HIV-infection completed neuromedical, NC, and psychiatric evaluations. Participants in each group - HIV-Only; HIV with comorbid SUD (HIV/SUD); and HIV with comorbid SUD+APD (HIV/SUD/APD) - were matched for demographics, reading ability, and if applicable, number and type of substance use disorder diagnoses. Average T-scores were compared using ANCOVA for global NC function and executive functioning, attention/working memory, learning, delayed recall, motor, processing speed and verbal domains.

**Results:** Mann-Whitney analyses revealed both HIV/SUD and HIV/SUD/APD groups had higher HIV load (both  $p's < .04$ ) than the HIV-Only group; groups were equivalent in CD4 counts. Covarying for viral load, the HIV/SUD/APD group evidenced lower global NC function compared to the HIV-Only group ( $p=.02$ ), and lower processing speed compared to both HIV-Only and HIV/SUD groups ( $p's < .05$ ). No NC differences were observed between HIV/SUD and HIV-Only groups (all  $p's > .19$ ).

**Conclusions:** Study results indicate comorbid SUD and APD is associated with increased deficits in global NC functioning and processing speed in HIV-infected adults, while SUD alone does not account for increased deficits. More research on APD and other psychopathologies commonly co-occurring with SUD is warranted to illuminate their potentially synergistic NC impact in HIV-infected populations.

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**J. SCOTT, O. VIGIL, S. WOODS, R.K. HEATON, I. GRANT, R.J. ELLIS & T.D. MARCOTTE. Multitasking in HIV-1 Infection: Implications for Everyday Functioning.**

**Objective:** While performance-based functional tests are reasonably sensitive to HIV-associated deficits in "real world" functioning (i.e., independently performing instrumental activities of daily living [IADL]), questions remain regarding the extent to which these tests' highly structured nature fully captures the inherent complexities of daily life. The aim of this study was therefore to assess the predictive and ecological validity of a novel multitasking measure in HIV infection.

**Participants and Methods:** Sixty individuals with HIV-1 infection (HIV+) and 26 demographically comparable seronegative healthy adults (HIV-) were administered a comprehensive neuropsychological battery, questionnaires assessing mood and everyday functioning, and a novel standardized test of multitasking, which involved balancing the demands of four interconnected performance-based functional tasks (i.e., financial management, cooking, medication management, and telephone communication).

**Results:** HIV+ individuals demonstrated significantly worse overall performance ( $p < .05$ ), fewer multitask attempts ( $p < .05$ ), and increased errors ( $p < .001$ ) on the multitasking test as compared to the HIV- sam-

ple. Within the HIV+ sample, multitasking impairments were modestly associated with deficits on standard neuropsychological measures of executive functions, episodic memory, and information processing speed, providing preliminary evidence for convergent validity. More importantly, multitasking deficits were uniquely predictive of dependence in IADL, independent of depression and global cognitive impairment, with excellent sensitivity (86%) but modest specificity (57%).

**Conclusions:** Taken together, these data indicate that the assessment of multitasking ability may ultimately provide an important adjunct to traditional neuropsychological testing in evaluating everyday functioning in HIV+ individuals. Findings may also inform the development of compensatory strategies to minimize the functional impact of cognitive deficits in persons living with HIV infection.

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**T.I. LOVEJOY, J.A. SUHR, T.G. HECKMAN, K.J. SIKKEMA, N.B. HANSEN & A. KOCHMAN. The Impact of Psychological States on Perceived and Actual Neurocognitive Functioning in HIV-positive Older Adults.**

**Objective:** To examine the impact of psychological states on perceived and actual cognitive functioning in HIV-positive older adults.

**Participants and Methods:** Participants (Mean Age = 55.6 years, 67% male, 28% Caucasian) were 227 HIV-positive persons 50-plus years of age enrolled in a three-arm coping improvement intervention. At baseline and 12-month follow-up, participants completed a psychosocial battery, the perceived cognitive functioning index of the Functional Assessment of HIV Infection (FAHI) measure, and underwent neuropsychological testing that included the Modified Mini-Mental State Exam, the Controlled Oral Word Association Task, the Trailmaking Test parts A and B, and the Grooved Pegboard Test.

**Results:** Compared to baseline reports, 59% of participants endorsed the same or worse cognitive functioning on the FAHI at 12-month follow-up, while 63% performed the same or worse across neuropsychological measures. After controlling for demographic characteristics and intervention condition, increases in anxiety (Adjusted O.R. = 2.26,  $p < .05$ ) and depression (Adjusted O.R. = 6.10,  $p < .05$ ) from baseline to 12-month follow-up were associated with worsening of perceived cognitive functioning but unrelated to actual cognitive functioning (all  $p$ 's  $> .10$ ), as measured by performance on neuropsychological tests.

**Conclusions:** Among this sample of HIV-positive older adults, nearly two-thirds of participants experienced static or worsening cognitive functioning, both perceived and actual, over the course of a year. However, negative affective states appeared to inflate cognitive complaints but were unassociated with performance on various neuropsychological tasks. When assessing the progression of age- and HIV-related cognitive decline using self-report methods, careful attention should be paid to patients' psychological states.

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**A.D. THAMES, J.M. FOLEY, L.J. HINES, A. RAMEZANI, M. KIM, S.A. CASTELLON & C.H. HINKIN. Executive Function Deficits Among HIV Positive Hypertensive Adults.**

**Objective:** This study examined the neuropsychological effects of hypertension among HIV+ adults.

**Participants and Methods:** A sample of 115 HIV+ adults (33 hypertensive, 82 normotensive by self-report) were recruited from Los Angeles community agencies and medical clinics. The mean age was 50.8 years [1.2] with 81% male. Most participants were identified as African American (51%) or Caucasian (30%). NP deficit scores (Heaton et al., 1991) were computed for the domains of Attention/Working Memory, Information Processing Speed, Learning/Memory, Verbal Fluency, Motor Functioning, Spatial Abilities, and Executive Functioning.

Preliminary analyses revealed significant age group differences (Young>Old) in NP domains of spatial processing and learning/memory. Significant ethnic group differences (African American<Caucasian) were found in domains of executive functioning, learning and memory, and motor functioning (Caucasian<African American). CD4 count was negatively correlated with executive functioning and motor deficit scores.

**Results:** One-Way ANOVA revealed significant differences between hypertensive and normotensive groups in executive functioning (EF)  $F(1, 114) = 5.31$ ,  $p = 0.02$ . HIV+ patients with hypertension demonstrated more EF deficits ( $M = .69$  [0.61]) than HIV+ normotensives ( $M = .42$  [0.56]). The additive effects of hypertension on EF, after controlling for age, ethnicity, and CD4 count, were examined using linear regression. After controlling for these factors, hypertension status contributed significantly to EF deficits,  $R^2 = 0.11$ ,  $F(5, 99) = 2.39$ ,  $p = 0.04$ .

**Conclusions:** Consistent with past studies that have examined hypertension among seronegative groups, the presence of hypertension is associated with reduced executive functioning among patients with HIV-infection even when controlling for other potentially contributing factors. Correspondence: *April D. Thames, Ph.D., Semel Institute for Neuroscience and Human Behavior, University of California Los Angeles, 760 Westwood Blvd., Los Angeles, CA 90065, United States. E-mail: Aprithames@aol.com*

**D. VANCE, P.L. FAZELI & J.C. MARCEAUX. Predictors of Neuropsychological Functioning in Adults with HIV.**

**Objective:** Cognitive deficits are common in adults with HIV. Such deficits may be more severe as people age with this disease. The purpose of this study was to identify predictors of neuropsychological performance among adults with HIV.

**Participants and Methods:** Psychosocial (Lubben Social Network Scale, Profile of Mood States), drug use, and neuropsychological measures of processing speed (Useful Field of View, Complex Reaction Time Test, Digit Symbol Substitution), executive function (CLOX, Trails B), psychomotor ability (Trails A, Finger Tapping Test, Digit Symbol Copy), and memory (Digit Span, Spatial Span) were administered to 98 HIV-positive adults (mean age = 45.23). Hierarchical regression analyses were used to examine predictors of neuropsychological performance. Step 1 examined the contribution of age and education quality (WRAT-3 Reading), and Step 2 examined the contribution psychosocial and health factors on neuropsychological performance.

**Results:** For several measures of neuropsychological performance, older age, poorer educational quality, mood problems, and more drug use predicted poor neuropsychological performance.

**Conclusions:** Among adults with HIV, the best predictors of neuropsychological test performance were age and education quality. Mood problems and drug use added to the prediction of cognitive deficits. Health factors such as years diagnosed with HIV, and the size of one's social network were not predictive of performance in any model. Results suggest individuals aging with HIV have some risk of cognitive decline. Implications for practice and research are posited.

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**E. WEBER, S.P. WOODS, B.M. WEISZ, J.C. SCOTT, I. GRANT & T. GROUP. Cognitive Reserve and Prospective Memory in HIV Infection.**

**Objective:** Cognitive reserve is a protective factor against neurocognitive decline in a number of clinical conditions (e.g., dementia). While a few studies have demonstrated that low cognitive reserve is associated with an increased risk of HIV-associated neurocognitive disorders, none have examined its specific impact on prospective memory (ProM) in HIV. ProM (i.e., "remembering to remember") is a dissociable aspect of episodic memory that is highly predictive of functional outcomes (e.g., adherence) in HIV.

**Participants and Methods:** The present study evaluated the hypothesis that low cognitive reserve is associated with poor ProM performance (as measured by the Memory for Intentions Screening Test [MIST]) in a sample of 162 HIV-infected individuals. Cognitive reserve was operationalized as an average of population-based z-scores (CRZ) for premorbid verbal IQ (Wechsler Test of Adult Reading) and a combined rating of educational and occupational attainment (Hollingshead Two-Factor Index), and divided into tertiles (i.e., low, medium, high).

**Results:** Kruskal-Wallis and follow-up Wilcoxon Rank-Sum analyses indicated that low CRZ individuals had significantly lower MIST scores than high CRZ individuals ( $p < 0.004$ ; Cohen's  $d = 0.53$ ), as driven by the MIST time-based index ( $p < 0.002$ ); a follow-up regression analysis confirmed that lower CRZ remained an independent predictor for MIST performance when considered alongside potential confounding demographic (e.g., age), psychiatric (e.g., substance dependence), and medical (e.g., nadir CD4) factors.

**Conclusions:** While these data suggest that low cognitive reserve may be a risk factor for HIV-associated ProM impairment, future studies that incorporate longitudinal designs and biomarkers of cognitive reserve (e.g., neuroimaging) are needed.

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#### S. YADAVALLI & J. GUNSTAD. Association between cognitive function and medication adherence in people living with HIV.

**Objective:** The present study investigated whether cognitive function was associated with adherence to highly active antiretroviral therapy (HAART) in 32 asymptomatic and symptomatic HIV-infected men and women.

**Participants and Methods:** Participants (53% African American) were recruited from Louis Stokes Cleveland Veterans' Affairs Medical Center (LSCDVAMC) and were interviewed and tested on site. Cognitive domains assessed were attention, executive function and information processing speed. Other variables included adherence, substance use, depression and medical variables.

**Results:** A multiple hierarchical regression analysis revealed a significant model fit for the association between cognitive variables and adherence at one month (adjusted R-squared = .31,  $F(7,32) = .27$ ,  $p < .05$ ). High levels of previously undetected cognitive impairment were found. High levels of adherence were also reported.

**Conclusions:** People with HIV/AIDS may benefit from monitoring of adherence at each visit and utilization of appropriate interventions as

needed. Further, this population may benefit from regular screening for cognitive impairment and referral for complete neuropsychological evaluation as appropriate. Further studies need to investigate the relationship between cognitive function and medication adherence in people living with HIV.

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#### Dementia (Subcortical, Specific Disorders, MCI, etc.)

#### M. RODRIGUEZ, E. POTTER, Q. SHEN, W. BARKER, J. AGRON, M. GREIG-CUSTO, D. LOEWENSTEIN & R. DUARA. Diencephalic Atrophy Measures on MRI in Lewy Body Dementia and Alzheimer's Disease.

**Objective:** The purpose of this study was to evaluate cognitive measures and measures of diencephalic atrophy (DCA) in distinguishing between Lewy Body Dementia (LBD) and Alzheimer's disease (AD).

**Participants and Methods:** Subjects with no cognitive impairment (NCI;  $n = 30$ ), AD ( $n = 30$ ), or LBD ( $n = 30$ ) were evaluated clinically, cognitively and with MRI scans. ANOVAs were calculated and correlations of DCA measures and MMSE and functional scores from the Unified Parkinson's Disease Rating Scale (UPDRS), and Clinical Dementia Rating Sum of Boxes (CDR-SB) were compared within and among the groups.

**Results:** NCI subjects had reduced 3rd ventricle widths and greater left and right subventricle widths than both AD and LBD subjects. In addition, LBD subjects had reduced ( $p < .01$ ) left and right insular - 3rd ventricular widths, whereas AD subjects had greater ( $< .001$ ) 4th ventricle widths than LBD subjects. AD subjects had greater 3rd ventricle widths and reduced subventricular widths, as compared.

Correlations in the LBD group were found between right insular - 3rd ventricle width ( $r = .67$ ,  $p \leq .001$ ), right Sub ventricle width ( $r = .66$ ,  $p \leq .001$ ), and UPDRS scores. In the AD group, UPDRS scores were correlated with left ( $r = -.50$ ,  $p < .01$ ), and right ( $r = -.49$ ,  $p < .01$ ) subventricle width.

**Conclusions:** 3rd ventricle width measures distinguish AD, LBD and NCI subjects from each other and show association with UPDRS scores but not with cognitive or functional measures, among LBD subjects only.

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### THURSDAY MORNING, FEBRUARY 4, 2010

#### Invited Address: Attention Networks: Normal Development and Pathology

Speaker: Michael Posner

9:00–10:00 a.m.

#### M.I. POSNER. Attention networks: Normal development and pathology.

The functions of attention include achievement and maintenance of a state of alertness, selection of information from sensory input, and regulation of responses when dominant or well-learned behavior is not appropriate. These functions have been associated with activation of sep-

arate networks of brain areas. This talk reviews studies examining the developmental course of the attention networks during infancy and childhood and the neural mechanisms underlying their maturation. The capacity to orient attention to external stimulation is present from quite early in life although aspects related to the voluntary orientation improve with age during childhood. Executive attention while present in infancy shows a strong developmental course during the preschool years. The shift from control by orienting to control by the executive networks marks an important transition during early development. Individual differences in the efficiency of attention networks are partly due to variations in genes related to neurotransmitters that modulate the activation of the attention networks. The role of parental involvement in modifying genetic effects is discussed. Finally, several forms of childhood and adult pathology that involve these attentional networks are discussed.

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## Paper Session 2: Autism

9:00–10:30 a.m.

### R. MANFREDI, M. LAZAR, K. GOLDBERG & S. STEADMAN. **Executive Functioning in High-Functioning Autism Spectrum Disorders: Relationship to Social and Adaptive Skills.**

**Objective:** Autism spectrum disorders (ASDs) are neurodevelopmental disorders characterized by social, communicative, and behavioral difficulties. A prominent neuropsychological theory of ASDs centers on difficulties in executive functions (EFs), higher-order thinking skills involving planning, organization, emotional regulation, behavioral inhibition, and self-monitoring, among others. While a substantial body of research has documented specific EF difficulties in ASDs, their impact on social and adaptive functioning has yet to be determined.

**Participants and Methods:** The current study investigated the relationship of parent ratings of EF to their ratings of social and adaptive functioning in a national sample of 117 children between the ages of 5 and 17 diagnosed with a high-functioning ASD.

**Results:** Compared to normative data, the sample showed clinically significant deficits in most areas of executive, adaptive, and social functioning. Multiple regression analyses showed metacognitive EFs to predict ratings on a measure adaptive functioning, accounting for between 7.1 and 12.9% of the variance across adaptive domains. Metacognitive skills, in combination with behavioral regulation skills, predicted social functioning, and together accounted for 36.7% of the variance as rated by parents. Exploratory statistical analyses showed that specific EFs differentially predicted various aspects of social and adaptive functioning, accounting for between 12 and 19.1% of the variance in ratings of adaptive skills, and 47.9% of the variance in ratings of social skills.

**Conclusions:** EF difficulties have a significant impact on both social and adaptive skills. While adaptive skills appear to depend on intact metacognitive skills, social skills appear to be substantially dependent on both metacognitive and behavioral regulation skills.

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### H.C. BOORSTEIN, A. VERBALIS, M. BARTON, J. GREEN, S. HODGSON & D. FEIN. **Regressive and non-regressive autism spectrum disorders: A comparison of developmental trajectories, autistic behaviors, and medical histories.**

**Objective:** Current research attempts to delineate subtypes of autism spectrum disorders. This study will examine a proposed phenotype of regressive ASDs and explore the validity and proposed mechanisms of regression.

**Participants and Methods:** This study examined the incidence, age at onset, and types of regression in 162 children with confirmed ASDs (mean age=26.3 months); 96 were also re-evaluated at a mean age of 51.6 months. The regression and non-regression groups were compared on cognitive and language abilities, early developmental milestones, medical histories, and diagnosis at re-evaluation.

**Results:** Regression in one or more areas was reported in 38.7% of children with losses of communicative intent (34.4%), word use (30.7%), and social relatedness (22.2%) most common. Mean age of language regression was 17.1 months. Regression was significantly more likely in those diagnosed with Autistic Disorder (47%) vs. PDD-NOS (32%). Differences between the two groups were found in overall cognitive scores, specific autistic symptoms, and clinical impression of autistic severity, with the regressed group faring worse at a significant or trend level. No differences were noted on any early or current medical variables, including GI symptoms. Regressed children met all early developmental milestones earlier than non-regressed children. At re-evalu-

ation, children who regressed were significantly more likely to have repetitive behaviors and more difficulty with change. Six regressed children lost their ASD diagnosis at re-evaluation but none were typically developing; 10 with early onset lost their diagnosis, with three considered typically developing.

**Conclusions:** Children with ASDs who regressed appear to have a somewhat different phenotype. This regression occurred in more than 38% of the sample with those more impaired more likely to have regressed. Possible neurobiological and developmental processes for regression and its sequelae will be explored.

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### E.D. BIGLER, J. SOUTHWICK, K. TUMBLIN, J. PETRIE, T. WU, A. CRAMOND, T. MERKLEY, M.B. DUBRAY, A. FROEHLICH, N. LANGE, A.L. ALEXANDER & J.E. LAINHART. **Inconsistent Recall on a Verbal Selective Reminding Task in Autism.**

**Objective:** Previous studies investigating strategies in list learning tasks have suggested that individuals with autism demonstrate an overall suppressed learning curve. This study examined learning curves on the Verbal Selective Reminding Test from the Test of Memory and Learning (TOMAL).

**Participants and Methods:** When observing total scores for each trial, the autism group (N= 32) performed significantly worse than age-matched controls (N = 22) and demonstrated a suppressed learning curve across all 8 trials. In addition to total scores, a Cumulative Consecutive Correct (CCC) score was also calculated for each trial, which was an index of how many words were consistently recalled in all consecutive trials. A learning curve was calculated based on the first 5 trials to eliminate ceiling effects in the control group.

**Results:** As with total scores, the autism group performed more poorly on a trial-by-trial basis, however, unlike total scores, the CCC slopes between groups were significantly different ( $p < .05$ ). Controls initially recalled a mean of 3.82 words, reaching 10.14 words consecutively correct by Trial 5, while the autism group initially recalled 2.19 words, reaching 6.91 words on Trial 5.

**Conclusions:** These finding suggests that while autism shows a generally suppressed learning curve, the autism group also became increasingly less reliable than controls in retaining words across trials. Increased trial-by-trial variability in memory performance suggests inefficiency in memory function which may be a reflection of aberrant connectivity in autism within neural systems that underlie memory. These findings have implications for abnormal temporolimbic circuitry in autism.

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### E.D. BIGLER, T.J. ABILDSKOV, M.B. DUBRAY, A. FROEHLICH, N. LANGE & J.E. LAINHART. **Stability of Brain Volume from Mid-childhood Through Adolescence and Early Adulthood in Autism.**

**Objective:** Early post-natal abnormal brain growth represents one theory associated with autism. By definition, less than three percent of the typical developing population would meet criteria for macrocephaly, whereas 20% or more of subjects with autism do. Several studies have implicated accelerated brain growth during the early post-natal period, but such overgrowth seems to stabilize by 4 years of age. To date, no study has examined total brain volume (TBV) in a longitudinal analysis through adolescence and early adulthood. Brain volumetry studies have demonstrated a subtle decrease in TBV after peak development in early childhood, presumably due to pruning. It was hypothesized that such reductions would have likely already occurred and be equally reflected both in autism and control subjects in this longitudinal investigation.

**Participants and Methods:** Repeated TBV measurements by MRI were conducted on individuals ranging in age from 7 to 33, including 74 with

autism compared to 38 typical developing controls matched on age, education, and performance IQ. Scans were obtained a minimum of 12 months apart; some subjects had as many as four scans. Total intracranial volume (TICV) was also measured to control for potential head size differences between the groups correcting for TBV by TICV.

**Results:** No longitudinal group differences in TBV were observed.

**Conclusions:** Results are discussed in terms of early differences in brain development that may differentiate autism and what the implications are for TBV stability during childhood latency and adolescent years in typical developing controls as well as individuals with autism.

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### Symposium 3: Neurocognitive, Psychosocial and Cultural Determinants of Awareness of Deficit in Early Stage Dementia

**Chair:** *Feggy Ostrosky-Solis*

**Discussant:** *George Prigatano*

**9:00–10:30 a.m.**

**L. CLARE, R.G. MORRIS, S. NELIS, A. MARTYR, I. MARKOVA, I. ROTH, R.T. WOODS & C. WHITAKER. Testing a biopsychosocial model of awareness in early-stage Alzheimer's disease.**

**Objective:** To test a biopsychosocial model of awareness in early-stage Alzheimer's disease by exploring the relative contributions of neuropsychological, individual psychological, and caregiver factors to level of scoring on measures of awareness, and identifying predictive variables.

**Participants and Methods:** Participants were 101 individuals with dementia (50 Alzheimer's disease, 31 vascular dementia, 20 mixed AD and vascular dementia; mean age 78.66 years; mean MMSE score 24.17. A family carer contributed in each case. Awareness of functioning was assessed in relation to the domains of memory, activities of daily living, and social behaviour, using participant-informant discrepancy measures. Awareness of performance was assessed in relation to memory by comparing participant post-dictions with objective test scores. People with dementia completed questionnaire measures and a brief neuropsychological battery. Carers provided both ratings of the person with dementia and self-ratings.

**Results:** Discrepancies were substantial in the domain of activities of daily living, moderate for memory and slight in relation to socio-emotional functioning. Regression analyses indicated that different combinations of variables predicted discrepancies in each domain. Carer distress and perceptions of the functioning of the person with dementia significantly predicted all participant-informant discrepancies. The ratings of self-concept made by the person with dementia predicted discrepancies in the domains of memory and social functioning. Scores on naming and letter fluency predicted discrepancies with regard to activities of daily living.

**Conclusions:** The results support a biopsychosocial model of awareness, indicating that scores on discrepancy measures in different domains are significantly predicted by varying combinations of individual psychological, neuropsychological and caregiver variables.

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**R.G. MORRIS, L. CLARE, S. NELIS, A. MARTYR, I. MARKOVA, R.T. WOODS & C. WHITAKER. Neuropsychological correlates of awareness of cognitive or behavioural dysfunction in early dementia.**

**Objective:** The study explored the association between neuropsychological deficits with loss of awareness of neuropsychological or behavioural deficit in early dementia. This study was conducted in reference to the CAM model which outlines different neurocognitive mechanisms associated with awareness of deficit.

**Participants and Methods:** The study included 101 people with early dementia (50 Alzheimer's disease, 31 vascular dementia, 20 mixed AD and vascular) mean age 78.66 years; mean MMSE score 24.17. The MARS memory function scale with informant versus patient report was used to measure awareness of memory loss and this technique was compared to the MARS memory performance scale in which estimate of memory performance by the patient is compared to actual performance on a memory procedure. Awareness of functional impairment was measured using informant and patient ratings on the functional activities questionnaire. To test neuropsychological cognitive function, the Rey AVLT, Graded Naming test (GNT), Pyramid and Palm Trees, Graded Naming Test, DKEFS verbal tests and SART tests were used.

**Results:** For the MARS memory function procedure worse performance on the Rey AVLT, GNT, Category fluency and SART errors of commission were associated with lack of awareness. For the MARS memory performance scale, the associations were with the Rey AVLT, GNT and the Pyramid and Palms Trees. The only association with awareness for functional impairment was with DKEFS letter fluency.

**Conclusions:** Deficits in episodic, semantic memory and attention may contribute to loss of awareness of cognitive deficits but this is less apparent with functional behavioral change. Awareness may be influenced by method of measurement and carer characteristics when rating the performance of people with dementia.

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**S. NELIS, R.G. MORRIS, L. CLARE, A. MARTYR, I. MARKOVA, I. ROTH & R.T. WOODS. Awareness of social and emotional functioning in early stage dementia.**

**Objective:** Impairments in social cognition have been reported in neurological conditions such as traumatic brain injury and in frontotemporal dementia. The extent of awareness of social functioning in Alzheimer's disease has been examined to a lesser extent. Of interest is whether people with early stage dementia demonstrate awareness of their social functioning.

**Participants and Methods:** Participants ( $n = 95$ ) with a diagnosis of Alzheimer's, vascular or mixed dementia (PwD) completed the Socio-emotional Questionnaire. They rated their ability to recognise emotions, the extent of their empathetic reactions and behaviour in social situations. Key relatives also completed the SEQ with respect to the current social functioning of the PwD. Awareness scores were calculated by comparing self reports with reports of their caregivers.

**Results:** Factor analysis of the scale proposed three key areas of social functioning: emotional recognition and empathy, social relationships and antisocial behaviour. PwD tended to overestimate their empathetic skills, and to a lesser extent their relationship skills or antisocial behaviour compared to informant ratings, suggesting a lack of awareness of their social functioning. Lack of awareness in social functioning was not related to quality of relationship or quality of life for the PwD but was related to higher levels of stress and poorer relationship quality for caregivers.

**Conclusions:** People with early stage dementia were relatively concordant with informant reports of their current socio-emotional functioning. Where loss of awareness was present it was related to elevated levels of stress in caregivers suggesting it may have an impact for those caring for PwD

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**F. OSTROSKY-SOLIS, G. PRIGATANO, L. CLARE, R.G. MORRIS, S. NELIS & D. MOGRABI. Neurocognitive, psychosocial and cultural determinants of awareness of deficit in early stage dementia.**

**Symposium Description:** Loss of awareness of impairment in dementia occurs even at the early stages and this is an important factor in early detection and neuropsychological assessment. There are several factors that determine loss of awareness and influence measurement. These include neuropsychological disorder either primarily affecting mechanisms central to awareness or producing a secondary effect through damage to cognitive support mechanisms such as memory. Psychosocial factors also play a role, including for example, personality and mood state, found to influence both the decisions the person with AD might make about their own functioning as well as the carers judgement. Finally, awareness is influenced culturally by societal knowledge and attitude to AD and this has been shown to have differential global regional impact on awareness of dementia. To explore these issues, the symposium brings together findings from two studies of dementia, namely the Mild Impairment and Dementia Awareness Study (MIDAS) project and the 10/66 Dementia Research Group project. The symposium as a whole provides information that should be considered when assessing awareness in early stage AD, taking into account factors in addition to neuropsychological deficit.

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**D. MOGRABI, C. FERRI, R.G. MORRIS, R. BROWN, M. PRINCE & J. LACKS. Lack of awareness (anosognosia) of memory impairment in dementia: findings from the 10/66 Dementia Research Group project.**

**Objective:** The main goals of the study were: to establish the prevalence of anosognosia in dementia, considering also potential international regional differences; to investigate the influence of demographic and contextual factors on unawareness of dementia; and to clarify the contribution of behavioural and cognitive factors to anosognosia of memory impairment.

**Participants and Methods:** This study is an analysis of data concerning awareness collected by the 10/66 Dementia Research Group project. The data were analysed from 1089 people who met the criteria for dementia out of a large community sample (n=15022) from three developing regions (Latin America, China and India). Two variables were created to measure lack of awareness of memory deficits: the first based on discrepancy between patient subjective report and objective results on memory tests and the second comparing patient and caregiver report about memory problems. The prevalence of anosognosia was calculated for each region and prevalence risks were calculated through poisson regressions to assess the relationship between unawareness and demographic, behavioural and cognitive factors.

**Results:** Regional differences in the prevalence of unawareness of memory impairments in dementia were found, with less awareness in India. Some demographic variables, such as educational level and socio-economic status, showed an association with unawareness of deficits in certain regions. The anosognosia variable based on caregiver report showed a greater relationship with behavioural and psychological symptoms, such as delusions, anxiety and mania, while the anosognosia variable based on comparison with performance was associated with cognitive variables such as memory, fluency and orientation impairments.

**Conclusions:** The results show how cultural factors may influence lack of awareness in dementia and also indicate that the relationship of anosognosia with ancillary factors is highly dependent on the way the concept is defined and measured.

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**Poster Session 2:**

**Drug/Toxin-Related Disorders, Memory Functions, Psychopathology/Neuropsychiatry (Schizophrenia & Other)**

**9:30–11:00 a.m.**

**Drug/Toxin-Related Disorders (Including Alcoholism)**

**J.R. CARRILLO, A.E. WAGNER, N. CROCKER & S.N. MATTSON. Visual-Motor Deficits in Children with Histories of Heavy Prenatal Alcohol Exposure are Not Accounted for by More Basic Skills.**

**Objective:** Although children with histories of heavy prenatal alcohol exposure demonstrate visual-spatial and fine-motor deficits, the relationship between these component processes and higher-order visual-spatial functioning has not been evaluated.

**Participants and Methods:** The present study assessed performance on the Beery-Buktenica Visual-Motor Integration (VMI) test and its two supplemental forms: visual perception (VMIvisual) and motor coordination (VMImotor). Subjects were children, ages 7-15, with heavy prenatal alcohol exposure (ALC, n=26) and non-exposed typically developing controls (CON, n=25).

**Results:** Data were analyzed using ANOVA, revealing significant between-group differences on the VMI ( $F(1,49)=7.504$ ,  $p=.009$ ) and the VMImotor ( $F(1,49)=4.767$ ,  $p=.034$ ) tests but not on the VMIvisual ( $F(1,49)=2.057$ ,  $p=.158$ ) test. Next, a two-step hierarchical regression was performed, with VMI as the dependent variable, and Group, VMI-motor, and VMIvisual as predictor variables. VMI-motor and VMIvisual were entered on step one, and Group was entered on step two. Both models accounted for a significant amount of variance in VMI performance and model 2 ( $F=4.534$ ,  $p=.038$ ,  $R^2=.227$ ) accounted for a significant increase in variance explained ( $\Delta R^2=.070$ ) over model 1 ( $F=6.118$ ,  $p=.004$ ,  $R^2=.170$ ). Group was a significant predictor ( $b=-6.107$ ,  $p=.038$ ) of VMI performance even after controlling for lower-order processes, suggesting a unique higher-order visual-motor integration deficit.

**Conclusions:** These results support previous findings of visual-spatial dysfunction in alcohol-exposed children but extend previous findings by indicating that these deficits cannot be attributed entirely to fine-motor or visual perception impairments and instead are better explained by higher-order processing deficits. Research supported by NIAAA grant R01 AA10820.

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**N.S. KANG, K.E. CALARCO, E.P. RILEY & S.N. MATTSON. Children with FASD and ADHD are Not Distinguishable Using a Visual Continuous Performance Paradigm.**

**Objective:** Attention problems are core deficits in fetal alcohol spectrum disorders (FASD) and high rates of attention-deficit/hyperactivity disorder (ADHD) are reported in this population. However, previous studies have been inconclusive, suggesting both similarities and differences between children with FASD and children with ADHD on continuous performance tasks (CPT). The current study builds on a preliminary investigation that reported differences in error rates on the Test of Variables of Attention (TOVA) in children with FASD compared to children with ADHD (Calarco et al., 2003).

**Participants and Methods:** Three matched groups were tested with the TOVA: children with histories of heavy prenatal alcohol exposure (ALC;  $n=58$ ), non-exposed children with ADHD (ADHD;  $n=29$ ), and typically developing non-exposed controls (CON;  $n=38$ ).

**Results:** Four TOVA indices were examined over the four TOVA quarters using repeated measures ANOVA: errors of omission and commission, response time, and variability. Results revealed a main effect of group on each TOVA index. Pairwise comparisons indicated that the CON group performed significantly better than both the ALC and ADHD groups, which did not differ from each other.

**Conclusions:** These data are consistent with some but not all previous comparisons of CPT performance in these two clinical groups. Results of the current study, which had larger sample sizes than previous studies, suggest both groups display comparable rates of inattention, impulsivity, processing speed and consistency in information processing. Future research should evaluate whether more sophisticated measures incorporating additional aspects of attention are able to distinguish between children with FASD and those with ADHD. Research supported by NIAAA grants R01 AA010820 and R01 AA010437.

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#### A.L. NORMAN, A.D. BAZINET, J.V. FILOTEO & S.N. MATTSON. Spatial and Object Working Memory in Children with Histories of Heavy Prenatal Alcohol Exposure.

**Objective:** Previous studies have identified visual working memory deficits in children with fetal alcohol spectrum disorders (FASD), with more studies of spatial recall than object recall. The present study examined potential differences between spatial working memory (SWM) and object working memory (OWM) in children with histories of heavy prenatal alcohol exposure.

**Participants and Methods:** Subjects were 21 children with FASD and 20 non-exposed matched controls. The alcohol-exposed group had significantly lower IQ scores. Children were shown a target image and, after a short (1000ms) or long delay (5000ms), were asked to indicate which of a pair of items matched the target image on either spatial location (SWM) or object shape (OWM). Item pairs were either similar or dissimilar to the target in location (SWM) or shape (OWM).

**Results:** Discriminability scores, reflecting both accurate responses and false alarms, were analyzed by ANOVA. Both groups performed significantly better on SWM vs. OWM, short vs. long delay, and dissimilar vs. similar conditions. Across conditions, alcohol-exposed children performed more poorly than controls and there was no differential group effect for SWM vs. OWM. However, across task, the difference between similar and dissimilar conditions was greater for controls than alcohol-exposed children.

**Conclusions:** These data support previous reports of spatial working memory deficits in children with histories of heavy prenatal alcohol exposure and further indicate that working memory deficits include object working memory. Additional research in this area should explore the effects of similarity in visual working memory, a potential target area for intervention. Research supported by NIAAA grant R01 AA010820. Correspondence: Sarah N. Mattson, Ph.D., Psychology, San Diego State University, 6363 Alvarado Court, Suite 209 (200M), San Diego, CA 92120, United States. E-mail: smattson@sunstroke.sdsu.edu

#### J.W. O'BRIEN, A.E. WAGNER, L. VAURIO, N. CROCKER, J.V. FILOTEO & S.N. MATTSON. Directed Attention in Children with Histories of Heavy Prenatal Alcohol Exposure.

**Objective:** Prenatal alcohol exposure is associated with attention problems, but the nature and specificity of these deficits are not well understood. The current study examined directed attention in this population.

**Participants and Methods:** Children with histories of heavy prenatal alcohol exposure (ALC,  $N=21$ ) and controls (CON,  $N=22$ ) were evaluated using a computerized measure of directed attention. Subjects were

shown hierarchical figures that were inconsistent (e.g., an H made of S's) or consistent (e.g., an H made of H's). They were directed toward either the global or local level (on separate blocks) and indicated whether that level was an H or an S. Reaction time (RT) for each condition and level was analyzed using ANOVA, with group as the between-subjects factor and condition (consistent vs. inconsistent) and directed level (global vs. local) as within-subject variables.

**Results:** In the global-directed condition, the CON group had slower RT for inconsistent than consistent figures [ $F(1,38)=3.202$ ,  $p=.082$ ,  $\eta^2_p=.078$ ], indicating a local bias. RT was unaffected by consistency in the local-directed condition [ $F(1,38)=0.652$ ,  $p=.424$ ,  $\eta^2_p=.017$ ], again suggesting a local bias. In the ALC group, RT was slower than the CON group for all conditions and there were no consistency effects for either global- [ $F(1,38)<0.001$ ,  $p=.989$ ,  $\eta^2_p<.001$ ] or local-directed trials [ $F(1,38)=0.394$ ,  $p=.534$ ,  $\eta^2_p=.010$ ].

**Conclusions:** The local bias demonstrated only by the CON group indicates that alcohol-exposed children are less susceptible to the interfering effects of hierarchical figures and may have deficits in local processing. Results support our previous findings of local-level deficits and suggest nonuniform visual-spatial attention deficits in this population. Research supported by NIAAA grant R01 AA10820.

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#### A.E. WAGNER, L. VAURIO, N. CROCKER, J.V. FILOTEO & S.N. MATTSON. Children with Histories of Heavy Prenatal Alcohol Exposure Display Impairments in Spatial Orientating of Attention.

**Objective:** Although children with histories of heavy prenatal alcohol exposure demonstrate deficits in attention, previous reports have been fairly global in nature and specific aspects of attention have not been addressed. The present study assessed spatial orienting of attention in children with histories of heavy prenatal alcohol exposure.

**Participants and Methods:** Two measures of orienting, using endogenous or exogenous cues, were administered. Four different cue-target intervals, or stimulus onset asynchronies (SOA) were used in both tasks: 50, 150, 250, or 1000ms. Subjects were children, ages 7-15, with heavy prenatal alcohol exposure (ALC,  $n=21$ ) and non-exposed controls (CON,  $n=22$ ). Validity effect (VE) scores were calculated by subtracting the median RT for valid trials from the median RT for invalid trials at each SOA.

**Results:** VE scores were analyzed by ANOVA with Group as the between-subjects factor and Condition (endogenous vs. exogenous) and SOA as within-subject factors. Groups demonstrated significant VE on both tests ( $p<.001$ ). The Group x Condition interaction was marginally significant ( $p=.077$ ), and follow up analyses revealed that the Group main effect was marginally significant for the endogenous task ( $p=.051$ ) and not significant for the exogenous task ( $p=.656$ ). Thus, children in the ALC group demonstrated larger VE than controls in the endogenous condition only. Further examination indicated that the deficit in the ALC group was due to impaired disengagement from an invalidly cued location.

**Conclusions:** These findings are consistent with previous findings of attention deficits, but also suggest specific damage to the anterior attention system and related brain areas in alcohol-exposed children. Research supported by NIAAA grant R01 AA10820.

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#### S. DOLAN & K. COLSON. Affective Processing in Alcoholics.

**Objective:** Current evidence suggests that affective processing deficits, such as abnormalities in identifying emotions conveyed in facial expressions may result from alcoholism and contribute to associated disruptions in emotional regulation. Previous research has produced mixed results, with some studies (Cermak et al., 1989; Oscar-Berman et al.,

1990; Uekermann et al., 2005) indicating no significant differences between recovering alcoholics and controls in identifying emotional expressions; other studies report that, compared to normal controls, abstinent alcoholics perform more poorly on such tasks (Kornreich et al., 2001a; Philippot et al., 1999; Townshend & Duka, 2003). Inconsistencies could be due to differences in the alcoholic patients' duration of abstinence at the time of testing, a finding supported by Kornreich et al. (2001) who reported that recently detoxified alcoholics performed less accurately than "mid-to long-term" abstinent patients and normal controls. This study seeks to elucidate these findings by examining facial affective decoding abnormalities in abstinent alcoholics with varying lengths of sobriety.

**Participants and Methods:** The Florida Affect Battery (FAB; Bowers et al., 1999) and a battery of neuropsychological tests were administered.

**Results:** Results suggested that longer abstinence was associated with better performance on the FAB facial affect discrimination task. In addition, in younger patients, alcoholics performed significantly worse than normal controls on this and other FAB tasks.

**Conclusions:** Techniques focusing on normalizing these affective processing abnormalities could increase the efficacy of substance abuse treatment.

This study was supported by the Baylor University Research Committee. Correspondence: Sara Dolan, Baylor University, One Bear Place #97334, Waco, TX 76798, United States. E-mail: sara\_dolan@baylor.edu

#### C.E. GAYTÁN & F. OSTROSKY. PERSONALITY PROFILE IN COLLEGE STUDENTS CONSUMERS OF MARIJUANA.

**Objective:** To compare the characteristics of temperament and character in marijuana users vs control subjects.

**Participants and Methods:** 66 subjects, divided into 2 groups: 33 subjects classified as marijuana users (mean age  $23.8 \pm 2.6$ ; mean years of education  $15.9 \pm 1.3$  years) and 33 controls (mean age  $22.2 \pm 2.6$ ; mean years of education  $15.8 \pm 1.4$ ). The marijuana users had consumption of 3 to 7 times per week at the time of the evaluation and had a history of two years of this type of consumption. Subjects were evaluated after a period 36 hours of abstinence. Personality was measured using the Temperament and Character Inventory (TCI) (Cloninger, 1993).

**Results:** The marijuana group scored significantly higher on Novelty Seeking (NS) ( $t = -3.34$   $p = 0.00$ ) which is a dimension of the temperament scale and in Self-Transcendence (ST) ( $t = -3.50$   $p = 0.00$ ) a dimension of the character scale.

**Conclusions:** High NS is characterized by exhilaration and exploration in response to novel stimuli, and an approach to signals of reward. Mesolimbic and mesofrontal dopaminergic projections have been shown to play a crucial role in incentive activation of each aspect of NS and it has been associated with D2 dopamine receptor polymorphism. High ST reflex a tendency toward spirituality and identification with the wider world, as well as the ability to accept ambiguity and uncertainty, this could be the result of the drug's use.

Research partially supported by UNAM SDEI-PTID-06-12 Grant project. Correspondence: Cecilia E. Gaytán, Licenciatura, Universidad Nacional Autónoma de México, calle v num 21 int 2 alianza popular revolucionaria, México DF 04500, Mexico. E-mail: cega\_jar@hotmail.com

#### R. GONZALEZ, R.M. SCHUSTER, K.R. DIVIAK, J. VASSILEVA, E.M. MARTIN-THORMEYER & R. MERMELSTEIN. Cannabis Use, Risky Decision-Making, and its Negative Consequences among Young Adults.

**Objective:** We examined risky decision-making (RDM) and declarative memory between cannabis users (CU) and non-users (NU), as well as their relationship with negative consequences from cannabis use.

**Participants and Methods:** Participants were 17 to 24 years old and classified into two groups well matched on demographic and mental health variables: CU ( $n = 18$ ) and NU ( $n = 20$ ). Exclusion criteria included a history of developmental, neurological, or diagnosed psychiatric disorders, as well as use of substances more than 10 times (besides

alcohol, cannabis, nicotine, and caffeine) or positive urine toxicology testing for any drug (other than cannabis). Participants in the CU group used cannabis regularly and within the last 45 days; whereas those in the NU group used cannabis less than 10 times ever and were negative for THC at testing. Measures of RDM were the Iowa Gambling Task (IGT), the Balloon Analogue Risk Task, and the Monetary Choice Questionnaire. The Hopkins Verbal Learning Test – Revised (HVLT-R) assessed declarative memory.

**Results:** The CU group performed more poorly than the NU group on the HVLT-R immediate recall ( $d = -.61$ ,  $p = .07$ ) and delayed recall ( $d = -.71$ ,  $p = .04$ ). No significant group differences emerged on measures of RDM. Among those that ever used cannabis ( $n = 23$ ), worse IGT performance correlated with negative job and interpersonal consequences from cannabis use ( $R^2 = .18$ ,  $p = .04$ ).

**Conclusions:** Cannabis use is associated with poorer memory, but not poor RDM among young adults. However, RDM was associated with negative consequences from cannabis use.

Supported by grants K23DA023560 (PI: Gonzalez) and 5PO1CA98262 (PI: Mermelstein).

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#### R.M. SCHUSTER, P. COLVIN, Z. LABUSCHAGNE, J. PAGKAS-BATHER, K. DIVIAK, R. MERMELSTEIN, J. VASSILEVA & R. GONZALEZ. Neurocognitive Disinhibition and Risky Sexual Behavior Among Emerging Adults With and Without Cannabis Use.

**Objective:** We examined the relationship between neurocognitive disinhibition (NcD) and risky sexual behavior (RSB) among participants aged 17 – 24, stratified by their use of cannabis.

**Participants and Methods:** Participants were 24 cannabis users (CU) and 38 nonusers (NU). RSB was assessed using the sexual behavior subscale of the HIV Risk-Taking Behavior Scale (HRBS). NcD was characterized by performance on two laboratory tasks of risky decision-making: the Iowa Gambling Task (IGT) and the Balloon Analogue Risk Task (BART).

**Results:** The CU group exhibited higher RSB than the NU group ( $p = .01$ ). Hierarchical multiple regressions were conducted with RSB as the dependent variable and performance on the IGT and BART as the independent variables, controlling for possible demographic confounds. In the combined sample, better performance on only the IGT was associated with decreased RSB ( $\beta = -.23$ ,  $p = .03$ ). When the groups were analyzed separately, associations between task performance and RSB emerged for the NU group (IGT:  $\beta = -.34$ ,  $p = .03$ ; BART:  $\beta = -.44$ ,  $p = .01$ ), but not for the CU group (IGT:  $p = .72$ ; BART:  $p = .69$ ). This relationship remained in the NU group even after excluding sexually inactive participants. Lifetime amount of cannabis use did not moderate the relationship between NcD and RSB for those in the CU group.

**Conclusions:** Results suggest that NcD affects RSB only among adolescents who do not abuse cannabis. This may be because cannabis use may increase risk for RSB regardless of NcD. Future studies will include additional measures of NcD and more detailed measures of risky sexual behaviors among a larger sample.

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#### M. HARCIAREK, J.B. WILLIAMSON, B. BIEDUNKIEWICZ, M. LICHODZIEJEWSKA-NIEMIERKO, A. DEBSKA-SLIZIEN & B. RUTKOWSKI. Predictors of Memory Performance of Dialyzed Patients with End-Stage Renal Disease.

**Objective:** Dialyzed individuals with end-stage renal disease (ESRD) often present with memory deficits. Nevertheless, the nature of this impairment remains controversial. Thus, this study aimed to better characterize memory functioning of dialyzed patients and to identify potential predictors of their memory performance.

**Participants and Methods:** Sixty one adequately dialyzed patients with ESRD and 30 demographically matched controls (NC) were the participants for this study. To assess their general cognitive status as well as affective symptoms, the Mini-Mental State Examination and the Hospital Anxiety and Depression Scale were used. Acquisition and recall of verbal material were assessed with the Rey Auditory Verbal Learning Test, whereas visual learning was assessed with the Brief Visual Memory Test-Revised.

**Results:** In comparison to NCs, individuals with ESRD obtained significantly lower memory scores. Further, the pattern of their performance was suggestive of retrieval deficits. However, mild to severe memory impairment was observed only in half of ESRDs. Regression analyses revealed that age, years of education, depression symptoms, blood urea nitrogen (BUN) and a history of coronary artery bypass grafting (CABG) were significant predictors of memory performance of dialyzed patients.

**Conclusions:** Memory performance of dialyzed patients is often below that of NCs, although severe mnemonic deficits seem to be rarely observed in this population. Lower memory scores of subjects with ESRD are associated with older age, fewer years of education, more depressive symptoms, higher BUN and the history of CABG. Moreover, memory profile of dialyzed individuals is similar to that seen in subjects with subcortical cerebrovascular disease.

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#### **M. KRENGEL & K. SULLIVAN. Independent neuropsychological effects of pesticide exposures in military pesticide applicators from Gulf War I.**

**Objective:** Gulf War (GW) veterans continue to report cognitive complaints many years following their deployment. Exposure to acetylcholinesterase (AChE) inhibiting pesticides has been a suspected cause for these complaints. The goal of this study was to evaluate the role of specific pesticides on current cognitive functioning in GW veterans with known exposures.

**Participants and Methods:** Participants included a unique group of 159 preventive medicine personnel (PM) including military pesticide applicators (high exposed) and PM personnel with little pesticide exposure (low exposed). In a prior analysis, veterans were characterized as being high or low exposed to 12 different pesticides of potential concern (POPC). Our prior work showed significant cognitive differences from combinations of pesticide exposures with those individuals in the high exposed group performing worse in the areas of memory and reaction times than those in the low exposed group. In the current analysis, we questioned whether specific pesticides would be independent predictors of neuropsychological performance. In order to address this question, stepwise regression analyses were performed.

**Results:** Results suggested that dichlorvos (pest-strips) was the best predictor for performance in the psychomotor domain ( $p=.01$ ), methomyl (fly bait crystals) and lindane (delousing powder) were the best predictors for the mood domain ( $p<.001$  and  $p<.005$ ) and diazinon (sprayed liquid) was the best predictor for performance in the visuospatial domain ( $p=.03$ ). Specific cognitive tests within each domain were significantly different and drove the overall results.

**Conclusions:** Findings suggest that although combinations of pesticides have contributed to persistent cognitive and mood differences in GW veterans, individual pesticides also had independent contributions.

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#### **L. KRIVITZKY, J. STRANG & S. EVANS. Neuropsychological functioning in two adolescents with leukoencephalopathy from “chasing the dragon”**

**Objective:** “Chasing the dragon” refers to the phenomenon of inhaling heroin vapor leading to toxic leukoencephalopathy. There appears to be little information in the literature on long term outcome in these cases. This study aims to characterize neuropsychological and rehabilitation outcomes in two adolescents with heroin induced leukoencephalopathy.

**Participants and Methods:** Two subjects are included (Subject 1: 17 year old male; Subject 2: 15 year old female). Both were found unconscious and brought to the ED with an initial GCS score of 3. MRI scans from both indicated diffuse white matter (wm) abnormalities (Subject 1: subcortical and periventricular wm, posterior cerebellum; Subject 2: centrum semiovale, occipital lobes, basal ganglia, periaqueductal wm, and bilateral cerebellum). Neither was known to be a chronic drug user, although both had been experimenting in the year preceding the injury. Subject 1 underwent neuropsychological evaluation (1 month post). Subject 2 was unable to complete comprehensive testing (3 months post), but underwent screening.

**Results:** Subject 1 demonstrated strengths in intellectual and basic academic functioning. Weaknesses were noted in speed of processing and executive functioning. Physically, he made significant improvements, with only mild right-sided weakness remaining. Subject 2 has demonstrated slowly improving cognition and strengths in language and basic academic skills. Physically, she has profound dysautonomia and significant problems with tone and thus is dependant for mobility.

**Conclusions:** Although the two subjects had different severity and courses of recovery, their presentations both suggest impact on aspects of motor and executive functioning. These outcomes are consistent with MRI findings of diffuse wm pathology. Further evaluation of the medical factors (e.g., anoxia, extent/location of wm damage) may help elucidate the reasons for their different recovery trajectories.

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#### **H.A. NEILSON, C.C. BARONE, F. VILA-RODRIGUEZ, G.W. MACEWAN, A.M. BARR, R.M. PROCYSHYN, D.J. LANG, A.E. THORNTON & W.G. HONER. Stimulant-Specific Effects on Decision Making in Polysubstance Users.**

**Objective:** Using stimulants and other illicit substances despite clear health risks represents poor decision making. Substance users may have pre-existing poor decision making skills, but these skills may be further impaired by the acute or neurotoxic effects of stimulant drugs. This study investigates whether more frequent use of cocaine (including crack cocaine) and methamphetamine is associated with poorer decision making.

**Participants and Methods:** Fifty-eight residents (45 M, 13 F, age 27-60) of single-room occupancy hotels completed the Iowa Gambling Task (IGT), a measure of decision making in which choosing low reward, low risk options yields the highest average gains. Self-reported substance use was recorded over several months with a timeline follow-back method, and urine drug screening was completed concurrently with the IGT. Seventy percent of the participants tested positive on the urine drug screen for two or more illicit substances. Regression analysis was used to evaluate potential associations between patterns of substance use and decision making performance on the IGT.

**Results:** After taking into account acute substance effects (based on urine drug screen results), demographic factors, and frequency of cannabis and heroin use, higher frequency (days per month) of cocaine use predicted poorer decision making on the IGT ( $p < .05$ ). In contrast, frequency of methamphetamine use was not significantly associated with decision making.

**Conclusions:** More frequent use of cocaine is associated with poorer decision making in currently using polysubstance users. The same relationship was not detected for methamphetamine use, suggesting that any effects of methamphetamine use on decision making may not be dose dependent.

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#### **A.G. VALDERRAMA, O. INOZEMTSEVA, E. MATUTE & J. JÚAREZ. Cognitive flexibility differences between cocaine and methamphetamine abusers.**

**Objective:** The aim of this study was to demonstrate the presence of cognitive flexibility differences between cocaine (CO) and metham-

phetamine abusers (ME), and non-drug abusers (NA) subjects. Several studies describe that psychostimulant abusers often have problems in executive functioning including cognitive flexibility. Cognitive flexibility is an important tool that allows an enhanced environment adaptation. It is not well known whether different types of psychostimulants (based in his mechanisms of action) could affect differently the executive functioning, particularly cognitive flexibility.

**Participants and Methods:** With this purpose the participants (CO n=8, ME n=7, NA n=8) were assessed with four specific cognitive switching tasks that are the part of trail making test, design fluency test, verbal fluency test and color-word interference test from D-KEFS battery (Delis-Kaplan, 2001). The psychostimulant abusers had  $27 \pm 3$  days of abstinence when they were assessed. ANOVA analysis was used.

**Results:** The drug abuser groups (CO y ME) showed a tendency to perform lower than NA in all tasks. Even, in color-word interference task CO group and ME group performed significantly lower than NA group ( $p=0.011$ ). Additionally, the ME group showed a tendency to perform lower than CO and NA in most tasks.

**Conclusions:** Our results suggest that the cognitive flexibility is affected by psychostimulants abuse and the ME abuse may have a great risk. Further studies with larger samples are needed for conclusive results.

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#### **A. VELEZ, F. OSTROSKY-SOLIS, K. BORJA, N. HEVIA & V. MEDINA. Marijuana Users and its Effects on Cerebral Metabolism.**

**Objective:** To compare cerebral metabolism on marijuana users vs control subjects.

**Participants and Methods:** Methods: Using positron emission tomography (PET), cerebral blood flow was compared on a 30 college students group, of which, 15 were frequent marijuana users (mean age= $22.37 \pm 2.57$ ; mean years of education= $15.95 \pm 1.78$ ) and 15 were non-using controls (mean age= $24.05 \pm 2.19$ ; mean years of education  $15.37 \pm 1.25$ ). Marijuana users had consumption of 3 to 7 times per week at the evaluation time and they had a consumption period of two year at least. Subjects were evaluated after a 36 hours period of abstinence.

**Results:** Results: Significant differences on brain metabolism were found in the inferior parietal region and the postcentral gyre on both cerebral hemispheres, in temporal transverse, superior and medial gyre of the right hemisphere, and on the insula and cerebellum in both hemispheres.

**Conclusions:** Conclusion: The differences on temporal areas could be related to deficits on memory and the cerebellar hipometabolism could be related to motor and temporal processing deficits reported on these subjects. Results are discussed with reference to endocannabinoids and marijuana consumption.

This research was realized with the support of the Universidad Nacional Autónoma de México, Secretaria de Desarrollo Institucional, Programa Transdisciplinario en Investigación y Desarrollo para Facultades y Escuelas, Unidad de Apoyo a la Investigación en Facultades y Escuelas, a través de su macroproyecto SDEI-PTLD-06-12

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#### **M. WEINBORN, S.P. WOODS, A. FOX, K. DYER & J. MOYLE. Prospective Memory Deficits amongst Polysubstance Dependent Individuals in Treatment.**

**Objective:** The ability to encode and successfully enact future intentions, known as prospective memory (ProM), has important implications for compliance with medical care, including the treatment of substance dependent individuals (SDI). However, very little is known about the nature and extent of objective ProM impairment amongst SDI.

**Participants and Methods:** A well-validated, clinically-focused measure of ProM, the Memory for Intentions Screening Test (MIST), was administered to 29 polysubstance dependent individuals currently in treatment, as well as a comparison group of 23 healthy adults (HA).

SDI reported a lifetime pattern of regular polysubstance use, primarily alcohol, marijuana, amphetamine/methamphetamine, and opiates. Breathalyzer and saliva screening were used to exclude data from acutely/recently intoxicated individuals. Groups were equivalent for age and gender, but the HA had higher levels of education and estimated premorbid IQ and lower levels of self-reported depression and anxiety.

**Results:** SDI performed significantly poorer than the HA for MIST Summary score (partial eta squared = .124), even after controlling for education, premorbid IQ, and mood state.

**Conclusions:** Findings indicate that SDI experience difficulty in executing future intentions, particularly when the retrieval cue is based on time. Further research is required to evaluate ProM performance amongst SDI with more specific use patterns (e.g., primarily alcohol vs primarily methamphetamine), and recovery of function following abstinence.

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## **Memory Functions**

#### **R. BERMAN, E. LUTHER & D. TUCKER. Reminiscent: Contextual Effects on Odor-Evoked Emotional Memory.**

**Objective:** The ability of an odor to elicit emotional memories has been examined extensively, but the process by which this occurs is not well understood. The role of context congruency in evoking emotional memory was tested using two scents with easily recognizable and empirically verified temporal contexts: a summer scent (sunscreen, beach) and a winter scent (evergreen, spices).

**Participants and Methods:** College-aged participants (N=154) were assigned to a winter-scented room, a summer-scented room, or an unscented control room and instructed to write narratives about two memories, one winter and one summer. Emotional content of memory was measured using the frequency of emotionally-valenced words, computed using Linguistic Inquiry and Word Count (LIWC) software.

**Results:** A general effect of scent was found by comparing the collapsed scented conditions with the unscented control: the scented groups utilized fewer negative words in their narratives, independent of context congruency ( $t(1,143)=2.30$ ;  $p<.05$ ). The role of context congruency was tested using a 2 (scent) X 2 (topic of narrative) mixed analysis of variance, with topic serving as a repeated measure, resulting in a significant interaction ( $F(1,93)=4.67$ ;  $p<.05$ ).

**Conclusions:** Context congruency had no significant effect in the summer condition, but did play a significant role in the winter condition: subjects used more positive words in their narrative when writing about a memory congruent with the ambient odor. Results suggest that odors may serve as potent contextual cues when accessing memories, and that context congruency may amplify emotional content. Clinical implications targeted for dementia and depressed populations are discussed. Correspondence: *Rachel Berman, B.A., University of Texas at Austin, 7744 Northcross Dr., Apt. #N263, Austin, TX 78757, United States. E-mail: rachel.berman@mail.utexas.edu*

#### **S.K. CHESTER, J.A. MOSES, L. HUTSON, F. PASTRANA, C. PREUSS, L. WURST, M.E. COTTINGHAM & M.J. WRIGHT. The Relationship Between the Item Specific Deficit Approach (ISDA) and List Learning Characteristics on the California Verbal Learning Test-Second Edition (CVLT-II).**

**Objective:** The Item Specific Deficit Approach (ISDA) is a novel item analytic method used to assess memory process disturbances on list learning tasks. It may provide an advantage over traditional indices to clinically assess for encoding, consolidation and retrieval deficits. Little is known about how the ISDA's deficit indices relate to traditional list learning characteristics.

**Participants and Methods:** An analysis of CVLT-II data collected from a sample of 94 adults with mixed psychiatric and neurological disorders was conducted (mean age = 51.57 years, SD = 13.73; mean education = 12.96 years, SD = 2.49) to determine the association between the ISDA indices and semantic clustering, recall consistency across learning trials, and learning slope.

**Results:** Pearson correlations revealed that the ISDA encoding index was negatively associated with learning characteristics for raw values (all  $r \geq -.53$ ,  $p < .001$ ). The ISDA consolidation index was also associated with learning characteristics, but to a lesser degree (all  $r \geq -.35$ ,  $p < .001$ ). Stepwise regression indicated that all three list learning characteristic indices predicted the ISDA encoding index (semantic clustering:  $R^2\text{change} = .39$ ,  $p < .001$ ; percent recall consistency across trials 1-5:  $R^2\text{change} = .12$ ,  $p < .001$ ; slope raw score:  $R^2\text{change} = .04$ ,  $p = .004$ ). Learning slope and semantic clustering predicted consolidation deficits, although the variance accounted for was fairly low (slope raw score:  $R^2\text{change} = .16$ ,  $p < .001$ ; semantic clustering:  $R^2\text{change} = .04$ ,  $p = .031$ ) as expected. The retrieval index was not predicted by list learning characteristics.

**Conclusions:** Overall, these data suggest that the ISDA encoding deficit index, and to a lesser degree the ISDA consolidation deficit index, are related to traditional list learning characteristics. Also, as would be expected, semantic clustering was found to be a robust inverse predictor of the ISDA encoding deficit index.

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#### A. DUROCHER, I. FOURNIER & P. NOLIN. Development of Verbal Memory and Categorization in Children.

**Objective:** The purpose of this study was to better understand the relationships between development of verbal memory and categorization abilities in normal children, using the California Verbal Learning Test – Children’s Version (CVLT-C).

**Participants and Methods:** Participants were 83 boys and 80 girls from 6 to 11 years of age. They were then divided in six age groups: (six years old:  $n=31$ , seven years old:  $n=31$ , eight years old:  $n=27$ , nine years old:  $n=36$ , ten years old:  $n=17$ , eleven years old:  $n=21$ ). Groups were compared on the total number of words of the five trials and on the number of semantic clusters obtained at the CVLT-C.

**Results:** A global significant difference (ANOVA) was found between groups in regards of the total of words for the five trials ( $F(5,162) = 19.02$ ,  $p < .001$ ) and semantic clusters ( $F(5,162) = 11.30$ ,  $p < .001$ ). Post-hoc analysis (LSD) demonstrate a significant improvement for both variables between seven and eight years old, whereas semantic clusters only improved consistently from ten to eleven years of age.

**Conclusions:** Results show an improvement in using semantic categorization closely parallel to the development of verbal memory, with a peak around seven and eight years old. Verbal memory could therefore be highly linked to executive functions such as semantic categorization. These observations will be discussed with other results on memory development and executive functions.

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#### R.L. ERICKSON, C. YOUNG, J. BIRATH, J. HARTMAN, L.K. PAUL & W.S. BROWN. Verbal Memory in Agenesis of the Corpus Callosum: Logical Memory and Paired Associates.

**Objective:** Individuals with Agenesis of the Corpus Callosum (ACC) and normal FSIQ demonstrate impaired functioning on complex cognitive and psychosocial processing. While these symptoms appear to be due to inefficient processing of complex information, the extent to which verbal learning and memory may contribute to these deficits is still uncertain.

**Participants and Methods:** Twenty-five adults with complete and partial ACC (FSIQ > 80; age 16-55) and 27 age- and FSIQ-matched controls were given the Logical Memory (LM) and Verbal Paired Associates (VPA) subtests from the WMS-III. It was hypothesized that the ACC group would exhibit deficient performance.

**Results:** Performance on LM and VPA were each assessed using a 2 X 2 Repeated Measures ANOVA: group (ACC vs. Controls) by time (Immediate vs. Delayed). Results indicated no significant group, time, or interaction effects on either the LM or VPA subtests ( $P > .05$  in all cases). In addition, no significant group differences were found on any of these Auditory Process Composites (e.g., Single-Trial Learning, Learning Slope, and Retention).

**Conclusions:** These results suggest that spontaneous recall of newly learned verbal information does not differ significantly between individuals with ACC and matched controls. Individuals with ACC are also not significantly deficient in recall after one exposure (Single-Trial Learning), retrieve across repeated exposures (Learning Slope), and recall after a delay (Retention). Thus, previous results demonstrating problems in individuals with ACC in complex cognition (including problem solving, non-literal language comprehension, humor, and social inference) cannot be attributed to problems in memory for verbal information.

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#### M. GONZÁLEZ RAMÍREZ, E. MENDOZA-GONZÁLEZ & R. LANDERO-HERNÁNDEZ. Relationship between Prospective/Retrospective Memory and Fibromyalgia Impact.

**Objective:** Complaints about Memory are common in people with fibromyalgia. Considering it, the aims of this study were to evaluate the relationship between prospective and retrospective memory with fibromyalgia impact, and also, to describe the most common complaints related to memory in this kind of patients.

**Participants and Methods:** The design was an open, cross-sectional, uncontrolled study. We used a self-administered questionnaire that contained each of the variables included in the study: The Prospective and Retrospective Memory Questionnaire (PRMQ; Smith, Della Sala, Logie, & Maylor, 2000), using González y Mendoza’s (2008) Mexican version; and The Fibromyalgia Impact Questionnaire (FIQ; Burckhardt, Clark & Bennet, 1991), using Rivera & González’s (2004) Spanish version. All of them have adequate psychometric properties. To perform the statistical analysis we used a parametric test.

**Results:** We report results about 25 female patients, their average age was 45.48 (SD=8.2). The correlation between prospective memory and fibromyalgia impact was  $\rho = .802$ ;  $p = .001$ ; between retrospective memory and fibromyalgia impact was  $\rho = .645$ ;  $p = .001$ . Complaints about prospective memory were more often than those about retrospective memory ( $\chi^2 = 4.006$ ;  $p = .001$ ).

**Conclusions:** This study suggests an important relationship between complaints of memory and the impact of fibromyalgia. It might be necessary to evaluate the real impact on memory, not only the self-perception. Nevertheless, studies on the memory are relevant in this kind of patients.

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#### E. HESSEN, M. LOSSIUS & L. GJERSTAD. Improvement in verbal memory after withdrawal of carbamazepine and valproate in seizure-free epilepsy patients: A randomized, double-blind study.

**Objective:** Neuropsychological side effects have been reported for most major anti epileptic drugs. Healthy volunteers studies have found that both carbamazepine and valproate may impair aspects of verbal memory. The aim of this study was to assess the effects of carbamazepine and valproate on verbal memory, in a seizure-free epilepsy population.

**Participants and Methods:** This was done with a placebo-controlled, prospective, randomized, double blind study of antiepileptic drug withdrawal in patients receiving monotherapy.

**Results:** Withdrawal of carbamazepine (n=92) significantly improved recall after 30 minutes ( $p=0.03$ ). Withdrawal of valproate (n=32) significantly improved performance of immediate word span ( $p=0.04$ ).

**Conclusions:** The improvement of memory, after both carbamazepine and valproate withdrawal was slight, and the consequences for daily life function is uncertain.

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**J. NOVITSKI, L. GUIDOTTI, M. LANCASTER, M. SEIDENBERG, S. RAO, K. NEILSON & J. WOODARD. Temporal Gradient in Younger and Older Adults: Semantic Knowledge of Recent and Remote Famous Names.**

**Objective:** Temporal Gradient (TG) refers to the notion that recent memories are more vulnerable to the effects of brain damage than are older memories. Less studied is the effect of age differences on the pattern of memory in relation to memory age. In this study we examined the TG for semantic knowledge of famous names from recent and remote time epochs in young and older adults.

**Participants and Methods:** 11 healthy young adult (mean age=24.8, SD=4.1) and 8 healthy older adult (mean age=70.9, SD=4.5) subjects were shown famous names from recent and remote time categories and were asked to provide as much semantic knowledge about each name as they could recall. Their responses were rated on a 10-point scale and total semantic knowledge average scores were calculated for each time epoch for each participant. Only names that were correctly recognized were included in the analysis.

**Results:** Younger and older participants showed different patterns of semantic knowledge for famous names based on memory age. The older group displayed the “typical” TG (remote semantic knowledge > recent semantic knowledge) while the younger group showed a “reversed TG” (recent semantic knowledge > remote semantic knowledge).

**Conclusions:** These findings add to the literature concerning the effect of age on the nature of the TG and have implications for current conceptualizations of the representation of information in relation to memory age.

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**S. PAVAWALLA, M. SCHMITTER-EDGECOMBE, R.E. SMITH, R. AUGER, S. GREEN, J. SUMMERVILLE & H. POONI. Prospective Memory Following Moderate to Severe Traumatic Brain Injury: A Formal Multinomial Modeling Approach.**

**Objective:** Prospective memory (PM), conceptualized as the processes involved in realizing a delayed intention, has been found to be impaired following traumatic brain injury (TBI). Because impairments in PM can be detrimental to successful rehabilitation given the need to remember important activities such as medical appointments, it is important to gain a thorough understanding of this complex construct. Although PM can be empirically dissociated from retrospective memory, prospective remembering inherently involves both prospective and retrospective components. The goal of this study was to disentangle within a TBI population the influence of strategic prospective processes, or remembering that an action needs to be taken, from the retrospective recognition processes of remembering when the action needs to be executed.

**Participants and Methods:** A formal multinomial processing tree (MPT) model developed and validated by Smith and Bayen (2004) was used to disentangle the prospective and retrospective recognition components underlying PM. Fifteen participants with a moderate to severe TBI and 15 age- and education-matched control participants completed an event-based PM task that was embedded within an ongoing color-matching task.

**Results:** Traditional data analyses revealed a significant cost to ongoing task performance with the inclusion of the PM task. Results of the MPT modeling indicated group differences in both the prospective and retrospective recognition components of PM, despite intact post-test recall of the PM task and target words.

**Conclusions:** Taken together, our findings suggest that prospective remembering within this event-based PM task requires capacity-demanding resources, and TBI seems to impact both the prospective and retrospective recognition components underlying prospective remembering.

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**A.N. PUENTE, C. FARACO, J.E. MACKEY & L.S. MILLER. The Neural Correlates of the O-SPAN: A Working Memory Task.**

**Objective:** Working memory is critical for the successful completion of most tasks in which we engage. The current study investigated regions of WM using a task from the contemporary cognitive psychology literature believed to measure working memory capacity, the operation span (O-SPAN). We hypothesized activation in areas previously identified as relating to WM: prefrontal cortex, the anterior cingulate cortex, and the parietal cortex.

**Participants and Methods:** This study was a cross sectional, within group design including nine participants. The O-SPAN was presented in a block design with three block types: 1) The operation span condition, where the individual decided whether an equation was incorrect or correct, followed by an immediate presentation of a letter later tested for recognition; 2) A response condition, wherein the individual chose letters seen during the first block; 3) An arithmetic-only section, whereby the individual decided whether an equation was incorrect or correct. To determine the neural correlates of working memory a contrast was created (operation span condition - Arithmetic, with baseline as an implicitly controlled variable).

**Results:** As predicted, significant activation was found in the prefrontal cortex, specifically within the frontal poles, and in the middle frontal gyrus. Additional activation was seen in the precentral gyrus, and supplementary motor cortex.

**Conclusions:** Findings suggest that the middle frontal gyrus and frontal poles reflect the integration of information and higher order cognition necessary during a working memory task. Activation in the precentral gyrus and supplementary motor cortex is likely caused by the voluntary control of the behavior required for responses, but could be due to, or increased by, the difficulty of the task. The neural correlates of the current study may be more representative of the current conceptualization of WM as compared to other tasks used in neuroimaging such as the n-back.

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**A.N. PUENTE, C. FARACO & L.S. MILLER. Neural Correlates of Retrieval during a Working Memory task.**

**Objective:** The current study investigated the neural correlates of retrieval during a complex span task. Working memory tasks historically are analyzed during encoding, and analysis of retrieval has been overlooked. Based on episodic memory paradigms of retrieval we hypothesized activation in the prefrontal cortex, medial temporal lobe, and the parietal cortex during the retrieval process.

**Participants and Methods:** A block design containing three blocks was used to present the operation span (O-SPAN) to twenty-five aged college students. 1) Block 1, the operation span task, wherein the individual decided whether an equation was incorrect or correct, then immediately was presented with a letter later tested for recognition 2) A response condition, wherein the individual chose letters seen during the O-SPAN. 3) An arithmetic-only section, whereby the individual decided whether an equation was incorrect or correct. To determine the neural correlates of the retrieval during a working memory task a contrast, Response – Baseline was created.

**Results:** As predicted, significant activation was found in the prefrontal cortex, specifically within the dorsolateral region, Brodmann Area (BA) 9, BA 8, the parahippocampal region of the medial temporal cortex, BA 22, and the precuneus. Additional activation was seen in supplementary motor cortex and areas associated with visual processing.

**Conclusions:** The current study indicates areas involved in retrieval during the OSPAN task include the prefrontal cortex, the medial temporal lobe, and the parietal cortex. These results support a dual component working memory model, suggesting that working memory includes a dynamic attention component (e.g., pre-frontal cortex) and a cue-dependent search component (i.e., hippocampus, and precuneus). Although additional areas were engaged during the response portion of the O-SPAN (i.e., supplementary motor cortex, and areas of the occipital cortex), it is believed those areas were specifically activated because of the inherent task demands.

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**S. RASKIN, S. WOODS, A. POQUETTE, A. MCTAGGART, J. SETHNA, R. WILLIAMS & A. TROSTER. A Differential Deficit in Time- versus Event-based Prospective Memory in Parkinson's Disease.**

**Objective:** The present study investigated prospective memory functioning in individuals with PD and demographically similar healthy adults using a standardized measure of prospective memory that allows for a direct comparison of time-based and event-based cues. In addition, participants were administered a series of standardized measures of retrospective memory and executive functions.

**Participants and Methods:** A total of 88 participants were drawn from two study sites. Exclusions for study participation included current psychiatric disorders and histories of cardiovascular or other neurologic disease, dementia, prior neurosurgery, current substance use disorders, or a visual impairment that would interfere with reading the testing materials. All PD participants were prescribed medication for parkinsonian symptoms and were tested in their "on" state. PD participants were in stages 0-4 of the Hoehn and Yahr scale (Hoehn & Yahr, 1967), with the majority in stages 1-3. Participants were given the Memory for Intentions Screening Test. Participants also completed several standard clinical measures of RetM, attention and executive functions

**Results:** Individuals with PD demonstrated impaired prospective memory performance compared to the healthy adults, with a greater impairment demonstrated for the time-based tasks. Time-based prospective memory performance was moderately correlated with measures of executive functioning, but only the Stroop Neuropsychological Screening Test emerged as a unique predictor in a linear regression.

**Conclusions:** Findings are interpreted within the context of McDaniel and Einstein's (2000) multi-process theory to suggest that individuals with PD experience particular difficulty executing a future intention when the cue to execute the prescribed intention requires higher levels of cognitive control.

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**S.J. WALKER, S.L. WRIGHT, B.D. LONG, E.M. BRICENO, A.M. KADE, J. ZUBIETA, E.A. YOUNG, L.A. BIELIAUSKAS, I.C. SMET, S.C. RIBEIRO, R.C. HATFIELD, J.F. LOPEZ, M.G. MCINNIS, D.F. MAIXNER, H. AKIL, B. GIORDANI & S.A. LANGE-NECKER. Learning and Memory Decrements in Symptomatic and Remitted Depression.**

**Objective:** Memory complaints are common in Major Depressive Disorder (MDD), although prior research has yielded conflicting results regarding the origin and extent of such difficulties. Among other re-

search, the frontal and hippocampal theories each posit disrupted neural circuits potentially underlying memory decrements in depression. Memory organization and retrieval are dependent upon fronto-limbic functioning, whereas diminished hippocampal functioning should result in reduced learning curve and delayed recall.

**Participants and Methods:** Learning and memory functioning in these domains, as measured by the California Verbal Learning Test-II (CVLT-II; Delis et al., 2000), were assessed in 210 participants (115 depressed patients, 95 healthy controls). The Hamilton Depression Rating Scale (HDRS) measured symptom severity, and between-group analyses were conducted among three groups: healthy control, symptomatic MDD, and remitted MDD.

**Results:** Those with symptomatic MDD, but not those with remitted MDD, exhibited decreased performance on tasks thought to rely on both frontal and hippocampal functioning. The healthy control group performed significantly better on several tasks (i.e., initial recall, recognition hits, recognition false positives), than did the symptomatic MDD group. The remitted group scored significantly better in terms of learning slope than did the healthy control group, with no other significant differences noted.

**Conclusions:** This study suggests difficulty in multiple aspects of learning and memory during active MDD. Learning and memory decrements in depression may be a state feature, reflecting temporary dysfunction in fronto-limbic systems, with more prominent hippocampal dysfunction. Variability in memory performance related to other factors, such as medication and years of illness will also be explored.

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### Psychopathology/Neuropsychiatry (Other)

**E. AVERY, K. HAZLETT, M. SCHALLMO, N. HUQ, A. BAHADORI, L.S. OWN, S.L. WRIGHT, A.F. CAVENEY, E.A. YOUNG, L.J. RAPPORT, L.A. BIELIAUSKAS, B. GIORDANI, J. ZUBIETA & S.A. LANGE-NECKER. Executive Functioning and Emotion Processing Predictors of Treatment Response in Major Depressive Disorder.**

**Objective:** Use of neuropsychological screening in psychiatry clinics to predict treatment response is increasing. We tested the hypothesis that dysfunction in facial emotion processing (FEPT) and parametric go/no-go (PGNG) tasks would predict success in a "treatment-as-usual" model.

**Participants and Methods:** Participants were 230 adults with major depressive disorder (MDD) who completed the PGNG and the FEPT at intake and then completed treatment as usual under specialty-care clinicians. Depression severity was assessed with the Patient History Questionnaire (PHQ) at intake and over the next 3-6 months. Multiple regression analyses predicting treatment response were employed with (a) all participants with PHQ > 5 who completed the PHQ at two subsequent times (N = 87); and (b) only those not taking psychotropic medications at the time of evaluation (n = 43). Predictors included accuracy and response time for angry, fearful, happy, and sad faces (FEPT) and inhibitory processing speed, response inhibition, and sustained and divided attention (PGNG).

**Results:** In the no-medication model, 30% of the variance in treatment response was predicted by response time and accuracy for fearful and angry faces and inhibitory processing speed (p = .02). In the whole model, 23.8% of the variance in treatment response was predicted by response time for angry and fearful faces, accuracy for angry faces, and inhibitory processing speed (p < .001). Effects were similar with baseline PHQ severity as a covariate.

**Conclusions:** Findings support the utility of using brief cognitive screening instruments to predict treatment response in MDD. Neuropsychologists should continue to build collaborative relationships with other mental health professionals.

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**A. BENITEZ & J. GUNSTAD. Comorbid Depression and Anxiety and Executive Functioning.**

**Objective:** Previous research has identified impaired executive functioning in depression and anxiety. However, it is unclear whether these deficits are unique to either disorder or result from their high comorbidity. This study hypothesized that individuals with high Anhedonic Depression (AD) and Anxious Arousal (AA; as defined in the Tripartite Model [Clark & Watson, 1995]) would demonstrate different impairments on an executive function battery and would have lower scores on these tests compared to a comorbid group (i.e. high AD&AA).

**Participants and Methods:** Undergraduates were recruited if their scores on the Mood and Anxiety Symptom Questionnaire (MASQ) exceeded 1 S.D. from the norm of the AD and AA subscales. Participants with high AD (n=34), AA (n=15), and both AD&AA (n=32) scores were compared on their performance on Letter-Number Sequencing, Similarities, Matrix Reasoning, COWAT, SCWT, and WCST.

**Results:** Contrary to expectations, only SCWT Color-Word differentiated the groups, wherein the AA group (M=42.72, S.E.=2.46) named fewer Color-Word pairs than the AD group (M=50.85, S.E.=1.65;  $F(2, 77)=3.74, p<.05, \text{partial } \eta^2=.09$ ). Furthermore, chi-square analyses revealed that the AD&AA group did not have more impaired cases than the AD and AA groups, with the exception of the AA group having significantly more participants with impaired performance on Trails B.

**Conclusions:** Although minimal differences emerged between depressed and anxious individuals on a comprehensive executive function battery, the current study suggests that comorbid depression and anxiety are not associated with greater neuropsychological impairment. Further work with groups with more severe pathology and other indices of psychopathology are needed to clarify these findings.

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**V.M. DOTSON, M.A. BEYDOUN & A.B. ZONDERMAN. Recurrence of Depressive Symptoms and Risk for All-Cause Dementia and AD.**

**Objective:** Dementia risk is increased in individuals with a history of depression. The risk may be particularly high in those with recurrent depression due to repeated insult to the brain. This study examined whether the number of episodes of elevated depressive symptoms (EDS) is monotonically related to mild cognitive impairment (MCI) and dementia risk.

**Participants and Methods:** 1,239 older adults from the Baltimore Longitudinal Study of Aging were followed for a median 24.7 years and completed the Center for Epidemiologic Studies Depression Scale (CES-D) every 1-2 years. Diagnoses of MCI and dementia were made at consensus conferences based on prospective data. Kaplan-Meier survival curves, log-rank test for trend for survivor functions, and Cox proportional hazards (PH) models were conducted to examine the risk of MCI and dementia by number of episodes of EDS (CES-D scores of  $\geq 16$ ).

**Results:** We observed a "dose-dependent" relationship between the number of episodes of EDS and the risk for all-cause dementia and Alzheimer's disease. The risk for all-cause dementia was increased by 14% with each episode. An 87-92% increase in dementia risk was associated with having one episode of EDS, while having two or more episodes nearly doubled the risk. Risk of incident MCI was not associated with recurrence of EDS.

**Conclusions:** These results provide further support for the hypothesis that depression is a risk factor for dementia. Moreover, they suggest that recurrent depression is particularly pernicious. Preventing the recurrence of depression in older adults may prevent or delay the onset of dementia.

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**K.M. EDWARDS, M.J. MURPHY, E.C. TANSILL, E.H. ZIMAK, T.L. RIDDLE, A.D. DESAI & J. SUHR. The Neuropsychological Correlates of Sexual Aggression.**

**Objective:** Research suggests that 22% to 57% of men report a history of sexual aggression. Although historical, personal, situational, and so-

ciocultural correlates of sexual aggression have been identified, little research has focused on neuropsychological correlates of sexual aggression, particularly in non-clinical or non-incarcerated samples. The purpose of the current study was to examine neuropsychological correlates of sexual aggression in a non-clinical sample of young men.

**Participants and Methods:** Participants included 32 college men (mean age = 19.25), most of whom identified as Caucasian (97%). Cognitive tests administered included WAIS-III Matrix Reasoning, WASI Vocabulary, Behavioral Analogue Risk Task, Stroop Color-Word Test, Rey Auditory Verbal Learning Test, Trail Making Test A and B, and Controlled Oral Word Association. To assess sexual aggression history, participants completed the Sexual Aggression subscale of the Conflict Tactics Scale Revised.

**Results:** Men with histories of sexual aggression (N = 10) were not different from men without sexual aggression histories on estimated intellect. However, they scored significantly worse on Auditory Verbal Learning Test learning over trials (Cohen's  $d = .96$ ), Stroop Interference (Cohen's  $d = .89$ ), and Trail Making B (Cohen's  $d = .77$ ), suggesting difficulties with verbal learning, selective attention, and cognitive flexibility.

**Conclusions:** Consistent with previous research, neuropsychological deficits may contribute to sexually aggressive behavior. Findings may implicate poor attention to secondary social cues or executive weaknesses. Future research is needed to inform theoretical understanding and assessment of sexual aggression.

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**E.J. HELDER, M. LACY, E. AUSTRIA & D. FRIM. Emotional and behavioral adjustment in children with hydrocephalus.**

**Objective:** Hydrocephalus is a neurological condition characterized by excessive cerebral spinal fluid build-up in the brain. Previous research has suggested that children with hydrocephalus are at increased risk for developing emotional and/or behavioral difficulties (Fletcher, 1995; Lindquist, 2006). However, the majority of prior research examining the emotional and behavioral functioning of children with hydrocephalus has focused on children with spina bifida or has included heterogeneous samples. Spina bifida has its own unique morphology along with physical limitations that may impact the emotional status of these children. In the current study we expand on this literature by examining a homogenous sample of children with hydrocephalus without spina bifida.

**Participants and Methods:** The current study compared 30 children with hydrocephalus due to periventricular hemorrhage with 18 healthy controls (age range 6 – 16) with regard to parent rated behavior and emotional functioning using the Parent Rating Scale of the Behavioral Assessment Scales for Children (BASC), controlling for IQ differences between groups.

**Results:** Results indicated that children with hydrocephalus had a higher incidence of clinically significant (i.e.,  $T > 70$ ) difficulties (30%) compared with controls (11%). Parent ratings of internalizing problems (i.e., depression, somatization) as well as attention problems were significantly higher in the children with hydrocephalus compared to controls.

**Conclusions:** These findings underscore the importance of monitoring behavioral and emotional adjustment in children with hydrocephalus and intervening where appropriate.

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**W.D. KILGORE, L.M. PRICE, J.C. BRITTON, A.L. GOLD, T. DECKERSBACH & S.L. RAUCH. Neural Correlates of Anxiety Sensitivity Factors During Presentation of Masked Fearful Faces.**

**Objective:** Individuals differ in the degree to which they fear the thoughts, symptoms, and social consequences associated with the experience of anxiety—a construct known as "anxiety sensitivity" (AS).

High AS significantly increases the risk of developing an anxiety disorder. Presently, the neurobiological basis of AS is poorly understood. However, based on previous evidence regarding the role of insular cortex in somatic/visceral perception, we hypothesized that insular activation during affective perception tasks would correlate positively with AS and specifically with sensitivity to the physical symptoms of anxiety.

**Participants and Methods:** Adult healthy controls (HC;  $n=23$ ) and individuals with small animal phobia (SAP;  $n=18$ ) completed the Anxiety Sensitivity Index (ASI), comprising subscales measuring Mental, Physical, and Social factors of AS. Participants underwent functional magnetic resonance imaging (fMRI) while viewing masked presentations of fearful versus neutral faces. The correlation between ASI scores and brain activation was mapped voxel-wise to test for significant relationships ( $p<.001$ ,  $k=20$ ).

**Results:** Groups did not differ significantly on ASI scores. For total ASI, three clusters of significant activation were found, with the greatest positive correlation occurring in the right insula. The Mental factor correlated positively with activation in medial prefrontal cortex and basal ganglia; the Physical factor correlated positively with activation in the right insula, supramarginal gyrus and left ventrolateral prefrontal cortex. No significant correlations were found for the Social factor.

**Conclusions:** Findings suggest that the Physical concerns of AS are associated with insular responses to affective stimuli, while responses within self-reflective medial prefrontal regions may contribute to the Mental aspects.

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**M. MCFADDEN, C. CONSIDINE, S. WRIGHT, L. BIELIAUSKAS, S. BERENT, D. MAIXNER & S. LANGENECKER. Auditory Memory Decrements are Present in Major Depressive Disorder, with no Evidence of Increased Levels of Dissimulation.**

**Objective:** Decreased memory performance among patients with Major Depressive Disorder (MDD) has been attributed to poor effort in some studies. The present study was designed to determine whether findings of increased levels of poor effort in medico-legal patients with depressive symptoms could be extended to individuals with major depressive disorder. We hypothesized that MDD and healthy control (HC) participants would not differ in performance on dissimulation tests, but would differ in performance on learning and memory tests.

**Participants and Methods:** The study sample included 52 MDD and 28 HC participants who were administered the Test of Memory Malinger (TOMM) and California Verbal Learning Test-II (CVLT). Thirty-four MDD and 18 HC participants completed the Michigan Spatial Relations Test (MSRT). Repeated measures ANOVA were conducted for a) TOMM trials 1 and 2, b) CVLT learning and delayed recall and recognition trials, and c) MSRT learning and delayed recall trials.

**Results:** HC and MDD patients performed equivalently on the TOMM, ( $F(1, 78) = .05$ ,  $p = .83$ ). For the CVLT, the interaction between group and CVLT variable was significant ( $F(10, 760) = 1.85$ ,  $p = .048$ ). Posthoc  $t$  tests demonstrated significant group differences on long delay recognition ( $F(1, 77) = 2.07$ ,  $p = .043$ ) and trend level differences for trial 4 and long delay cued recall. For the MSRT, there were no main effect of group  $F(1, 50) = 0.04$ ,  $p = .85$ ), nor was the interaction between group and MSRT variable significant ( $F(7, 350) = 0.64$ ,  $p = .72$ ).

**Conclusions:** The present results support the contention that findings of a relationship between failed dissimulation tests and depressive symptoms in medico-legal patients do not translate to individuals with major depressive disorder, where effort is within normal limits yet auditory memory decrements exist.

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**B.A. RICH, T. HOLROYD, F. CARVER, B. CORNWELL, N. FOX, D. PINE, R. COPPOLA & E. LEIBENLUFT. A Magnetoencephalography (MEG) Study of Irritability in Pediatric Bipolar Disorder.**

**Objective:** Pediatric bipolar disorder (BD) is a highly debilitating illness, and irritability is prevalent and impairing. Despite this, there are no neuroimaging studies of irritability in pediatric BD. To elucidate the neural correlates of irritability, self-regulation, and attention to emotional stimuli in youth with BD, we examined neural activity (theta band oscillations) during a frustrating condition using magnetoencephalography (MEG).

**Participants and Methods:** We compared 20 BD (14.9+2.0 years; 45% male) and 20 control (14.7+1.7 years; 45% male) subjects. Patients met strict DSM-IV criteria for BD and were euthymic when tested. Controls had no psychiatric history. We used the affective Posner task, an attention paradigm that uses rigged negative feedback to induce frustration, to compare BD youth and healthy controls. MEG measured the instantaneous changes in neuronal electrical activity following negative and positive feedback.

**Results:** BD youth reported a significantly more adverse emotional response than did controls to negative feedback. Whole-brain, Synthetic Aperture Magnetometry (SAM) analysis of MEG data found that following negative feedback, BD subjects, compared to controls, displayed greater theta synchronization in the right anterior cingulate cortex (ACC;  $p=.001$ ) and bilateral parietal lobe ( $p=.003$ ). In contrast, controls displayed greater left ACC theta synchronization than BD subjects following positive feedback ( $p=.004$ ).

**Conclusions:** In the first MEG study of BD youth, in response to frustration-inducing negative feedback, BD youth displayed aberrant patterns of theta oscillations in the ACC and parietal lobe. Results suggest that in BD youth, frustrating, negative emotional stimuli elicit heightened attention to negative information, exaggerated self-monitoring, and mood dysregulation that characterizes pediatric BD.

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**K.A. RYAN, S.A. LANGENECKER, E.F. SAUNDERS, A.M. KADE, M.T. RANSOM, A.C. VEDERMAN, M. KAMALI, L. FRANTI & M.G. MCINNIS. Executive Functioning Performance Across Phase of Illness in Bipolar Disorder.**

**Objective:** Individuals with bipolar disorder (BD) often experience executive dysfunction, with selective executive impairments during the manic phase of the illness. However, most studies have examined individual indices of executive functioning rather than reliable estimates of underlying cognitive constructs using factor scores. This study examined the influence of phase of BD illness on executive functioning constructs.

**Participants and Methods:** Healthy control subjects (HC,  $n=60$ ), and euthymic (E,  $n=110$ ), depressed (D,  $n=62$ ), and hypomanic/mixed (HM,  $n=24$ ) patients with BD who were enrolled in the Prechter Longitudinal Study on Bipolar Disorder were administered a battery of cognitive tasks known to measure executive functioning (WCST, TMT, Verbal Fluency, Parametric Go/no go, Stroop, Digit Symbol). Tasks comprised four executive function factors consistent with previous literature; processing speed with interference resolution, verbal fluency and processing speed, conceptual reasoning and set-shifting, and inhibitory control.

**Results:** Multivariate analyses showed that the HC outperformed all BD groups in processing speed with interference resolution. HC only outperformed the active phase BD groups in verbal fluency and processing speed, and only the HM group in inhibitory control. The HM performed significantly more poorly than all groups in inhibitory control. There was no difference between groups for the conceptual reasoning factor.

**Conclusions:** These results indicate that there is a differential pattern of executive dysfunction across the different phases of bipolar disorder. Consolidating executive functioning tasks into reliable factor scores can provide unique information to measure and define cognitive deficiencies throughout phases of BD and may aid in redefining treatment focus.

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**S.C. FIELDSTONE, T.D. VANNORSALL, B. GORDON & D.J. SCHRETLEN. Validation of the 15-Item Geriatric Depression Scale (GDS-15) for Clinical Use with Young and Middle-Aged Adults.**

**Objective:** The 15-item Geriatric Depression Scale (GDS-15) yields self-ratings of depression severity. It is brief, easy to read (Flesh-Kincaid 4.8 grade level), and well-validated for use with older adults. The aim of this study was to determine whether the GDS-15 is suitable for clinical use with young and middle-aged adults.

**Participants and Methods:** We administered the GDS-15 to a community sample of 394 adults aged 18-96 years. Each person also completed a structured psychiatric interview, the NEO Five-Factor Inventory (FFI), and a comprehensive medical and neurological assessment. We then compared 175 healthy, non-depressed participants with 32 who met DSM-IV diagnostic criteria for current major depressive, bipolar, or dysthymic disorder. We further compared these two groups after stratifying both by their median ages (63 and 50 years, respectively).

**Results:** Discriminant, logistic regression, and receiver operating characteristic (ROC) analyses all yielded similar results. A cut-off score of 5 or more on the GDS-15 distinguished between depressed and non-depressed participants with nearly identical accuracy in younger and older adults. This cut-off correctly classified 75% old and 69% young adults with depression and 96% old and 99% young adults without depression. Further, when we combined depressed and non-depressed participants, their GDS-15 scores correlated positively with FFI Neuroticism scores for old and young subgroups ( $r_s = 0.75$  and  $0.69$ , respectively), and negatively with FFI Extraversion scores for old and young subgroups ( $r_s = -0.55$  and  $-0.57$ , respectively).

**Conclusions:** The GDS-15 shows very good and nearly identical diagnostic sensitivity, specificity, and construct validity for young and old adults.

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**M. SEMKOVSKA & D.M. MCLOUGHLIN. Retrograde Memory following Treatment for Severe Depression – Is Electroconvulsive Therapy Worse than Pharmacotherapy?**

**Objective:** Depression may impair autobiographical memory. Retrograde amnesia following electroconvulsive therapy (ECT) is frequently reported. Its occurrence is regularly attributed to ECT without considering possible depression-related contributions. We aimed to detect extend of retrograde amnesia specifically associated with ECT by comparing non-ECT and ECT treated depressive patients.

**Participants and Methods:** Inpatients with Major Depressive Disorder were recruited if scoring  $\geq 21$  on Hamilton Rating Scale for Depression (HRSD). Therapy type was decided by treating psychiatrist. Previous ECT was an exclusion criterion for the non-ECT group. Ability to recall personal semantic, episodic extended (lasting more than a day) and episodic memories was assessed with the structured Autobiographical Memory Interview (AMI-SF). Impersonal Events Questionnaire (IEQ) covering four time periods measured memory for public events. Non-ECT and ECT groups were compared on demographic, psychopathology, and retrograde memory variables using mixed-effects repeated measures (baseline:end-of-treatment) ANOVA.

**Results:** ECT ( $n=33$ ) and non-ECT ( $n=21$ ) patients showed comparable HRSD and AMI-SF semantics scores at both baseline and end-of-treatment. Non-ECT patients were younger than the ECT group ( $p=0.003$ ) and performed better on baseline AMI-SF episodic ( $p=0.01$ ) and IEQ-15-previous-years ( $p=0.02$ ) variables. At end-of-treatment, non-ECT retrieved more AMI-SF episodic and episodic extended details and showed better performance on IEQ variables ( $p<0.05$ ). After ANCOVA controlling for age, all three group differences were no longer significant with the exception of the ECT group worse performance on IEQ-5-previous-years ( $p<0.03$ ).

**Conclusions:** ECT and non-ECT patients showed comparable post-treatment semantic and episodic autobiographical memory. Amnesia for impersonal events that occurred during the 5 previous years appeared specifically associated with ECT. Retrograde amnesia described after ECT may encompass trait-like memory impairments in depression.

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**K.M. STANEK, M. SELLBOM & J. GUNSTAD. Neuropsychological Correlates of Body Image Disturbance.**

**Objective:** Body image disturbance (BID) is a significant concern for many individuals, including those without eating disorders. The symptomatology of BID provides for numerous intuitive links between specific cognitive dysfunction and body-related perceptual, attitudinal, and behavioral disturbances; however, few studies have addressed possible neuropsychological correlates of BID, particularly in non-clinical samples. The current study examined associations of three components of BID (body dissatisfaction, body checking, and body size misperception) with neuropsychological test performance.

**Participants and Methods:** One-hundred females (age range 18-26 years) without eating disorders underwent assessment of body composition (BMI range 15- 45), BID components, neuropsychological performance in multiple cognitive domains, and conceptually relevant psychological covariates.

**Results:** Several conceptually indicated bivariate associations emerged between BID components and neuropsychological test performance. Multiple regression analyses for each BID component indicated that only increased body checking was significantly associated with cognitive dysfunction [slower information processing speed ( $\beta = .22$ ,  $p = .02$ )], after controlling for age, BMI, and depressive and obsessive-compulsive symptomatology.

**Conclusions:** Results suggest an independent association between behavioral disturbances of BID and neurocognitive function, a finding that carries important clinical implications for assessment and treatment of BID in young women without eating pathology. Moreover, findings from the present study suggest the possibility of shared underlying etiological mechanisms (e.g., white matter abnormalities) that may account for shared variation of cognitive dysfunction in BID, depression, and OCD. Future prospective studies should address this possibility.

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**S.R. SUTTERBY, L.N. JOHNSTON & J.S. BEDWELL. Neuropsychological Functioning in Social Phobia.**

**Objective:** The purpose of the current study was to clarify the neurocognitive mechanisms underlying social phobia. Previous research in this area has identified some specific group differences in neurocognitive functioning between individuals diagnosed with social phobia and nonpsychiatric controls, but has failed to administer a comprehensive neuropsychological battery to a social phobia patient group, resulting in a piecemeal understanding of the neurocognitive functioning of this population and an incomplete picture of the neuropsychological profile inherent to this group.

**Participants and Methods:** The present research utilized a broader collection of neuropsychological tests to assess nine cognitive domains: Verbal Learning, Verbal Delayed Memory, Visual Immediate Memory, Visual Delayed Memory, Visual-Spatial Processing, Verbal Working Memory, Visual Working Memory, Executive Functioning, and Attention. This battery was administered to 25 individuals diagnosed with social phobia and 25 nonpsychiatric controls.

**Results:** A mixed analysis of variance (ANOVA) did not reveal a significant group by cognitive domain interaction, nor a significant main

effect of group. As this was the first study to examine multiple cognitive domains in a single sample of individuals with social phobia, exploratory univariate analyses were performed to examine group differences for the specific cognitive domains. This revealed significant group differences specific to the Visual Working Memory domain, with the social phobia group scoring significantly lower than the nonpsychiatric control group.

**Conclusions:** This is the first study to suggest visual working memory deficits for individuals with social phobia. Implications of these findings and directions for future research are discussed.

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#### A. ZEDLITZ, M.F. VAN VREESWIJK & L. FASOTTI. Depression and Fatigue after Acquired Brain Damage, a review of the literature.

**Objective:** In recent years attention for fatigue after acquired brain damage (ABD) as a distinct entity, has grown (DeLuca, 2005). The prevalence of both fatigue and depression after ABD is high, however a dissociation between the two clearly exists (Staub and Carota, 2005). Here this dissociation will be clarified in order to get a better understanding of both sequelae and to adjust treatment adequately.

**Participants and Methods:** The authors conducted an extensive literature review, using Pubmed, ScienceDirect and well-known textbooks.

**Results:** Prevalence rates of both fatigue and depression vary greatly in different studies (e.g. Hackett, 2008; Ammon 2008), due to different measurements, designs and populations.

**Conclusions:** Fatigue and other neurologic sequelae of ABD are in danger to be classified mistakenly as symptoms of depression. Furthermore, the dissociation between depression and fatigue after ABD is found to be greater than the overlap of both syndromes. A thorough assessment of both syndromes is needed, since different treatment strategies are advisable.

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#### E.H. ZIMAK, E. TANSILL, A. DESAI, K. EDWARDS, M. MURPHY, T. RIDDLER & J. SUHR. Neuropsychological Correlates Of Primary And Secondary Psychopathic Characteristics In An Undergraduate Sample.

**Objective:** Emerging evidence from non-institutionalized populations indicates that the personality and behavioral features of psychopathy may be associated with divergent neuropsychological correlates. Primary psychopathic traits (e.g., interpersonal-affective characteristics) may relate to affective processing deficits, and secondary psychopathic traits (e.g., behavioral deviance) may relate to response inhibition, risk-taking, and executive functioning deficits (e.g., Schum & Verona, 2007). The purpose of the current study was to clarify the relationship between psychopathic traits and neuropsychological variables in a non-clinical sample.

**Participants and Methods:** Participants were 32 male college students (mean age 19) who completed WASI Vocabulary, Behavioral Analogue Risk Task (BART), Stroop Color-Word Test (SCWT), Auditory Verbal Learning Test (AVLT), Iowa Gambling Task (IGT), and Trail Making Test (TMT). To assess psychopathic traits, participants completed the Levenson Self-Report Psychopathy Scale (LSRP).

**Results:** After controlling for intelligence, primary psychopathy was related to higher impulsivity and risk-taking on BART ( $r = .42, p = .03$ ) and marginally poorer performance on AVLT delayed recall ( $r = -.35, p = .08$ ). After controlling for intelligence, secondary psychopathy was related to greater risk-taking on Quintile 5 of the IGT ( $r = -.42, p = .03$ ), faster psychomotor processing on TMT part A ( $r = -.49, p = .01$ ), and marginally more words read on Stroop Word ( $r = .36, p = .06$ ).

**Conclusions:** Consistent with previous research, psychopathic factors appear to have divergent neuropsychological correlates. Thus psychopathic characteristics may generally relate to risk-taking, secondary psychopathic traits may be related to faster processing speed. Implications of these findings for theory, research, and assessment purposes will be discussed.

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#### R. SEGARRA, N. OJEDA, J. PENA, J. EGUILUZ, M. GUTIERREZ, A. RODRIGUEZ-MORALES, I. RUIZ, R. HIDALGO & J. BURON. Insight in First Episode Psychosis and its relation to clinical symptoms, treatment adherence and global functioning: One year follow-up.

**Objective:** The Eiffel study is a longitudinal naturalistic study of patients with a first episode psychosis (FEP) designed to evaluate the predictive value of defective insight on treatment adherence and global functioning.

**Participants and Methods:** 577 patients with a FEP were assessed at baseline and at 1 year follow-up. They were compared regarding sociodemographics, psychopathology, insight, treatment adherence and functional outcome terms. Longitudinal functionality was prospectively assessed with the Clinical Global Impression (CGI) and Global Assessment of Functioning (GAF) rating scales.

**Results:** At baseline, up to 50% of our sample presented lack of insight. Most clinical symptoms improved over the follow-up, including insight. Insight, education and social withdrawal significantly predicted CGI and GAF at follow-up. Treatment adherence was also predicted by insight and type of treatment (injectable atypical antipsychotic medication).

**Conclusions:** Insight significantly predicted the general clinical course, treatment adherence and functional outcome in our FEP sample at one year follow-up. Only education additionally accounted to explain the longitudinal course. Since our results suggest that better insight improves treatment adherence and consequently clinical course and functional outcome, insight could be a specific target of treatment in early intervention programs.

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#### Psychopathology/Neuropsychiatry (Schizophrenia)

#### N. OJEDA, J. PEÑA, R. SEGARRA, P. SANCHEZ, E. ELIZAGARATE, J. EGUILUZ, J. EZCURRA & M. GUTIERREZ. Is it time to include executive functioning as diagnostic criteria for schizophrenia?

**Objective:** The predictive value of cognitive deficits in schizophrenia for the course of clinical symptoms and related variables remains unclear. Specifically, previous studies have failed to prove the longitudinal predictive value of cognition in determining the final diagnoses of the first episode psychosis (FEP) samples assessed.

**Participants and Methods:** Eighty-three FEP patients were recruited and followed-up during a 2 year follow-up period after onset. Assessment included clinical interview, psychiatric evaluation (PANNS, Young Mania Scale, MADRS Depression Scale) and neurocognitive (attention, processing speed, memory, language, executive functions) and functional assessment.

**Results:** Logistic regression models revealed that executive dysfunction correctly classified patients with schizophrenia (87%), from patients with bipolar disorder (81.3%), and other psychoses (72.4%). The prediction was stable despite the inclusion of positive, negative, affective symptoms, and other cognitive tests into the model. Just Wisconsin Card Sorting Test- categories completed and percentage of perseverative errors, correctly classify up to 79.4% of patients.

**Conclusions:** These results showed that executive functioning, as measured by the Wisconsin Card Sorting Test, may be a promising tool to use in basic clinical approach to FEP and schizophrenia. As far as the au-

thors are aware, this is the first attempt to assess the ordinal predictive value of neurocognitive performance and clinical symptoms on the clinical diagnosis of the ICD. Our results support previous suggestions of the importance of including cognition as a part of the diagnostic criteria for schizophrenia.

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**J. PEÑA, N. OJEDA, P. SANCHEZ, E. ELIZAGARATE, A. KOLLER, J. EZCURRA & M. GUTIERREZ. Speed Explains Differences in Cognitive Performance between Patients with Schizophrenia and Normal Controls.**

**Objective:** Processing speed (PS) is a key feature of schizophrenia regarding cognition and functional outcome. The aim of this study was to clarify the interactions among PS and other neurocognitive variables in schizophrenia compared to healthy controls.

**Participants and Methods:** One-hundred patients with schizophrenia and fifty three healthy control participants were matched on age, gender and years of formal education. All participants underwent a common assessment which included socio-demographics, and cognitive variables (processing speed, attention, verbal memory, verbal fluency, working memory and executive functioning). Patients also completed a clinical and psychiatric protocol (PANAS, Young Mania Scale, MADRS Depression Scale, Insight).

**Results:** After controlling for PS, the differences between groups initially found in other cognitive domains highly decreased. The % of F value that decreased ranged from 77.3% for verbal memory to 99% for working memory (WM). The percentage of the effect size decreased similarly ranged from 0.2% for attention to 96.1% for WM. Other cognitive domains included as covariates showed similar results. Therefore, we decided to control the effect of PS on the rest of cognitive factors and afterwards, to include individually these "PS free" cognitive domains as covariates to identify patterns of interaction. After controlling for the effect of processing speed on other cognitive factors (standardized residuals), results demonstrated that it is the processing speed component which accounts for the differences between groups, and no difference in other cognitive performances.

**Conclusions:** Processing speed is a core deficit in schizophrenia that underlies other higher cognitive functions in schizophrenia

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**G. GARCIA AGUILAR, A. GONZÁLEZ-GARRIDO, V. MEDINA-HERNÁNDEZ & J. RAMOS-LOYO. Inhibition Of The Prepotent Response To Emotional Stimuli In Schizophrenia.**

**Objective:** It has been reported that schizophrenics show impairments in the inhibition of prepotent response as well as in emotional recognition. The objective of the present work was to identify the possible deficits in the inhibition of prepotent response to emotional stimuli in schizophrenic patients.

**Participants and Methods:** Fifteen schizophrenic patients and 15 healthy men were evaluated; groups were paired by age and educational level. Schizophrenic patients were under pharmacological treatment and had 2 to 3 years of disease evolution. Participants carried out 4 Go/NoGo tasks: one with neutral objects of IAPS; another one of genre inhibition with neutral facial expressions and; 2 inhibiting happiness and anger emotional expressions.

**Results:** Schizophrenic patients did not show deficits in the inhibition of prepotent response, neither to emotional nor to non-emotional stimuli compared to controls. Nevertheless, they showed slowness in responding to all the tasks, accordingly with that reported in previous studies. Only the patients showed lower number of correct responses and higher reaction times to emotional stimuli compared to those for genre and objects.

**Conclusions:** Patients did not show impairments in the inhibition of the prepotent response with emotional or non-emotional stimuli. This might suggest that the emotional stimuli did not generate a prepotent response in the patients or, that due to the short evolution time of the disease, the patients did not show the inhibitory impairments described in the literature for another kind of stimuli.

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**S. WORTH, R.K. KESSLER, P.L. BRITNELL & T. GIOVANNETTI. Everyday Distraction in People with Schizophrenia.**

**Objective:** Everyday tasks (i.e., making lunch) are often executed in the context of potentially distracting objects that are not essential for task completion. This pilot study examined the influence of non-target, distracting objects on everyday action performance in people with schizophrenia.

**Participants and Methods:** Forty-seven people with schizophrenia (SZ) were recruited for the study. Healthy controls (n = 18) and participants with dementia (n = 45) also were included as comparison groups. All participants were videotaped while they completed the Naturalistic Action Test (NAT), a standardized performance-based measure. Two of the 3 NAT items include distractor objects in the task setup: Task 2 - gift wrapping and Task 3 - packing a lunchbox and schoolbag. Performance on these 2 items was coded for instances when participants touched or used distractor objects.

**Results:** SZ participants made more distractor errors than controls (p < .02), but not more than dementia participants (p > .05). Error type (i.e., touch vs. use) analyses showed a significant Group x Error type interaction (F = 4.49, p = .03), with SZ participants more likely to use (65%) distractor objects than just touch them (35%). Dementia participants showed the opposite pattern (use=30%; touch=70%). An item analysis also showed that relative to dementia participants, SZ participants made more errors to distractor objects that were unrelated to the task goals/objects.

**Conclusions:** People with SZ are vulnerable to interference from a wide range of objects, even those unrelated to the task goal. Distractor interference in SZ frequently leads to task derailment. Rehabilitation approaches for SZ should eliminate distractor objects from performance settings.

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**K. GODDARD & S. PURDON. The Sensitivity and Specificity of d' Scores in Distinguishing First Episode Schizophrenia from Substance Induced Psychosis.**

**Objective:** Continuous Performance Task (CPT) deficits have been well documented in premorbid, acute, and chronic schizophrenia, and among family members at high risk for the illness; however, the specificity of the deficits to schizophrenia has yet to be fully established. This study examined CPT d' scores in two groups of first episode psychosis patients during a baseline and follow-up evaluation. Sensitivity and specificity values were calculated at various d' scores across time, and classification rates were compared with DSM-IV diagnoses at study entry.

**Participants and Methods:** 81 first episode psychosis patients (55 Schizophrenia/Schizophreniform (FES), 26 Substance-Induced Psychosis (SIP)) underwent the Structured Clinical Interview for DSM-IV (SCID). Patients completed three CPT tasks (CPT-AX, CPT-IP2, CPT-IP4) within a comprehensive clinical and neuropsychological unmedicated baseline evaluation and after 9 weeks of treatment with risperidone, quetiapine, or olanzapine.

**Results:** The CPT-AX and CPT-IP2 each exhibited good sensitivity with increasing d' scores across assessments, although the specificity of both tasks was poor. The CPT-IP4 showed a similar pattern of good sensitivity and poor specificity at the baseline examination, but the specificity of the CPT-IP4 improved at follow-up. At 9 weeks post-treatment, the CPT-IP4 showed optimal sensitivity (80%) and specificity (76%) at a d' score of 2.17, achieving a hit classification rate of 80% in relation to baseline DSM-IV diagnoses.

**Conclusions:** After stabilization of an acute psychotic episode, the CPT-IP4 task showed good sensitivity and specificity in distinguishing between FES and SIP. The CPT-IP4 task may be a useful supplement to clinical diagnostic interviewing in first episode psychosis

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**A.M. HARTZELL, B. IZAGUIRRE & R.S. KERN. Declarative and Non-Declarative Memory in Schizophrenia.**

**Objective:** Cognitive impairments are a core feature of schizophrenia, with impairments in memory perhaps most severe. In examining memory in schizophrenia, few studies have compared multiple areas within declarative and non-declarative systems. This study aimed to assess memory functioning in individuals with schizophrenia compared to healthy adults on selected areas of declarative and non-declarative memory.

**Participants and Methods:** Participants included 40 schizophrenia outpatients matched for age and gender with 30 healthy individuals. Participants were administered a memory battery assessing the following areas of memory functioning: verbal learning, working memory, semantic memory, remote memory, verbal retention, procedural memory, and priming. The battery was counter-balanced to control for order effects. Group differences were assessed using a one-way MANOVA with diagnosis serving as the between-group variable and performance scores from the seven memory domains as the separate dependent variables. Identification of outlier domains were examined by comparing the mean of each domain to the mean of the remaining six domains.

**Results:** Significant group differences were found in verbal learning, working memory, semantic memory, remote memory, and priming, with the patient group performing significantly worse than healthy adults. No group differences were found in verbal retention and procedural learning. Patients showed impairments relative to healthy adults in verbal learning, semantic and working memory, but showed relative sparing of verbal retention and procedural learning.

**Conclusions:** The results highlight the unevenness of memory functioning in persons with schizophrenia. These findings may be useful for planning rehabilitation interventions that capitalize on the integrity of relatively preserved areas of cognitive functioning.

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**M. IAMPIETRO, D.A. DRABICK, R.K. KESSLER & T. GIOVANNETTI. Empirically Defined Patterns of Executive Function Deficits in Schizophrenia and their Relation to Everyday Functioning: A Latent Class Analysis Approach.**

**Objective:** Executive function (EF) deficits in schizophrenia (SZ) are well documented; much less is known about patterns of EF deficits and their association to differential impairments in everyday functioning. This study used latent class analysis (LCA) to empirically define SZ groups based on measures of various EF abilities and compare EF groups on everyday action errors.

**Participants and Methods:** Forty-five inpatients with SZ completed subtests from the Delis Kaplan Executive Function System (D-KEFS) and the Naturalistic Action Test (NAT), a performance-based measure of everyday action. NAT performance was videotaped and coded for total errors, including omissions and commissions (i.e., perseverations, off-task actions, etc.) LCA models of D-KEFS scores were run by first testing a one-class model followed by exploration of additional models with more classes. After determining the best fitting model, NAT errors were compared across the classes.

**Results:** Statistical indicators, including the Bayesian Information Criteria (BIC; 1879.84), adjusted BIC (1798.32), and Bootstrap Likelihood Ratio Test ( $p < .001$ ), indicated that the 3-class model provided the best fit to the D-KEFS data. The 3 EF classes were based on severity and type of EF impairment, with class 1 exhibiting im-

pairment in establishing mental set ( $n=5$ ), class 2 demonstrating relatively spared EF ( $n=9$ ), and class 3 showing marked perseveration ( $n=31$ ). Follow-up covariate analyses showed that the classes also differed on NAT total errors ( $p = .01$ ), total commission errors ( $p = .03$ ), and perseverations ( $p < .01$ ), with class 2 consistently showing fewer errors. There were no differences for NAT omissions or off-task errors.

**Conclusions:** People with SZ demonstrate variable EF deficit patterns that differ according to the ability to maintain mental set vs. perseverative behaviors. Specific EF deficits are unrelated to differential functional deficits; both types of EF deficit are associated with more inaccurate actions and perseverations on everyday tasks.

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**D.M. OREM & J. BEDWELL. The Role of Emotional Content on Selective Attention in Individuals with Schizophrenia and Demographically Matched Controls.**

**Objective:** Previous research has suggested a relationship between attention and delusion-proneness in individuals with schizophrenia, however, the influence of emotion on this relationship is not well understood. The aim of this study was to investigate the effect of emotional content on selective attention (using an emotional Stroop task) in individuals with schizophrenia and controls. It was hypothesized that individuals with schizophrenia would perform more poorly on this task, though it was expected that within both groups, participants would exhibit an attentional bias (AB) toward emotional stimuli. It was hypothesized that this bias would be larger in the schizophrenia group, and that it would increase as severity of delusion-proneness increased.

**Participants and Methods:** Twenty-five individuals with schizophrenia and 25 demographically matched controls completed an emotional Stroop task containing emotional and neutral words. AB was indicated by increased reaction time. All participants completed a multidimensional measure of delusion-proneness. Data was analyzed using a series of mixed ANCOVAs and paired-samples *t* tests.

**Results:** Results revealed a statistical trend towards poorer performance on the task in the schizophrenia group. As hypothesized, individuals with schizophrenia exhibited a statistically significant AB, though controls did not. Contrary to hypotheses, the schizophrenia group did not demonstrate a larger AB compared to controls. The hypothesis that AB would increase as delusion-proneness increased was not supported.

**Conclusions:** Results indicated support for AB toward emotional stimuli in individuals with schizophrenia, though the proposed relationship to delusion-proneness was not supported. Factors that may have contributed to this pattern of results, including the effect of stimulus valence, are discussed.

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**E.G. TIRADO-DURÁN, M. CASTAÑEDA-FRANCO & M. MARTÍNEZ-RODRÍGUEZ. Neuropsychology of Delusional Thinking: Reasoning or Meaning.**

**Objective:** Delusions are the product of the deficit on reasoning, however another postulate proposes that meaning is the major impairment; so people infer incorrect premises based on wrong concepts. Hence, the objective of this investigation is elucidate if the principal failures in patients with delusional thinking are related to meaning or reasoning.

**Participants and Methods:** Seventy-one adults participated: 26 with paranoid schizophrenia, 23 with Delusional Disorder y 22 healthy adults. There were no differences in age and scholarship between groups, and all patients were under antipsychotic medication. The Wechsler Intelligence Scale for Adults (WAIS) and the Wisconsin Card Sorting Test (WCST) were administered by trained neuropsychologists.

**Results:** No differences were found in any of the variables of the WCST. Meanwhile, differences were found in the subtests of Vocabulary ( $F=9.732$ ,  $p=.000$ ), Comprehension ( $F=14.004$ ,  $p=0.000$ ), Digit-Symbol ( $F=15.452$ ,  $p=0.000$ ), and Picture Completion ( $F=28.170$ ,  $p=0.000$ ) after a post-hoc analysis of Tukey.

**Conclusions:** These findings suggested that deficit in delusional thinking is related to meaning and reasoning applied to social problems because the WCST was not significant. Both groups of patients share impairment in Comprehension, Vocabulary, and Picture Completion; so meaning and reasoning are implicated, especially concepts applied to the solution of hypothetical social dilemmas. Elucidate the neuropsychological substrate in delusional thinking will allow the development of therapeutic strategies for patients with psychotic disorders.

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**E.W. TWAMLEY, C. BURTON, L. VELLA, G. SAVLA, J. GUIDRY, M. ABELES, A. MINASSIAN, R. BILDER & J. KELSOE. COMT Genotype, Cognition, and Everyday Functioning in Schizophrenia.**

**Objective:** The Val158Met single nucleotide polymorphism of the catechol-O-methyltransferase (COMT) gene on chromosome 22 influences dopamine catabolism and is related to cognitive impairment in schizophrenia. Previous research has found that the Met allele is associated in a dose-response fashion with better performance on most neuropsychological tests.

**Participants and Methods:** We assessed 116 outpatients with schizophrenia-spectrum disorders (62% men; 68% Caucasian; mean age=48; mean years of education=13) with a blood draw and a comprehensive neuropsychological, functional, and clinical battery. Participants with the Val/Val ( $n=38$ ), Val/Met ( $n=53$ ), and Met/Met ( $n=25$ ) genotypes did not differ on demographic variables, diagnosis, type or dosage of antipsychotic medication, or duration of psychosis.

**Results:** Spearman correlations between the “dose” of the Met allele (0, 1, or 2 Met alleles) and the neuropsychological, functional, and clinical variables demonstrated that a higher number of Met alleles was associated with better estimated premorbid intellectual functioning ( $r=.21$ ,  $p=.028$ ). Correlations between the number of Met alleles and performance on the UCSD Performance Based Skills Assessment (Household Chores and Recreation Planning subtests) were  $>.15$ , but did not reach statistical significance. Met homozygotes significantly outperformed Val homozygotes on the UPSA Household Chores subtest ( $t=2.0$ ,  $df=59$ ,  $p=.049$ ).

**Conclusions:** The Met allele appears to be associated with better performance in selected neuropsychological domains and functional capacity tasks. Because the Val158Met polymorphism typically explains a small amount of variance in cognitive performance and given the size of the current sample, these results need to be replicated with a larger sample and other variants should be considered to further understand genetic contributions to cognition.

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**L. VELLA, C.Z. BURTON & E.W. TWAMLEY. Improvements in Neuropsychological, Functional, and Clinical Outcomes after Compensatory Cognitive Training in Psychosis.**

**Objective:** Commonly recognized schizophrenia symptoms include positive, negative, and disorganized symptoms; however, individuals with these disorders also have multiple neuropsychological and functional deficits. We compared a 12-week, group-based, compensatory cognitive training intervention plus standard pharmacotherapy (CT) to standard pharmacotherapy alone (SP), hypothesizing that the CT group would show differential improvement in the targeted neuropsychological domains (prospective memory, attention, learning, memory, and executive functioning) and in functional capacity.

**Participants and Methods:** Sixty-four schizophrenia-spectrum outpatients were randomized to CT ( $n=33$ ) or SP ( $n=31$ ). Assessments at

baseline, post treatment, and three month follow-up included a neuropsychological battery and measures of functional capacity (UCSD Performance Based Skills Assessment; UPSA), the Positive and Negative Syndrome Scale (PANSS), Hamilton Depression Rating Scale, and Quality of Life Interview. Z summary scores were created to summarize targeted and non-targeted neuropsychological domains. Treatment outcomes were examined using hierarchical linear modeling, with effect estimates (EE) generated for each time by treatment effect.

**Results:** As predicted, the CT group performed significantly better over time than did the SP group on the targeted neuropsychological domain score (EE=0.21,  $p=0.036$ ) and the UPSA (EE=7.90,  $p=0.005$ ). Compared with the SP group, the CT participants also demonstrated fewer negative symptoms over time (PANSS Negative scale, EE=-3.84,  $p=0.023$ ). Changes in non-targeted neuropsychological performance, quality of life, positive and depressive symptoms did not differ between groups (all  $p\geq 0.07$ ).

**Conclusions:** These results suggest that compensatory cognitive training has the potential to improve not only neuropsychological performance, but also functional capacity and negative symptom severity.

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## Genetics/Genetic Disorders

**J. MARTONE, K.S. WALSH, A. WEINSTEIN, M. ACOSTA & S. CUSHNER-WEINSTEIN. Gender differences in quality of life in children with Neurofibromatosis Type 1: The role of neurocognitive impairments and resiliency.**

**Objective:** Little research has been reported on gender differences in NF1, especially as it relates to the prevalence of neurocognitive impairments and quality of life in males and females. Children with NF1 have more learning disabilities and attention deficits than the general population. Few studies have assessed quality of life, and none have evaluated resiliency in this population. This study examines gender differences related to neurocognitive disabilities, resiliency and quality of life.

**Participants and Methods:** Thirty-five children with NF1, ages 11-17 years, were evaluated for learning disabilities, quality of life and resiliency. Fifty-four percent were female. Regression analysis was used to evaluate the relationship between gender, disability status resiliency and quality of life.

**Results:** A significant proportion of variance was accounted for by gender ( $p=.02$ ;  $R^2=1.5\%$ ) and disability status ( $p=.00$ ;  $R^2=2.7\%$ ). Resilience accounted for 44.6% of the variance ( $p=.00$ ), moderating the relationship between gender and quality of life. Disability status remained a significant contributor ( $p=.001$ ;  $R^2=6.2\%$ ). Males were more likely to have learning and attention disabilities ( $t=-3.4$ ;  $p=.002$ ) and report less resiliency ( $t=2.7$ ;  $p=0.12$ ) than females, resulting in poorer quality of life.

**Conclusions:** These findings highlight the importance of considering gender differences in NF1, particularly as it relates to the severity of neurocognitive disabilities and resiliency on quality of life. Resiliency appears to moderate the relationship between disability and quality of life for genders differently, with males faring more poorly.

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## Other

**D. AASE, R. MINTZ, B. CHWALISZ, L. BITYOU, J.F. FINK & N.H. PLISKIN. Longitudinal Neuropsychological Symptom Changes Following Electrical Injury: An Exploratory Study.**

**Objective:** Individuals who have experienced an electrical injury often report physical, cognitive, and affective disturbances. Compared to individuals who have been victims of other traumatic experiences, electrically-injured (EI) patients endorse more somatic and internalizing affective distress (Wicklund et al., 2008). Furthermore, while deficits in

attention, processing speed, and motor domains of functioning have been well-documented (Pliskin et al., 1998; 2006), the trajectory of the neuropsychological sequelae over time following electrical injury requires more investigation. Prior research suggests that some neuropsychological symptoms may not manifest until EI patients enter the post-acute phase of recovery (e.g., Bailey et al., 2008; Ramati et al., 2009).

**Participants and Methods:** The present study assessed twenty-five EI patients who were evaluated at least twice following their injury. Change scores were utilized to assess the impact of both baseline injury features (i.e., acute vs. post-acute, presence of loss of consciousness) as well as prospective characteristics (i.e., litigation status, changes in depressive symptoms, time between assessments) on cognitive outcomes.

**Results:** As an overall group, there was little change over time in cognitive performance. However, results indicated that improvements in depressive symptoms were associated with improvements in performances on complex attention tasks, but not simple attention tasks (increased depressive symptoms held the opposite pattern). Litigation status was negatively associated with improvement on one complex attention task. Loss of consciousness, baseline injury status (acute vs. post-acute) and time between evaluations were not significant predictors of changes in cognitive performance.

**Conclusions:** Implications for the treatment of comorbid affective issues and for future research on victims of electrical trauma are discussed. Correspondence: Darrin Aase, DePaul University, 1130 South Michigan Ave #4214, Chicago, IL 60605, United States. E-mail: daase@depaul.edu

**D.W. BEEBE, M.D. RIS, M.E. KRAMER, E. LONG & R. AMIN. Association Between Sleep-Disordered Breathing and Neurobehavioral Functioning During Middle to Late Childhood.**

**Objective:** This study had two objectives: (1) to determine the associations between Sleep-Disordered Breathing (SDB) and neurobehavioral performance and school grades during middle- to late-childhood, an under-researched developmental period in the SDB literature, and (2) to clarify whether associations between SDB and school grades are mediated by deficits in primary neurobehavioral functions.

**Participants and Methods:** A total of 163 overweight subjects aged 10-16.9 years underwent inpatient overnight polysomnography and brief neuropsychological assessment. Questionnaires measured parent- and self-report of school grades and sleep, as well as parent- and teacher-report of daytime behaviors. The sample was divided into four groups based upon their obstructive apnea + hypopnea index (AHI) during polysomnography and parent report of snoring: Moderate-Severe Obstructive Sleep Apnea (OSA; AHI>5, n=42), Mild OSA (AHI=1-5, n=58), Snorers (AHI<1 + snoring, n=26), and No SDB (AHI<1 and nonsnoring, n=37).

**Results:** Multivariate analyses showed that the four groups significantly differed in academic grades and parent- and teacher-reported behaviors, particularly inattention and learning problems. These findings remained significant after covarying for subject sex, race, socioeconomic status, and school night sleep duration. These associations were confined to reports of difficulties in real-world situations, and did not extend to office-based neuropsychological tests. Findings from secondary analyses were consistent with, but could not definitively confirm, a causal model in which SDB affects school grades via its impact on day-to-day neurobehavioral functioning.

**Conclusions:** SDB during middle- to late-childhood is related to important aspects of neurobehavioral functioning, especially inattention and poor study skills, that may result in significant functional impairment at school. Correspondence: Dean W. Beebe, Ph.D., Psychology (MLC 3015), Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229, United States. E-mail: dean.beebe@cchmc.org

**K.V. CÁRDENAS, L. FERNANDO, D. ZARABOZO & E. MATUTE. Characteristics of Eye Movements in Reading Words and Nonwords with and without Stress Mark.**

**Objective:** Our aim is to know the role of the stress mark in reading Spanish using an eye-tracking paradigm. In Spanish, this diacritic is used to signal the stressed syllable of words with a non-dominant stress pattern.

**Participants and Methods:** The subjects were ten right-handed 16 years old Spanish native speakers. Two tasks were designed: (1) A list of 200 high-frequency words was read, 80 of which followed the dominant stress pattern (DSP) whilst the other 120 did not (NDSP). Half of the words in each sublist were incorrectly written, i.e. having or lacking the appropriate stress mark. (2) A list of 100 nonwords was read, of which 40 followed the DSP and 60 did not.

**Results:** The dependent variables were number of fixations and total time of fixation. A factorial ANOVA 2 (DSP, NDSP) x 2 (with and without stress mark) was performed on the results of Task 1. Although neither the stress pattern nor the stress mark had an effect on the eye movement variables, an interaction between these two variables was detected. That is, a significantly higher number of fixations was found only if NDSP words had an inappropriate stress mark. A Student t test was applied to Task 2 results. NDSP nonwords were read with a higher number of fixations and a longer total time of fixation.

**Conclusions:** Thus, the observed interaction between stress mark and stress pattern confirms the usefulness of the stress mark when reading words in Spanish; and stress pattern by itself seems to have an effect only when reading nonwords (and by inference low-frequency words).

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**M. CAMPBELL, J. KOLLER, S. BANDAK & K.J. BLACK. Cognition in Parkinson disease: Effects of levodopa and an adenosine A2a antagonist.**

**Objective:** Adenosine 2a (A2a) receptors co-localize with dopamine (D2) receptors in the striatum and thalamus. Animal studies demonstrate that A2a antagonists generally increase dopaminergic function, enhancing motor and cognitive functioning. The present study examined the effects of an A2a antagonist with levodopa on cognition in Parkinson's disease (PD) patients.

**Participants and Methods:** PD patients participated in this double-blind, crossover study with random allocation to 1 week of SYN115, 1 week washout, then 1 week placebo or the reverse order. Active drug was 60mg (N = 14) or 20mg (N = 12) of SYN115 administered BID. At the end of each treatment week, participants completed motor assessments, Continuous Performance Test (CPT), Go/No-Go (GNG) Test, and 2-Back Test after overnight withdrawal of levodopa and after levodopa infusion.

**Results:** SYN115 + levodopa resulted in faster GNG reaction times (60mg;  $p < .01$ ; 20mg;  $p = .05$ ), without reducing accuracy ( $ps > .25$ ). There were no significant effects of either dose of SYN115 + levodopa on the 2-Back or CPT tests (all  $ps > .05$ ). Participants reported less sleepiness with SYN115 60mg, before and after levodopa ( $ps < .05$ ), compared to placebo, but no significant difference with SYN115 20mg ( $ps > .05$ ). There was a significant motor benefit of SYN115 60mg, before and after levodopa ( $ps \leq .05$ ), on tapping speed and a significant SYN115 60mg + levodopa effect on the rapidly alternating hand movements item from the UPDRS ( $p = .03$ ).

**Conclusions:** These results suggest that there may be a dose response curve for the beneficial interaction between A2a antagonists and levodopa on cognition in PD.

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**N. CARLOZZI, D. TULSKY, R. KURKOWSKI, K. BROWNE, K. WORTMAN & R. GERSHON. The NIH Toolbox Project: The Development of a Measure of Working Memory.**

**Objective:** A new working memory measure for the NIH Toolbox for Neurological and Behavioral functioning, was developed for use across the lifespan. The Toolbox team created a List Sorting Task based upon

an adaptation of Dan Mungas' Spanish and English Neuropsychological Assessment Scales. The task includes size order sequencing of fruits and animals. The test includes a one-list task which requires food or animals to be sequenced and a two-list task which requires presentation of a mixture of food and animals with separate sequencing.

**Participants and Methods:** Study 1 examined 10 3-year-olds (children) and 11 high-functioning 21-30-year-olds (adults) for task feasibility. Study 2 examined participants ages 3 to 4 (n= 32), 5 to 7 (n= 26), 8 to 14 (n= 27), 23 to 35 (n= 31), and 65 to 85 (n= 30); in adults, the WAIS-IV Letter Number Sequencing subtest was also administered to evaluate task validity.

**Results:** Study 1 data provided estimations of item difficulty and demonstrated that longer lists are increasingly harder to remember than short spans, data that parallels traditional span tests such as Digit Span and Letter Number Sequencing tasks from the Wechsler Tests. There was an adequate range of scores for the List Sorting one-list of 2-24 (maximum 27) and 2-25 (maximum 30) for the 2 two list. Test-retest reliability was good (.94). Pearson correlations with Letter Number Sequencing ranged from .63 to .84 for ages 23-35 and 65-85, respectively.

**Conclusions:** Taken together, results indicated that most children were able to understand the basic concepts of both tasks and that the task was sufficiently difficult for adults. Test-retest reliability and concurrent validity were both good. The final task version takes less than 10 minutes to administer.

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**P. BAUER, S. DIKMEN, R. HEATON, D. MUNGAS, J. DEOCAMPO, J. SLOTKIN & R. GERSHON. The NIH Toolbox: The Development of a Measure of Episodic Memory/Learning.**

**Objective:** Develop a measure of memory and learning for the NIH Toolbox that is applicable across the age span of 3 to 85, easy to use, and in the public domain. Based on extensive review of the literature the Imitation Based Assessment of Memory (IBAM), an experimental procedure used in studying episodic memory in infants and young children, was chosen for development. The NIH Toolbox seeks to assemble brief, comprehensive assessment tools that will be useful in particular in measuring outcomes in epidemiologic studies and clinical trials across the lifespan.

**Participants and Methods:** The IBAM involves computerized presentation of a sequence of pictures in a fixed order, and the subject is asked to reproduce the order over three learning trials. The score is the number of adjacent pairs correctly reproduced. Number of pictures in the sequence reflects the difficulty level of the task, and varies by age. Several waves of pre-testing involving 270 subjects have been performed to derive number of steps necessary for different age bands, number of learning trials necessary, test-retest reliability, and relationship to "gold standard" measures of episodic memory.

**Results:** Preliminary data are encouraging in indicating that the IBAM is usable across the target age span, is reliable, and relates well to gold standards in the field.

**Conclusions:** Based on pilot and pre-testing performed to date, IBAM appears to be a promising measure of episodic memory. Validation will be performed on additional 600 subjects, and the results will be available for presentation at INS meeting.

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**D. TULSKY, N. CARLOZZI, R. KURKOWSKI, K. BROWNE, K. WORTMAN & R. GERSHON. The NIH Toolbox Project: The Development of a Measure of Processing Speed.**

**Objective:** In order to design a measure of processing speed for use across the lifespan (ages 3-85) an extensive review of both clinical and experimental literature was conducted. Possible candidate measures were

identified on the basis of ease of administration and potential use across the lifespan. The Toolbox team and NIH chose to adapt a Pattern Comparison Task (identify whether a stimulus/pattern is either the same, "yes" or "no" from another stimulus/pattern) as their processing speed measure.

**Participants and Methods:** Study 1 examined 10 3-year-olds (children) and 11 high-functioning 21-30-year-olds (adults) for task feasibility. Study 2 examined participants ages 3 to 4 (n= 32), 5 to 7 (n= 26), 8 to 14 (n= 27), 23 to 35 (n= 31), and 65 to 85 (n= 30). The adult sample also completed criterion variables including the WAIS-IV Processing Speed Index and a Pattern Comparison task used in cognitive/experimental tests designed by Tim Salthouse.

**Results:** Study 1 revealed age differences in performance with children achieving an average score of 44.4 (SD = 12.3) and adults achieving an average score of 110.8 (SD = 18.9). Study 2 revealed similar trend with average scores ranging from 20.19 (SD = 9.77) for ages 3-4 to 58.29 (SD = 15.20) for ages 23-34. Test-retest reliability yielded high coefficients (r = .79) across the sample. Pearson correlations between the Pattern Comparison test and the WAIS-IV Processing Speed Index was .51 for the adult sample with correlations between the Toolbox Pattern Comparison and the Salthouse version of .67.

**Conclusions:** Together, results indicate that the NIH Toolbox Pattern Comparison test is a valid measure of Processing Speed that takes 90 seconds to administer.

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**L. EL-MESSIDI. Etiology and Lesion Level in Early Hydrocephalus: Effects on Cognitive Functioning.**

**Objective:** Along with secondary neural insults of hydrocephalus, the physical phenotype of children with spina bifida (i.e. location of the lesions) is associated with cognitive performance. We examine variations in cognitive outcomes in relation to etiology (aqueductal stenosis, Spina Bifida Menigomyelocele) and lesion level.

**Participants and Methods:** The 248 school-age children with shunted hydrocephalus were grouped as follows: spina bifida menigomyelocele (SBMM) with lower level lesions (<=L1, n=187), SBMM with upper level lesions (>=T12, n=62), aqueductal stenosis (AS) with no lesion (n=29), along with normal controls (n=61). Each child was given a battery of neuropsychological and achievement tasks assessing verbal and nonverbal IQ, word identification, passage comprehension, calculation, visuomotor skills, concept formation and verbal skills.

**Results:** A linear composite was computed across all tasks. Children with SBMM and upper level lesions consistently performed lower than other children on all tasks (M=65.71). The Children with SBMM and lower level lesions performed higher than their SBMM counterpart, but lower than children with AS or normal controls (M=69.87). Both SBMM groups performed particularly low on spatial and memory tasks. The children with AS and no spinal lesion performed higher than the SBMM groups (M=89.92), but still lower than normal controls (M=98.38).

**Conclusions:** Children with upper and lower level spinal lesions differ primarily in the level of performance, with parallel profiles. Children with AS perform at higher levels, with less discrepant performance in spatial and motor domains. Etiology and lesion level are critical factors in differentiating outcome in congenital hydrocephalus.

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**V. FERNANDEZ, B. KNOWLTON, R. POLDRACK, S. BOOKHEIMER, R. BILDER, J. COHEN & R. ASARNOW. The Development of Automaticity.**

**Objective:** Research has suggested that habit learning relies on corticostriatal circuitry (Foerde, Knowlton & Poldrack, 2006), and that different forms of habit learning rely on separate, specific corticostriatal

circuits (Grafton, Hazeltine, & Ivy, 1995; Porltrack, Prabhakaran, Seger, & Gabrieli, 1999; Marsh, Alexander, Packard, Zhu & Peterson, 2005). How these systems develop in children is not clear. This study aims to explore the normal development of these neural circuits in children and adolescents from a behavioral point of view.

**Participants and Methods:** We examined the two circuits in 101 normal control children and adolescents by examining their performance on two procedural learning tasks. A motor skill circuit that originates in the supplementary motor cortex and includes the supplementary motor area, putamen, globus pallidus, and thalamus was studied using the Serial Reaction Time task (SRT). A cognitive skill circuit involving the caudate nucleus/dorsolateral prefrontal cortex and ventral striatum/orbitofrontal cortex was studied using the Probabilistic Classification Task (PCT).

**Results:** Both accuracy and reaction time across trials were examined with repeated measures ANOVAs. We compared the performance of children ages 8-11 to that of adolescents ages 12-15 and 16-19. While the children tended to have a slower reaction time on the SRT, they benefited as much as the older adolescents from the sequenced trials and showed a similar cost during the presence of a dual (interference) task. The PCT on the other hand, showed that the adolescents learned faster and achieved higher levels of accuracy than the children, while all groups showed little cost at the dual task, implying that they all automated the task well.

**Conclusions:** This research supports the idea that separate corticostriatal circuits exist for different types of procedural learning and develop independently of one another, while providing a context for their development.

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**A.C. GRAEFE, K.M. FOLEY, B.P. MARX, S.P. PROCTOR & J.J. VASTERLING. The Relationship Between Warzone Deployment Stress and Post-deployment Neuropsychological Outcomes in Active Duty Army Personnel.**

**Objective:** Prior research has found that war-zone deployment is associated with alterations in neuropsychological functioning (Vasterling et al., 2006). It is unclear which aspects of deployment may account for these alterations, but it has been hypothesized that stress exposure may play a role. In the present study, we sought to examine associations between stress exposure and neuropsychological performance by performing a secondary analysis of the data collected for the Neurocognition Deployment Health Study.

**Participants and Methods:** Active duty Army personnel (N=654) were assessed at military installations before and after deployment. Performance-based neuropsychological tasks examining reaction time, sustained attention, visual-spatial, and verbal memory, as well as measures of PTSD symptom and depression symptom severity and deployment-related stress were administered as part of a larger test battery.

**Results:** After controlling for pre-deployment neuropsychological test performance, age, gender, education, head injury, test-retest interval, and PTSD and depression symptom severity, results revealed that perceived threat was negatively associated with residualized post-deployment visual memory retention proficiency ( $p = .004$ ). Post-deployment life stress was negatively associated with both residualized post-deployment sustained attention proficiency and reaction time efficiency ( $ps = .002$  and  $.000$ , respectively). Finally, although combat exposure severity was negatively associated with residualized post-deployment immediate verbal memory proficiency, post-battle experience severity was positively associated with immediate verbal memory proficiency ( $ps = .011$  and  $.001$ , respectively).

**Conclusions:** Findings suggest that specific stressful aspects of war-zone deployment may adversely affect neuropsychological functioning. Correspondence: *Anna C. Graefe, B.A., VA Boston Healthcare System, 150 S. Huntington Ave., Jamaica Plain, MA MA, United States. E-mail: anna.graefe@gmail.com*

**M. HENRY, M. DÉRY, L. ÉTHIER & P. NOLIN. Problem-Solving in Maltreated Children.**

**Objective:** Traditionally all about executive functions and memory, neuropsychology has gradually opened its expertise to new cognitive domains; emotional intelligence for example. In addition, child maltreatment show growing interest mainly because of the important cognitive deficits that are observed in these children. The purpose of this paper was therefore to study social problem-solving in maltreated children from six to seven years of age, with the Test Of Problem-Solving (TOPS-3).

**Participants and Methods:** The study group was composed of 15 boys and 9 girls all receiving child protective care services. Children were from 6 to 7 years of age (Mean: 7.1 years, SD: 0.51). Four sub-scales (Making Inference, Predicting, Determining and Problem-Solving) of the TOPS-3 were used to determine social problem-solving abilities.

**Results:** Outcomes on every one of the four sub-scales were compared using age equivalency. Five categories were then identified to better understand children's results (where equivalent age was subtracted from chronological age): over 12 months below average; between 6 and 11 months below average; from 5 months below average to 5 months over average (considered mean); between 6 and 11 months over average; more than 12 months over average. Overall, the majority of the sample scored below expected range on all sub-scales. Hence: Making Inference: 79.17%; Problem-Solving: 62.5%; Predicting: 54.17%; Determining Causes: 70.83%.

**Conclusions:** These results indicate a lower social problem-solving ability in early school-aged maltreated children. Results are explained by the negative impacts of these stressful environments on the development of socioemotional abilities. This paper supports the importance for neuropsychology to better include social measures in standard evaluations.

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**R. JAYAKAR & W.L. THORNTON. Self-Efficacy and Everyday Problem Solving Performance.**

**Objective:** The association between cognitive performance and cognitive self-efficacy remains poorly understood. Past research on self-efficacy has mainly employed traditional measures of cognitive performance such as executive functioning, declarative memory, and working memory. The purpose of this study was to assess the association between self-efficacy and everyday problem solving (EPS) by attempting to manipulate task-specific self-efficacy.

**Participants and Methods:** Participants (N = 42, age range: 17-25) responded to measures of mood, general self-efficacy, EPS self-efficacy, and EPS performance. Participants were assigned randomly to either the control or the experimental group. For those in the experimental group, self-efficacy was manipulated using false negative feedback. The dependent variables consisted of EPS self-efficacy ratings and EPS test scores. The independent variables were group (control/experimental) and time (pre-test/post-test).

**Results:** A repeated-measures ANOVA indicated that participants' EPS self-efficacy was significantly lowered after false feedback ( $p = .01$ , partial  $\eta^2 = .17$ ). However, this manipulation did not significantly impact EPS performance ( $p = .45$ , partial  $\eta^2 = .01$ ). Also, there was no significant correlation between EPS self-efficacy and EPS performance ( $p > .05$ ).

**Conclusions:** The study demonstrates the malleability of EPS self-efficacy, but calls into question its salience as a predictor of EPS performance. Over reliance on cross-sectional, correlational designs in extant research may have hidden the complexity of the relation between self-efficacy and cognitive performance, because such designs do not allow evaluation of performance from the perspective of within-person change. As self-efficacy seemed to exert no effect on subsequent performance in the current study, it is important to continue research exploring within-person changes in cognitive self-efficacy and cognitive performance.

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**A. JEFFREYS, J. ANDERSON, P. HWANG, P. LEWIS & M. DALLY. THE COGNITIVE AND HAEMODYNAMIC OUTCOME OF PATIENTS WITH LARGE AND ELOQUENTLY LOCATED AVMS UNDERGOING HYPOFRACTIONATED STEREOTACTIC RADIOTHERAPY.**

**Objective:** The aim of this study was to investigate the effect of hypofractionated stereotactic radiotherapy (FSRT) on the cognition of patients with large and eloquently located arteriovenous malformations (AVMs). A secondary aim was to examine cerebral steal in these patients using Transcranial Doppler Ultrasound (TCD).

**Participants and Methods:** The sample comprised 13 participants (mean age = 43 years, SD =13) with large and eloquently located AVMS. A prospective repeated measures study design was employed, with three levels of time. Participants were required to undergo 2 hour neuropsychological assessments over three time points (pre treatment, 6-weeks and 6-months post treatment), that tapped the cognitive domains of attention, processing speed, visuospatial function, naming, memory (learning and delayed recall), semantics and executive function. In addition, TCDs were conducted at all three time points in order to measure artery velocities over time as a marker of cerebral steal.

**Results:** Findings revealed that pre-treatment, participants were impaired on 3 of the 8 cognitive domains. Outcome data showed that 6-weeks post-treatment, performances remained stable on the majority of cognitive domains. Decrements in performance, however, were found specifically for learning and semantics. Follow-up assessment at 6-months post-treatment revealed restitution of these functions, and no significantly different scores were obtained in comparison to the two previous assessments.

**Conclusions:** These results are encouraging in light of no harmful effects being seen at these time points. No support for the steal hypothesis was found, although significantly reduced patient numbers were used in these analyses, which is likely to have impacted upon results.

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**M.R. KANDALAFT, N. DIDEHBANI, T. TOON, M. MCCLELLAND, D. KRAWCZYK, M. CULLUM & S. CHAPMAN. Theory of Mind in Asperger's Syndrome and Schizophrenia.**

**Objective:** Theory of Mind (ToM), one aspect of social cognition, is commonly impaired in Asperger's (ASP) Syndrome and Schizophrenia (SCZ), although few studies have compared these groups across a variety of ToM measures.

**Participants and Methods:** Subjects included 14 ASP, 11 SCZ and 9 normal controls (NC) who completed a battery of measures that included an estimate of global intelligence (WASI), the MSCEIT, Reading the Mind in the Eyes (Eyes), animated ToM videos (ToMv), and the Empathy Quotient (EQ). Group differences were analyzed using ANOVA with alpha set at  $p = .01$ .

Results:	Asperger's	Schizophrenia	Controls
MSCEIT	48.5 (10.0)	46.3 (13.1)	56.3 (10.6)
ToMv	21.5 (4.4)	20.1 (3.4)	25.2 (1.6)
Eyes	21.0 (4.7)	25.8 (2.6)	28.3 (2.7)
EQ	29.2 (8.7)	41.7 (15.0)	54.3 (10.2)

The groups did not differ in mean education or estimated FSIQ. Age was higher in the SCZs [29 vs. 22 ASP and 23 NC,  $F(2,31) = 7.17, p < .01$ ], but was uncorrelated with the social cognition measures.

The Eyes task revealed significant differences  $F(2,27) = 10.93, p < .0001$ , between ASP and NC. ToMv was slightly higher in controls than SCZ,  $F(2,26) = 5.04, p = .014$ , and EQ was much lower among ASP  $F(2,25) = 14.76, p < .0001$ . The MSCEIT did not differ across groups,  $F(2,29) = 2.12, p = .14$ .

**Conclusions:** Results indicate that ASP and SCZ subjects with equivalent FSIQ's achieved lower ToM scores than NC, suggesting social cognitive impairment. However, SCZs performed lower on ToMv, while ASP performed lower on Eyes and EQ. Future research should elucidate the social cognitive profiles of these populations.

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**J. KATZENSTEIN, J. OGHALAI, J. HAYMOND, R. TONINI, D. BAKER & S. CAUDLE. Neurodevelopmental Skills Continue to Lag Behind in Pre-Term Children Following Cochlear Implantation.**

**Objective:** Children born prematurely are at significant risk for attention and learning difficulties. Compounding these difficulties are children who are born deaf and requiring cochlear implantation (CI). This study examined the cognitive development of pre-term children following CI compared to full-term children also requiring CI.

**Participants and Methods:** Twenty-six children were administered the Mullen Scales of Early Learning (MSEL) prior to and following CI. Of the children, 17 were born full-term (>37 weeks) and 9 were born pre-term (<37 weeks). All children were diagnosed with sensorineural hearing loss, with the majority of unknown etiology. Children were 8 – 45 months of age at pre-evaluation ( $M = 19.34, SD = 10.15$ ) and were re-evaluated approximately 20-months later.

**Results:** Across domains, full-term children performed better on the MSEL than the pre-term children both prior to and following CI. Prior to implantation, full-term children exhibited better expressive language skills [ $t(24) = 2.06, p < 0.05$ ] and there was a trend for better performance in receptive language skills [ $t(24) = 1.71, p < 0.10$ ] and fine motor skills [ $t(24) = 1.72, p < 0.10$ ]. This pattern of results continued post-CI.

**Conclusions:** These findings suggest deaf pre-term children continue to exhibit difficulties with acquisition of developmental skills following CI, compared to deaf children born full-term. Thus, full-term and pre-term children continued to gain developmental skills following implantation; however pre-term children did not catch up to their full-term peers after approximately 20-months. Additional follow-up is needed to determine if additional catch-up occurs in children born pre-term.

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**K.A. KERNS, H. CARMICHAEL-OLSON, M. VANADEL & R.J. MCINERNEY. An Examination of Multitasking in Children with FASD: The Impact of Increasing Task Demands.**

**Objective:** Since the identification of individuals with the circumscribed deficits known as "strategy application disorder" due to frontal lobe damage there has been increased interest in researching the ability to organize multiple future actions or 'multi-task'.

**Participants and Methods:** Children with FASD and age-matched controls (ages 7-14) completed the Children's Multiple Activities Game (CMAG) (McInerney & Kerns, 2009), a computerized task in which points are maximized over a fixed time period by performing four different but simple tasks: (1) visual monitoring; (2) auditory monitoring; (3) counting; and (4) visual search. Children practiced each activity separately followed by the 'multi-tasking' activity which began with the visual search game alone; an additional task was added after each minute of play, with all tasks running simultaneously for the final two minutes.

**Results:** The multi-task, visual monitoring, was assessed over 5 minutes of play. Groups did not differ on the task when played in isolation, but over the entire game children with FASD performed more poorly. While adding additional tasks significantly impacted performance on this task for all participants, children with FASD showed much greater losses on the first task as each additional task was added. The overall reduction in performance in children with FASD was 57% compared to 21% in controls ( $t=3.32, p<.01$ ).

**Conclusions:** Children with FASD were differentially impacted by increased task demands, even when tasks are simple and can be performed adequately in isolation. Results support the view that increasing task complexity and cognitive demands has a significantly greater impact on children with FASD than on typically developing children.

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**E. KOZORA, J. PELZMAN & L. ZHANG. Comparing Rey-Osterrieth Scoring Systems in nonNPSLE Patients and Controls.**

**Objective:** To compare three different scoring systems for the Rey-Osterrieth Complex Figure (Rey-O) in SLE patients without overt neuropsychiatric symptoms (nonNPSLE) to controls.

**Participants and Methods:** Subjects included 30 nonNPSLE patients (7% male, 73% Caucasian, mean age = 36, mean education = 14 years, mean length of SLE diagnosis = 77 months, and mean SLE disease activity index = 6) and 15 control subjects similar in age, education, gender and ethnicity. Subjects were administered the copy, immediate and delayed recall of the Rey-O as part of a larger study on cognition in SLE and scored using three systems: Meyers and Meyers (1995); Taylor (1991) and BQSS (Stern et al, 1994).

**Results:** No differences on total copy, immediate recall, delayed recall or percent delayed retention were found in any scoring system across groups. Component scores were significantly correlated across systems. Using normative data on delayed recall, 43.3% of the nonNPSLE patients and 66.6% of the controls were impaired on the Meyers system, 16.7% of nonNPSLE and no controls were impaired on the Taylor system, and 10% nonNPSLE and no controls were impaired on BQSS. NonNPSLE patients had lower copy planning ( $p=0.04$ ) and high delayed figure reduction ( $p=0.04$ ).

**Conclusions:** NonNPSLE patients were not impaired compared to controls on copy or delayed scores using different scoring systems. NonNPSLE patients had worse organizational skills despite similar copy/recall scores. Impairment levels differed dramatically depending on the scoring system. Demographic differences in normative sample likely account for differences across methods and may have implications for study design.

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**S. TARTAR, M. MACE, R. MARTINO & D. LOVEJOY. A Survey of Regional Referring Providers' Use of and Perceived Utility of Neuropsychological Services.**

**Objective:** Clinicians from a range of specialties (medicine, nursing, psychology, social work, etc.) refer patients for neuropsychological evaluation, but little is known about aspects of neuropsychological evaluation that providers do and do not find useful.

**Participants and Methods:** A range of regional clinicians were surveyed regarding their use of and satisfaction with neuropsychological evaluations and recommendations; contributions of evaluations to direct patient care; and their perception of resulting improvements in patient quality of life.

**Results:** Preliminary findings (1% response rate after 2 months, 71 completed surveys) suggest that clinicians generally found neuropsychological evaluations to be useful in the treatment of their patients. Physicians remain the primary referral source for neuropsychological evaluations (53.6%), with nursing specialists as the second most common referring provider (40.5%). Consistent with previous research, respondents referred patients most often for diagnostic purposes and treatment recommendations. Lack of familiarity with neuropsychology the primary obstacle to referral cited by non-M.D. clinicians. Medical doctors indicated that, while they were familiar with the service, other factors (e.g. specialty, such as primary care or obstetrics) reduced referrals.

**Conclusions:** Most clinicians rated the implementation of treatment recommendations was only somewhat useful in improving patient recovery, suggesting that this may be an area of focus for neuropsychologists interested in maximizing evaluation usefulness. Initial low response rate represents a current weakness, with data continuing to be collected. However, current results confirm initial hypotheses, with needed focus on the referral process, clinical access to neuropsychological services, clinician education regarding contributions of neuropsychology to patient care, and recommendation utility.

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**C.A. MAHONEY, M.A. ROCQUE & A. PODRAZA. A Neuropsychological Comparison Study of Differing Types of Maltreatment on School-Age Children.**

**Objective:** Few studies have examined whether neuropsychological differences exist between children with diverse trauma histories. The literature is mixed regarding the relationship between different forms of maltreatment and cognitive functioning of children. The objective of this study was to determine whether children who suffered abuse and neglect (AN) exhibited a different neuropsychological profile from children with neglect only (NO).

**Participants and Methods:** Data on neuropsychological assessments of 73 children (42 AN, 31 NO) were collected. The children ranged from 7-12 years of age, were victims of maltreatment, and living in foster or adoptive care. Exclusion criteria included: FSIQ below 70, and known neurological disorder. The test battery included measures of neurocognitive ability, academics, and behavior.

**Results:** Bivariate and multivariate analyses indicated that the two groups did not differ statistically on neuropsychological measures, with few exceptions. Mean IQ scores were low for both groups ( $-0.67$  SD). The only significant differences were found on behavioral measures, with the AN group scoring higher on measures of aggressive behavior ( $p=.043$ ) and thought problems ( $p=.01$ ).

**Conclusions:** These results support a growing body of literature that suggests different trauma categories are not associated with differing cognitive abilities. The behavioral data suggested that children with abuse histories were more prone to be physically aggressive and exhibit thought problems. These data appear to support literature suggesting higher rates of aggressive behavior and possible linkage to development of psychiatric disorders in individuals with abuse histories. Clinical implications exist for targeted early intervention techniques for prevention of further deterioration later in life for victims of abuse.

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**C. MYERSON, H. KATZEN, R. LEWY, F. NAHAB & B. LEVIN. Redefining the Link Between Apathy and Cognition in Parkinson's Disease.**

**Objective:** Apathy is a common neuropsychiatric symptom in Parkinson's disease (PD) and has been linked to cognitive dysfunction. Cognitive, emotional, and behavioral subtypes of apathy have been proposed, but the impact of each subtype on cognition is not known. This study explored the contribution of each apathy subtype to cognitive decline and specific neuropsychological impairments in PD.

**Participants and Methods:** Seventy-three patients with idiopathic PD underwent detailed neuropsychological evaluation including completion of the Apathy Evaluation Scale (AES). The AES was divided into cognitive, emotional, and behavioral sub-scales based on Marin et al., (1991). Standardized z-scores were calculated for tests of executive function, language, memory, and visuospatial skills. A global cognitive score was calculated by averaging the z-scores across all tests administered. Correlation and regression analyses were employed to further define the relationship between apathy and neuropsychological function.

**Results:** Overall, higher levels of apathy were associated with greater cognitive dysfunction ( $p = .022$ ). When specific subtypes of apathy were examined, only cognitive apathy predicted neuropsychological test performance ( $p = .012$ ). That is, patients scoring high on cognitive apathy demonstrated greater neuropsychological impairments. In contrast, neither behavioral nor emotional apathy predicted cognitive performance. Correlational analyses indicated that cognitive apathy was associated with executive dysfunction ( $p = .004$ ) but not other cognitive domains.

**Conclusions:** These results suggest that the link between neuropsychological dysfunction and apathy is driven by mental disengagement (cognitive apathy) as opposed to flattening of affect and behavioral withdrawal. This study also lends support to prior research showing that apathy is linked to frontal executive impairments.

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**D.G. NEMETH, T.W. OLIVIER, L.T. WHITTINGTON & N.E. MAY. Integrating the Practices of Outpatient Clinical Neuropsychology and Medical Psychology.**

**Objective:** As more clinical neuropsychologists are actively designing and implementing intervention strategies for attentional, learning disabled, and brain damaged individuals, the issue of integrating psychopharmacological management into the overall intervention program must be addressed. In the State of Louisiana, clinical medical neuropsychologists now have prescriptive authority.

With the concurrence of the individual's primary care/attending physician, clinical medical neuropsychologists can prescribe and titrate appropriate medications as a part of the individual's overall treatment plan.

**Participants and Methods:** Several examples of individual neuropsychological rehabilitation programs, wherein medication management/titration plays an integral part, will be outlined. Medication choices and titration schedules will be addressed.

**Results:** The integration of neuropsychological rehabilitation and psychopharmacological intervention is clearly a more comprehensive form of overall case management when it is performed by the clinical medical neuropsychologist. This results in a more efficient and cost-effective intervention system.

**Conclusions:** As more clinical neuropsychologists complete post-doctoral programs in medical psychology, they will experience far more flexibility in case management. Being able to choose, titrate, and/or regulate medication in response to an individual's observable difficulties and/or progress during a treatment session is an exciting new vista. This will hopefully encourage more clinical neuropsychologists to move beyond the "evaluating professional" role in order to serve in the more comprehensive "treating professional" role.

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**A. NORDLUND, M. GOTHLIN & W. ANDERS. The Effects of Vascular Disease and Alzheimer-typical Biomarkers in MCI: Additive or Synergetic?**

**Objective:** To study the cognitive profiles of three groups diagnosed with Mild Cognitive Impairment (MCI), one with vascular disease (MCI-vas), one with Alzheimer-typical (AD) biomarkers (MCI-bio) and one with both vascular disease and AD biomarkers (MCI-vasbio).

**Participants and Methods:** One hundred and eighty-two consecutive subjects (MCI-vas=52, MCI-bio=34, MCI-vasbio=46) diagnosed with MCI between 2001 and 2007 were examined with a neuropsychological test battery comprising the cognitive domains speed/attention, memory, visuospatial function, language and executive function. Eighty-six MCI subjects with neither vascular disease or AD biomarkers (MCI-no) were added for comparison.

**Results:** The groups did not differ significantly in terms of education or MMSE score, while MCI-vasbio were slightly older. Corrected for

age, MCI-vas and MCI-bio performed quite similarly neuropsychologically, whereas MCI-vasbio performed poorer than the other groups. The only significant differences between MCI-vas and MCI-no were on memory tests, MCI-bio performing slightly worse. While MCI-vas and MCI-bio performed close to MCI-no on most tests, MCI-vasbio performed significantly worse on speed/attention, visuospatial, language and executive tests, with the most clear-cut differences on an executive test.

**Conclusions:** Considering the small differences between MCI-vas and MCI-bio, vascular disease alone does not seem to cause a specific cognitive profile, whereas AD typical biomarkers seem to be associated only with poorer memory performance. The combination, on the other hand, seems to be associated with marked impairment. Considering the markedly greater impairment in the MCI-vasbio group, we suggest that the effects of vascular disease and AD biomarkers are synergetic rather than additive.

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**A. OLSZEWSKI, S.A. WARSCHAUSKY & P. DIXON THOMAS. Social Integration in Children with Differing Onset and Type of Disability.**

**Objective:** This study examined differences in social integration of children with congenital neurodevelopmental conditions (ND), traumatic brain injury (TBI), and physical impairment (PI).

**Participants and Methods:** Fifty-one children with cerebral palsy or spina bifida, 14 children with TBI, 18 with a physical impairment, and 60 typically developing (TD) children, ages 6-12 participated in the study. Friendship characteristics and friendship quality were examined with measures of social networks (e.g., number of and ages of friends), social behaviors, and friendship attributes. Instruments were administered to parents and children, including the Social Network Inventory for Children- Child Version, Friendship Quality Questionnaire-Revised, and Personality Inventory for Children, Second Edition.

**Results:** MANOVA for friendship characteristics revealed a significant main effect for Group; Wilks' Lambda = 0.74,  $F(18, 379.495) = 2.37$ ,  $p = .001$ . Post hoc analyses showed children in the ND group had fewer playmates overall than did children in the TD group,  $F(3, 142) = 5.47$ ,  $p = .001$ . The TD group had a greater number of non-related friends than the ND group,  $F(3, 142) = 6.18$ ,  $p = .001$ . Children in the TD group reported more contact with their friends as compared to children in the ND group,  $F(3, 142) = 3.24$ ,  $p = .024$ . With regard to friendship quality, the main effect for Group was not significant.

**Conclusions:** Among children with different types of disabilities, there are significant differences in friendship characteristics, but not in some aspects of friendship quality. Findings support the need for continued emphasis on programs that support the social development of children with disabilities.

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**V. PARRA, C. GARVAN, C. JACOBSON, R. RODRIGUEZ, H. FERNANDEZ, A. FOGEL, B. SKOBLAR, D. BOWERS, M. OKUN & B. KLUGER. The Prevalence and Clinical Significance of Fatigue following Deep Brain Surgery in Parkinson's Disease.**

**Objective:** To determine the prevalence of clinically significant fatigue following Deep Brain Stimulation (DBS) surgery in Parkinson's disease (PD), and its impact on Health Related Quality of Life (HR-QOL).

**Participants and Methods:** We recruited 45 subjects, who had undergone DBS surgery. At least one year following DBS placement, they were administered the Fatigue Severity Scale (FSS), the Parkinson's Disease Questionnaire of HR-QOL (PDQ), the Marin Apathy Index, the Beck Depression Inventory, the Beck Anxiety Inventory, the UPDRS and standard neuropsychological tests of cognition.

**Results:** 58% of subjects reported moderate to severe fatigue based on the FSS. FSS scores were significantly associated with a composite rating of HR-QOL from the PDQ ( $r = 0.38$ ,  $p = 0.01$ ). Fatigue was also associated with depression ( $r = 0.47$ ,  $p = 0.01$ ) and anxiety ( $r = 0.49$ ,  $p < 0.01$ ) but not apathy, UPDRS, or any neuropsychological tests scores. Depression pre-operatively was the only predictive factors of fatigue ( $r = 0.48$ ,  $p = 0.03$ )

**Conclusions:** Fatigue is a common non-motor symptom following DBS surgery that significantly impacts HR-QOL. Our data suggest that fatigue may be related to other mood disturbances associated with PD and DBS surgery. Correspondence: *Veronica Parra, N/A, Neurology, University of Colorado Health Sciences, 8401 Harrison Way, Thornton, CO 80229, United States. E-mail: veronica.parra@email.cudenver.edu*

**J. PERRY AVERY, A. DEBASTOS, J. NEWMAN, S. MEACHEN, D. BATTON & S. RAZ. Preterm - Birth Preschoolers With Intrauterine Growth Restriction: a Comparison of Neuropsychological Outcome With Birthweight Controls.**

**Objective:** Outcome studies of preterm infants with intrauterine growth restriction (IUGR) typically use a preterm comparison group equated on gestational age. Our objective was to compare the neuropsychological outcome of preterm children with IUGR to a birthweight - matched comparison group with appropriate growth for gestational age (AGA).

**Participants and Methods:** Thirty preschoolers without cerebral palsy ( $60 \pm 8$  months corrected age) born  $< 36$  weeks with IUGR (birthweight stratified by gestational age  $< 10$ th percentile) were compared to 30 AGA preschoolers ( $58 \pm 10$  months), matched for birthweight (within 200g) and for sex. Average birthweights were  $1,274 \pm 367g$  for the IUGR group vs.  $1,277 \pm 345g$  for the controls, while average gestational ages were  $32 \pm 2.5$  weeks for the IUGR group vs.  $28.5 \pm 3.0$  weeks for the controls. Outcome measures were general intelligence (WPPSI-R), language (PLS-3), and motor (PDMS-II) skills.

**Results:** The multivariate analysis of neuropsychological measures, with SES, days ventilation, and number of perinatal complications as covariates, revealed that despite longer gestation and decreased time on the respirator ( $4.47 \pm 11.81$  days vs.  $14.63 \pm 23.58$  days for the IUGR and controls), the IUGR group obtained lower scores on the PDMS-II Fine Motor scale ( $F_s [1, 51] = 4.67$ ,  $p < .05$ ). No significant group differences were observed on other measures.

**Conclusions:** IUGR should be considered together with birthweight in evaluating the motor outcome of preterm children. The added risk of IUGR may outweigh the beneficial effects of several additional weeks of gestation on fine motor development.

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**S.J. PULLEN, T.M. BROWN, S. STEAD & C.A. WALL. Neuropsychiatric Outcomes Of Pediatric Deep Brain Stimulation.**

**Objective:** Deep brain stimulation (DBS) has been successfully used to treat a variety of adult neurologic and psychiatric conditions (e.g., Parkinson's Disease). However, the efficacy of DBS in adults has been tempered by documented psychiatric and cognitive complications, including suicide and verbal/language decline, necessitating careful pre- and post-surgical evaluations screening for these potential complications. In fact, risk for such negative sequelae can determine whether or not surgery proceeds. More recently, DBS has been used to treat a range of neurologic conditions, including movement disorders, in the pediatric population. Despite increasingly widespread use of DBS in children and adolescents, there is scant literature documenting the safety of DBS in this population, specifically pertaining to potential cognitive and psychiatric sequela.

**Participants and Methods:** Here we present the pre- and post-neuropsychological functioning of two adolescents (ages 13 and 17) who underwent DBS for movement disorders (dystonia and Tourette's syndrome, respectively) at the Mayo Clinic, Rochester. One patient was treated with bilateral internal globus pallidus (Gpi) stimulation, the other with bilateral central-median perifascicular nucleus implantation.

**Results:** Overall, no psychiatric or cognitive sequela that could be attributed to DBS were observed. Most importantly, despite having significant pre-morbid cognitive impairment or mood problems, patients did not exhibit worsened symptoms after surgery. In fact, both patients reported improvement in adaptive functioning and quality of life in the context of generally stable cognitive functioning noted on formal psychometric testing.

**Conclusions:** These findings provide preliminary outcome information for guiding future clinical and research endeavors with pediatric DBS patients.

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**C.A. RACINE, J. GRACE, C.E. KREUGER, D. CAHN-WEINER, J. ROTHLIND, G.A. GLASS, P.A. STARR & J.L. OSTREM. Effect of Subthalamic Nucleus (STN) Deep Brain Stimulation (DBS) on Cognition and Mood in Individuals with Primary Cranial and Cervical Dystonia.**

**Objective:** STN DBS, a well-established therapy in advanced Parkinson's disease (PD), has recently been shown to be a potentially effective therapy for individuals with primary dystonia as well. After STN DBS in PD, some studies have demonstrated negative cognitive and mood changes. One goal of this ongoing clinical trial was to investigate the effect of STN DBS on cognition and mood in patients with primary dystonia.

**Participants and Methods:** To date, nine individuals with severe medically refractory primary cranial and cervical dystonia have enrolled [mean age:  $47.33 \pm 13.97$ , range 23-72; 5M/4F]. Here we report baseline and 6 month post-operative neuropsychological testing from the first eight individuals. Age-adjusted z-scores were used in the statistical analyses.

**Results:** At baseline, patients performed below average ( $z < -1.0$ ) on tasks of information processing speed (Trails A & B), verbal learning and recall (HVLTR). Depressive symptoms ranged from minimal to severe. As a group, six months after intervention, there were no areas of significant cognitive or mood decline. Interestingly, there was a significant improvement in information processing speed (TrailsA  $p = .0075$ ; TrailsB  $p = .05$ ).

**Conclusions:** In this preliminary study, STN DBS in dystonia appears to have minimal negative impact on cognition and mood. Rather, there was notable improvement in processing speed. This raises the possibility the negative cognitive and mood side effects previously associated with STN-DBS in PD may be disease specific and not as relevant in the dystonia population. Larger studies with longer follow-up will be needed to confirm these findings.

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**V. RAMOS, D. BODIN, K. YEATES & A. GEST. Predictors of Cognitive Ability in Preterm Infants with Bronchopulmonary Dysplasia at Preschool Age.**

**Objective:** Children with bronchopulmonary dysplasia (BPD) and other neonatal complications related to preterm birth are at-risk for cognitive deficits and academic difficulties. Studies of neurodevelopmental outcome in this population have produced varied results, with rates of impairment ranging from 12-80%. BPD survivors are at risk for academic delays and receive more special education services than term-born children. The current study compares the validity of developmental assessment, gestational age, and neonatal complications as predictors of cognitive ability in preschool children diagnosed with BPD in infancy.

**Participants and Methods:** Participants included 26 children with BPD referred from the BPD Clinic at Nationwide Children's Hospital. They were administered the Bayley Scales of Infant Development (BSID-

II) at age 24 months and the Wechsler Preschool Primary Scale of Intelligence (WPPSI-3) at age 37 months. Multiple regression analysis was conducted with the WPPSI-III Full Scale IQ as the dependent variable. Independent variables included neonatal complications, gestational age, and the BSID-II-Cognitive Composite.

**Results:** Gestational age and the presence of neonatal complications contributed significantly to the prediction of the WPPSI-III Full Scale IQ when entered first in the analysis; however, neither remained significant after accounting for performance on the BSID-II, which accounted for unique variance when entered in the second step. Notably, gestational age and neonatal complications predicted performance on the BSID-II.

**Conclusions:** The results indicate that early developmental assessment is a better predictor of later cognitive ability than gestational-age and neonatal complications in preschool children diagnosed with BPD in infancy.

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#### S. RANE & J.M. FLETCHER. Adaptive Functioning in Children with Spina Bifida Myelomeningocele (SBMM).

**Objective:** SBMM is the most common type of Spina bifida, and accounts for about 80% of the cases with Spina bifida. Children with SBMM are shown to have variety of motor deficits, and weaknesses in reading comprehension, arithmetic, working memory and attention. One area of study that has not yet been well established is which factors contribute to adaptive behavior in this population. We addressed this question by using the Scales of Independent Behavior – Revised (SIB-R), and identified demographic, cognitive, environmental, medical and imaging predictors of different aspects of adaptive behavior as measured by the various domains of the SIB-R.

**Participants and Methods:** The study sample consisted of 298 children with SBMM and shunt-treated hydrocephalus and 111 developmentally normal controls. In addition to neuroimaging, the children completed cognitive tasks. Rating scales were completed by parents.

**Results:** In comparison with the normal controls, the SBMM sample showed a unique pattern of performance across the SIB-R subscales. The mean standard scores on motor, personal living and community living were in the impaired range as compared to the Language and Social Communication score, which was in the low average range. Hierarchical multiple regression indicated that the predictors varied across the different domains of the SIB-R.

**Conclusions:** Children with SBMM and shunt-treated hydrocephalus show a range of adaptive outcomes, but language/social communication seems to be relatively unimpaired. The predictors of adaptive behavior vary according to the domains. This understanding can help us develop specific interventions in improving independent functioning in SBMM.

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#### J. REESMAN, C. MCGILL & G.A. GIOIA. Serial Neuropsychological Assessment of Sturge-Weber Syndrome Post-Hemispherectomy: 3 Case Presentations.

**Objective:** Sturge-Weber syndrome (SWS) is a rare neurocutaneous disorder associated with seizures and varying degrees of abnormal cortical vascular development and/or calcification occurring in approximately 1 in 50,000 live births. Three cases highlight neuropsychological outcomes in SWS post-hemispherectomy as little has been published with this patient group.

**Participants and Methods:** Three children with SWS and hemispherectomy before 12 months of age (patient 1, male, left hemispherectomy; patient 2, male, right hemispherectomy; patient 3, female, right hemispherectomy) underwent two or more serial neuropsychological assessments between ages 4-11. Assessments examined general intellectual, language, visual-spatial, memory, attention, executive control, fine motor, and social-emotional functioning.

**Results:** Verbal intellectual functioning was a strength for all while visual/nonverbal functioning was below average for patients 2 and 3 (patient 1 VIQ SS=90-96, PIQ SS=89-91; patient 2 VIQ SS= 88-96, PIQ SS=57-76; patient 3 VIQ SS=102, PIQ SS=71). Noteworthy weaknesses were commonly evident in attentional and executive functioning (e.g., patient 1 BRIEF Working Memory, Tower of London; patient 2 BRIEF Working Memory, Tower of London; patient 3 TEA-Ch Sky Search, Creature Counting) as well as bilateral weaknesses in fine motor functioning with particular deficits on the side contralateral to the hemispherectomy.

**Conclusions:** Three cases of SWS with early hemispherectomy demonstrate generally positive outcome with profiles of specific impairment. Young age at hemispherectomy and early intervention may be positive factors. These cases highlight specific neuropsychological weaknesses in executive functioning that previously received little attention in this unique population with implications for developmental brain-behavior relationships.

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#### H.K. RYLAND, A.J. LUNDERVOLD, I. ELGEN & M. HYSING. The protective effect of normal to high intellectual function on mental health in children with a chronic physical illness.

**Objective:** The aim of the study was to explore if normal to high IQ has a protective effect on mental health in children with CI, and if this effect is more substantial than in a group of children without any chronic physical illness (NCI).

**Participants and Methods:** All subjects participated in the Bergen Child Study (BCS), of whom 96 children met the criteria of a CI (the CI-group). Another 96 children without CI, matched on FSIQ-level, were included in a comparison group (the NCI-group). CI and mental health were assessed during a diagnostic interview (Kiddie-SADS-PL), generating psychiatric diagnoses and information about the general level of functioning. IQ was measured by the WISC-III Full Scale score (FSIQ). Based on the FSIQ, the children were allocated to a group defined according to one of three FSIQ-levels: "very low" (<70), "low" (70 to 84), or "normal to high" (>84).

**Results:** Children with a normal to high FSIQ-level had a significantly lower frequency of psychiatric disorders than children with a very low and low FSIQ-level, and the general level of functioning increased as a function of higher FSIQ. This was true both for children with and without CI.

**Conclusions:** The present study showed an overall protective effect of normal to high intellectual function on mental health, an effect that was as substantial in children without a CI as in children with a CI.

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#### S. SANCHEZ, F. OSTROSKY-SOLÍS, J. ALBERÚ-GÓMEZ & L.E. MORALES-BUENROSTRO. Cognitive Functioning Before and After Kidney Transplant.

**Objective:** To assess the prevalence of cognitive impairment in Chronic Kidney Disease (CKD) patients and the impact of kidney transplantation on neuropsychological functioning.

**Participants and Methods:** The present phase I study included 120 CKD patients and 41 healthy donors –control group– were evaluated with the Neuropsi Attention and Memory Hospital Anxiety and Depression Scale, Epworth Sleepiness Scale and Fachingki ischemic Scale. Longitudinal phase: Of these 120 patients 42 were assessed with the same instruments before kidney transplant (KT). 28 of them were followed up 6 months after transplantation and 15, were also assessed 1 year after KT. Kidney donors were evaluated at same times of study group for comparison purposes.

WITHDRAWN

**Results:** Global neuropsychological impairment was present in 23% of CKD patients. Specific neuropsychological patterns for End Stage Renal Disease and hemodialysis patients were observed. Global cognitive functioning improved after KT (when learning effects were controlled). Possible factors associated with cognitive impairment before KT and cognitive improvement after KT were not determined.

**Conclusions:** As CKD progresses, some patients may present mild cognitive disorder, but this may progress to a moderate or severe impairment in other groups of patients. CKD has an impact in attention and executive function, probably due to uremic-related mechanisms. Hemodialysis seems to affect cerebral regions involved with memory functioning. Renal transplant is suggested as an ideal solution to eliminate factors that impact over cognitive functioning.

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#### **D.D. SCHWARTZ, M.E. AXELRAD & B.J. ANDERSON. Neuropsychological Screening at Diabetes Diagnosis: Preliminary Findings.**

**Objective:** This retrospective chart review investigates the relationship between neuropsychological functioning at diagnosis of Type 1 diabetes and medical adherence, to identify early markers of risk for poor diabetes control. It was hypothesized that 1) neuropsychological dysfunction would increase the likelihood of nonadherence resulting in acute complications, and 2) behaviorally-dysregulated children would miss more clinic appointments.

**Participants and Methods:** Seventy-eight children ages 3 – 17 were seen for neuropsychological screening within 3 days of diabetes diagnosis. They were administered a short neuropsychological test battery (Trails A and B, Grooved Pegboard, Verbal Fluency, Digit Span, VMI;  $n = 73$ ), and their caregivers completed a standardized measure of executive functioning (BRIEF;  $n = 78$ ), an ADHD symptom index ( $n = 51$ ), and a semi-structured interview. Data were analyzed via consecutive ANOVAs with acute complications (indexed by diabetes-related ER visits) and missed appointments as the dependent variables.

**Results:** ER visits within 9 months following diabetes diagnosis were predicted by performance on Trails A ( $p = .023$ ), Trails B ( $p < .001$ ), FAS ( $p < .001$ ), Animal fluency ( $p < .001$ ), Grooved Pegboard ( $p < .001$ ), and VMI ( $p < .001$ ). Parent ratings of executive functioning and ADHD symptoms did not predict nonadherence, but children with prior reported history of ADHD were more likely to miss appointments ( $p < .05$ ).

**Conclusions:** Findings indicate that neuropsychological screening at diabetes diagnosis can identify children at risk for acute medical complications and missed clinic appointments early in the course of illness. This has implications for understanding the role of neuropsychological functioning in medical adherence.

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#### **C.M. SMART & L. RENTERIA. Mentoring in Neuropsychology: Incidence and Impact on Professional and Psychosocial Functioning with a Focus on Women and Minorities.**

**Objective:** The virtues of mentorship in academia have long been extolled. Within the field of neuropsychology, there have been recent initiatives for mentorship targeted specifically toward women and minorities, understanding the diversification of our profession and of our clientele. However, systematic research examining incidence and impact of mentorship among early-career neuropsychologists has yet to be forthcoming.

**Participants and Methods:** We created an anonymous online survey to be administered to trainees and early-career neuropsychologists (i.e., less than or equal to 5 years following residency), recruited via pre- and post-doctoral neuropsychology training programs and select listservs.

**Results:** Three hundred and thirty-two individuals completed the survey (74% female, 82% Caucasian). Ninety-two percent had at least one

mentor: this was most commonly a postdoctoral supervisor (33%), with only 3% being matched through a formal matching program. Mentor/mentees tended to be matched on ethnicity (68%) and sexual orientation (63%) but not necessarily gender (49%), although these variables were not deemed a necessary part of the relationship. Degree of burnout in the sample was relatively low. The average respondent was satisfied with their decision to become a neuropsychologist, with no significant difference between those with and without mentors. However, 9% reported having received no formal diversity training and 40% were less than satisfied with their training to work with diverse populations.

**Conclusions:** While current findings suggest that early-career neuropsychologists are thriving in our profession, we may still be lacking in attending to the needs of diverse trainees and clientele. Implications of the findings are discussed.

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#### **B. SPICKARD & J. SUHR. Relation of Cogniphobia to Cognitive Test Performance in Chronic Headache.**

**Objective:** Fear avoidance and pain catastrophizing are known to be related to chronicity of pain, avoidance of behaviors that might elicit pain (kinesophobia), and increased risk for pain-related disability. A related construct that has received little attention is cogniphobia, the fear that cognitive exertion will exacerbate headache-related pain, which was first described more than a decade ago as a factor potentially related to failure on symptom validity tasks in patients with chronic pain. In the present study, we examined the relationship of cogniphobia to anxiety and to cognitive test performance.

**Participants and Methods:** Participants were 42 non-treatment seeking young adults who reported at least several months' history of chronic headaches (4 or more per month) on a pre-study medical screen. Individuals completed measures of state depression, state anxiety, and cogniphobia, and were administered a brief cognitive battery as part of a larger study.

**Results:** All individuals passed the validity subsets of the Word Memory Test (WMT). High cogniphobia was related to worse recall (WMT free recall subtest  $r = -.39$ ,  $p < .01$ ), and to worse performance on the Paced Auditory Serial Addition Test,  $r$ s from  $-.12$  to  $-.34$ . In addition, high cogniphobia was related to higher pre-test stress (State Trait Anxiety Inventory state score,  $r = .37$ ,  $p < .01$ ), although pre-test anxiety was not related to cognitive test scores. Cogniphobia was not related to pre-test depression or to current headache level.

**Conclusions:** Results suggest that pain-related fear may in fact be a factor contributing to lower cognitive test scores in those with chronic headache.

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#### **J. WARD, L. BURRELL, M. NAQIBUDDIN, D. POWERS, S. BARR, L. KLEM & M. PETRI. Cognitive Functioning and Work Status in Systemic Lupus Erythematosus.**

**Objective:** The presence of cognitive and mood difficulties in systemic lupus erythematosus (SLE) is well established. However, the relationship of cognitive functioning and mood to work status has been rarely investigated in SLE. In the current study, we assessed cognitive and adaptive functioning and mood in working and disabled SLE patients and healthy control participants.

**Participants and Methods:** Participants were 24 working SLE patients (95.8 % female; 14 Caucasians and 10 African Americans, mean age 41.8 years), 10 disabled SLE patients (90% female; 4 Caucasians and 6 African Americans, mean age 47.8), and 16 controls (56.3% female, 12 Caucasians and 4 African Americans, mean age 39.7). Study participants were administered a comprehensive neuropsychological battery and measures of mood and adaptive functioning.

**Results:** Although working SLE and control participants performed comparably on cognitive measures, disabled SLE patients exhibited significantly poorer performance on measures of processing speed, mental flexibility, inhibitory control, complex problem solving, visual learning and memory, implicit learning, visuoconstruction, and fine motor speed. Additionally, disabled SLE patients exhibited significantly lower verbal learning and memory than working SLE patients. Both working and disabled SLE patients endorsed a significantly greater degree of depressive symptoms than controls.

**Conclusions:** The current results indicate notable cognitive deficits among disabled SLE patients. Although endorsing a significantly greater degree of depressive symptoms than controls, working SLE patients performed comparably to controls on cognitive measures. Thus, cognitive deficits beyond those associated with depression may be related to disability status in SLE. These preliminary data are part of an ongoing study, which will ultimately allow more direct investigation of the relationship between cognitive functioning and work status in SLE.

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### Invited Symposium: Structural and Functional Cerebral Asymmetries: Handedness, Hormones, and Developmental Disorders.

**Chair: Ian Kirk**

**10:15–11:45 a.m.**

#### **I.J. KIRK, G. BADZAKOVA, K.E. WALDIE & M. HAUSMANN. Structural and Functional Cerebral Asymmetries: Handedness, Hormones, and Developmental Disorders.**

**Symposium Description:** Hemispheric specialisation is now well established in the human brain. In the majority of the healthy population, language functions are lateralised to the left hemisphere, while the right hemisphere specialises in visuospatial functions. There is little evidence however, for structural asymmetries that have been proposed to support these functional asymmetries. In the first talk of this symposium, we present data from diffusion tensor imaging (DTI) that indicates there are significant microstructural differences between the hemispheres across a number of areas in right-handed males. This data is compared to functional EEG measures for right-, and left-handers, and for those with schizophrenia or ADHD. In the second talk, functional asymmetries in right-, and left-handers are explored in greater detail across a variety of cognitive domains. In the third talk, atypical asymmetries in people with dyslexia are discussed. Finally, although cerebral asymmetries are relatively stable in men, they change during the menstrual cycle in women, suggesting that sex hormones play an important role in modulating functional brain asymmetries. The final talk in this symposium will discuss the mechanism of action, functional consequences, and significance of sex hormones in cerebral processes.

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#### **I.J. KIRK & S.J. IWABUCHI. Hemispheric Asymmetries in White Matter Architecture.**

**Objective:** Hemispheric specialisation is now well established in the human brain. In the majority of the healthy population, language functions are lateralised to the left hemisphere, while the right hemisphere specialises in visuospatial functions. While such functional asymmetries are well-documented, there is little evidence for structural asymmetries that have been proposed to support them.

**Participants and Methods:** With the use of diffusion tensor imaging (DTI) we investigated cerebral hemispheric asymmetries in white matter microarchitecture. Twenty-nine right-handed males underwent DTI, and fractional anisotropy (FA) was calculated for four brain regions within each hemisphere: the frontal, temporal, parietal and occipital.

**Results:** A significant rightward asymmetry in FA was observed across the parietal lobes, areas primarily involved in spatial and attentional processes. The parietal lobes also showed significantly higher FA values than the other lobes in both hemispheres. Finally, in only the left hemisphere the temporal lobe FA was significantly higher than the occipital.

**Conclusions:** These findings will be discussed with reference to EEG measures of interhemispheric communication in right-, and left-handers, and in people with schizophrenia and ADHD.

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#### **G. BADZAKOVA. Functional Lateralization and Handedness: an fMRI Study.**

**Objective:** Lateralization for language production, spatial attention and face recognition was assessed.

**Participants and Methods:** 155 healthy subjects (103 right-handers, 52 non-right handers) using fMRI-derived laterality indices.

**Results:** Most subjects showed a bias towards the left hemisphere for language and the right hemisphere for spatial attention and faces. A reverse pattern for both language and spatial attention/faces was observed only in a small number of non-right handed subjects. Notably, a number of subjects had different functions lateralized to the same hemisphere suggesting that the biases for these lateralized functions are independent. That is, division of labour between the hemispheres is not compulsory; for example, having language lateralized to the left hemisphere does not preclude the possibility of having spatial attention or faces also lateralized to the left.

**Conclusions:** The current results are consistent with the view that complementary specialization is not necessarily a causal occurrence, and it should only be viewed as a statistical norm.

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#### **K.E. WALDIE, H. PARK & N.A. MCNAIR. Brain Activity in Bilingual Developmental Dyslexia During Lexical Decision Tasks.**

**Objective:** Reading requires the use of primarily left hemisphere processing systems. In dyslexics, this network is hypothesised to be disrupted. We have previously reported that adult dyslexics show predominantly right frontal activation during lexical decision tasks, likely as a compensatory reaction to left temporoparietal dysfunction. We have also shown that bilingual adults who have acquired their second language late appear to utilize right hemisphere resources during reading to a greater extent than their monolingual peers. Little is known, however, about bilingual developmental dyslexia (BDD), particularly with early acquisition of both languages.

**Participants and Methods:** Here we present an fMRI study of a German (L1)- and English (L2)-speaking dyslexic adult. Comparisons on five tasks in English were made with bilingual normal readers, monolingual normal readers, and monolingual dyslexics.

**Results:** Both a non-verbal and a lettercase judgement task resulted in similar bilateral activation across groups. In contrast, activation differed during irregular word reading between the BDD and all other groups. Differences in the location of activity were also observed between the BDD and all other groups, particularly during sublexical decision-making. As phonological processing demands increased, so did the amount of right hemisphere activation, with monolinguals showing mainly left dorsal activity, bilinguals showing bilateral activation and the bilingual dyslexic showing mainly utilizing right hemisphere resources.

**Conclusions:** Right hemisphere compensatory activity will be discussed in relation to chronological age and L2 acquisition and proficiency.

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#### **M. HAUSMANN. Sex Hormones and Plasticity in Functional Brain Asymmetries.**

**Objective:** Hemispheric asymmetries are a basic principle of functional brain organization in humans and many other species. However, the degree of hemispheric asymmetries shows inter-individual differences and dynamically changes within relative short time periods. For example, it has been shown that hemispheric asymmetries are sex specific: While they are relatively stable in men, they change during the menstrual cycle in women, suggesting that sex hormones play an important role in modulating functional brain asymmetries.

**Participants and Methods:** Sex hormones have indeed powerful neuronal actions in the brain and affect the interaction between functionally linked cortical areas within and across cerebral hemispheres. However, the underlying mechanisms are still not fully understood. It is unlikely that sex hormones selectively affect one hemisphere. Here it is suggested that sex hormones modulate interhemispheric interaction via the corpus callosum due to their neuromodulatory properties, which could diminish cortico-cortical transmission and thus reduce hemispheric asymmetries.

**Results:** Menstrual cycle-related dynamic fluctuations in functional cerebral asymmetries and interhemispheric crosstalk have been shown to be a useful experimental model to investigate the activating effects of sex hormones on functional connectivity in the brain.

**Conclusions:** Besides a better understanding of sex hormonal effects on cognitive brain functions, this research may also contribute to addressing the question of whether sex differences in cognitive brain functioning truly exist and where they originate from.

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### **Symposium 4: The Cognitive Reserve Hypothesis: Clinical Expression of Neurologic Disease Across the Lifespan**

**Chair: James Sumowski**

**Discussant: Yaakov Stern**

**10:45 a.m.–12:15 p.m.**

**J.F. SUMOWSKI, Y. STERN, E.D. BIGLER, J.F. SUMOWSKI, C.M. ROE & Y. STERN. The Cognitive Reserve Hypothesis: Clinical Expression of Neurologic Disease Across the Lifespan.**

**Symposium Description:** The cognitive reserve (CR) hypothesis states that lifetime intellectual enrichment lessens the negative impact of brain disease on cognition. As such, the CR hypothesis may help explain the incomplete relationship between neurologic disease severity and clinical outcome. For instance, (a) children with similar brain trauma often express different cognitive outcomes, (b) neuropathology in Multiple Sclerosis (MS) accounts for relatively little variance in cognition, and (c) dementia prevalence varies among elders with similar degrees of Alzheimer's Disease (AD) neuropathology. This symposium evaluates CR across the lifespan.

In a comprehensive longitudinal evaluation of a pediatric traumatic brain injury sample, Bigler et al. discuss premorbid brain development as a key source of CR. Other contributors include: educational attainment, socioeconomic, and family variables. Transitioning to adulthood, Sumowski et al. show that intellectual enrichment protects against the

negative impact of MS disease severity on cognition, and that vocabulary knowledge and early life cognitive leisure activity represent independent sources of CR. Roe et al. investigate CR in the elderly. Using an innovative in vivo estimate of AD neuropathology based on uptake of [<sup>14</sup>C]PIB, Roe et al. show that educational attainment lessens the impact of fibrillar amyloid on global cognitive functioning (e.g., MMSE). Finally, Stern discusses fMRI evidence for the neural bases of CR, including neural reserve (efficiency) and neural compensation (altered patterns of recruitment). Stern proposes that such patterns help persons better cope with neuropathology. As the discussant, Stern also examines interventions based on cognitive leisure activity to protect persons with neurologic diseases from cognitive decline.

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**E.D. BIGLER, E.A. WILDE, G. HANTEN, A.T. SCHMIDT, X. LI, J.V. HUNTER, D. CHU & H.S. LEVIN. Cognitive Reserve in Pediatric Traumatic Brain Injury.**

**Objective:** A longitudinal investigation of pediatric traumatic brain injury (TBI) at the Baylor College of Medicine began approximately seven years ago.

**Participants and Methods:** Seventy-six children with TBI are now enrolled in the study. As part of the investigation 71 matched controls, including children with orthopedic injury also have been followed. All children in this study have undergone serial cognitive, behavioral and neuroimaging assessments along with tracking when they return to school and academic achievement.

**Results:** Quantitative neuroimaging has shown in this cohort that brain injury disrupts the normal developmental trajectory of white and gray matter, partly dependent upon the severity of injury. In the current investigation a variety of issues that relate to cognitive reserve and developmental outcome in pediatric TBI are explored. Total intracranial volume (TICV) is a marker for maximal or total brain volume (TBV) and basically becomes invariant by about 8 years of age. TBI results in cerebral atrophy reflected as a reduction in TBV, which is linearly related to injury severity. The degree of cerebral atrophy is also positively correlated with neuropsychological outcome. We hypothesized that smaller TICV at the time of brain injury, would be associated with smaller pre-injury TBV and that smaller pre-injury TBV would be associated with less cognitive reserve as well as affecting post-injury neural development.

**Conclusions:** Partial support for the role of cognitive reserve in TBI outcome was observed. This study also explored pre-injury educational, socioeconomic and family variables as proxies for cognitive reserve and their relationship to outcome and brain development following pediatric TBI.

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**J.F. SUMOWSKI, N. CHIARAVALLOTI, G. WYLIE & J. DELUCA. Lifetime Intellectual Enrichment Lessens the Negative Impact of Brain Atrophy on Cognition in Multiple Sclerosis.**

**Objective:** Cognitive impairment is prevalent in persons with multiple sclerosis (MS); however, there is an incomplete and inconsistent relationship between estimates of MS disease severity (e.g., brain atrophy) and cognitive status (e.g., cognitive efficiency). Based on the cognitive reserve (CR) hypothesis, we examined whether higher lifetime intellectual enrichment lessens the negative impact of MS disease on cognition.

**Participants and Methods:** Thirty-eight persons with clinically-definite MS completed tasks of cognitive efficiency (SDMT + PASAT). Disease severity was estimated with brain atrophy (third ventricle width on MPRAGE MRIs). CR was estimated with acquired vocabulary knowledge (Wechsler Vocabulary). Multiple regression was used to predict cognitive efficiency with brain atrophy, intellectual enrichment, and, most importantly, the atrophy X enrichment interaction.

**Results:** Brain atrophy predicted worse cognitive efficiency ( $p < .01$ ), and intellectual enrichment predicted better cognitive efficiency ( $p = .01$ ), but these effects were moderated by the atrophy X enrichment interaction ( $p < .01$ ) such that the negative effect of atrophy on cognitive efficiency was lessened at higher levels of enrichment. Of note, similar results were found for learning / memory as a dependent variable (SRT), and when CR was estimated with early life cognitive leisure activity (e.g., reading books).

**Conclusions:** Lifetime intellectual enrichment lessens the effect of MS disease on cognition. Results help explain inconsistencies in the relationship between atrophy and cognition in previous MS research. More specifically, our literature review revealed a significant inverse relationship between (a) the correlation between atrophy and cognition and (b) the CR of the sample across previous studies.

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**C.M. ROE, M.A. MINTUN, G. D'ANGELO, C. XIONG, E.A. GRANT & J.C. MORRIS. Alzheimer's and Cognitive Reserve: Education Effect Varies with [<sup>11</sup>C]PIB Uptake.**

**Objective:** To examine whether, in accordance with the cognitive reserve hypothesis, individuals with more education maintain better cognitive functioning than those with less education when level of fibrillar brain amyloid is elevated.

**Participants and Methods:** Uptake of [<sup>11</sup>C]PIB was measured for participants assessed between August 15, 2003 and January 8, 2008 at the Washington University Alzheimer's Disease Research Center and diagnosed with normal cognition (N=161) or Dementia of the Alzheimer Type (N=37). Multiple regression was used to determine whether [<sup>11</sup>C]PIB uptake interacted with level of educational attainment to predict scores on global cognitive functioning measures (Clinical Dementia Rating - Sum of Boxes [CDR-SB], Mini-Mental State Exam [MMSE], and Short Blessed Test [SBT]) and tests assessing specific cognitive processes [Animal Naming, Trailmaking A and B, Free and Cued Selective Reminding Test, and the Similarities subtest of the Wechsler Adult Intelligence Scale III [WAIS III Similarities]].

**Results:** [<sup>11</sup>C]PIB uptake interacted with years of education in predicting scores on the CDR-SB ( $p=.003$ ), the MMSE ( $p<.001$ ), the SBT ( $p=.03$ ) and WAIS III Similarities ( $p=.02$ ). Performance on the global cognitive functioning measures increased with increasing education for participants with elevated PIB uptake, but education was unrelated to global cognitive functioning scores among those with lower uptake.

**Conclusions:** These results provide additional support for the hypothesis that the association between AD pathology and cognition differs as a function of individual cognitive reserve. Cognitive reserve, as reflected in education, may have a stronger or earlier effect on some types of cognitive processes than others.

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**Y. STERN. fMRI studies of Cognitive Reserve in Aging.**

**Objective:** Cognitive reserve (CR) is hypothesized to account for the disparity between brain changes (or pathology) and the clinical consequences of those changes. Presumably reserve is mediated by individual differences in resilience/plasticity of cognitive networks in the face of disruption.

**Participants and Methods:** Our fMRI studies are designed to elucidate how CR may be neurally implemented. One approach we take is to challenge participants with a demanding task and investigate differences in task-related activation between individuals with high and low CR.

**Results:** We have found two possible ways that CR may be implemented and help individuals with higher CR maintain performance in the pres-

ence age-related brain changes: 1) differential efficiency or capacity of networks: neural reserve; and 2) adopting new networks typically unused in individuals without brain changes: neural compensation. Depending on the task and context, use of these compensatory networks can be associated with better or worse performance. We have also begun to explore ways in which CR may be mediated that are separate from the networks needed to perform any specific task. In one study, we identified a single network that, in two different tasks, was expressed to a greater degree in individuals with higher CR.

**Conclusions:** We hypothesize that such networks may allow greater resilience to brain changes across a range of tasks and challenges. In our more recent studies, we are attempting to quantitate aspects of age-related brain changes in order to more directly explore how our identified networks allow some individuals to cope with this pathology better than others.

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**Paper Session 3:  
Executive Functions**

**10:45 a.m.–12:15 p.m.**

**L. ORCHINIK, H. TAYLOR, K.A. ESPY, N. MINICH, N. KLEIN, M. HACK & T. SHEFFIELD. Effects of extreme prematurity on executive function and other cognitive measures in kindergarten.**

**Objective:** The purpose of this study was to examine cognitive outcomes of extremely low birth weight/extremely preterm birth (ELBW/EPTB) in kindergarten. Our hypothesis was that children with ELBW/EPTB would have pervasive cognitive deficits relative to term-born normal birth weight (NBW) children but that measures of executive functioning (EF) would be especially sensitive indicators of sequelae.

**Participants and Methods:** A sample of 104 children with ELBW/EPTB (<1000 g or <28 weeks gestational age) was compared with a group of 100 NBW classmate controls on cognitive tests administered in kindergarten. Measures included the Brief Intellectual Ability (BIA) from the Woodcock-Johnson III; standardized tests of perceptual-motor ability, phonological processing, and memory; and three experimental tasks of EF designed for younger children (Shape School, Trails-Pr, Nebraska Barnyard). Only children testable on measures of EF were considered. Comparisons were made using ANCOVA, with age, sex, race, and SES as covariates. Regression analysis was used to examine associations of neonatal risks with cognitive outcomes within the ELBW/EPTB group.

**Results:** The ELBW/EPTB group scored more poorly than the NBW group on most cognitive measures and on all of the EF tasks, but differences on the BIA had the largest effect size (Cohen's  $d=.87$ ). Measures related to neonatal risk were the BIA, Shape School, Trails-Pr, and a perceptual-motor test.

**Conclusions:** Findings suggest that multiple measures of cognitive ability, including tests of EF, are sensitive to the effects of ELBW/EPTB at school entry. Further task analysis is needed to isolate the effects of prematurity on specific executive skills.

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**C.A. CLARK, T.D. SHEFFIELD, J. MIZE NELSON & K.A. ESPY. AN ENRICHED HOME ENVIRONMENT IS ASSOCIATED WITH ADVANCED EARLY EXECUTIVE CAPABILITIES.**

**Objective:** Consistent with the neuroscientific grounding of the concept executive function, recent studies have begun to explore the role of

the child's social context on brain development and the shaping of executive skills. Using a longitudinal, cohort-sequential design, this study examined the impact of multidimensional aspects of children's early socio-familial context on emerging developmental trajectories of inhibitory control and set-shifting.

**Participants and Methods:** Preschoolers ( $n=345$ ) carefully sampled on social risk were assessed at 36, 45 and 54 months with the Shape School, a graduated measure incorporating baseline, inhibitory control and set-shifting conditions. At study entry, observational measures of children's proximal home environment and self-reported measures of family finances, stressful life events, access to social supports, parenting stress and parenting style were collected.

**Results:** Factor analysis identified three broad dimensions of early socio-familial experience tapped by study measures, including children's access to enriching resources, family social support networks, and sensitive parenting. Although social support and parenting were not predictive of task performance, children who had been exposed to more enriched, stimulating home experiences showed clear advantages in performance accuracy and consistency relative to those exposed to less optimal conditions. At 36 months, a 5-13% advantage in performance was evident across both non-executive and executive demanding Shape School conditions. By age 54 months, this achievement gap had closed somewhat (1-2%) for baseline task performance, but discrepancies were persistent for conditions demanding greater inhibitory control and set-shifting capabilities.

**Conclusions:** Findings suggest that early opportunities to learn and engage with an enriched environment are associated with advanced executive function during early childhood. Such advantages are likely to have cascading implications as children face the demands of formal schooling.

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**J. PA, K.L. POSSIN, S.M. WILSON, L.C. QUITANIA, J.H. KRAMER, A.L. BOXER, M.W. WEINER & J.K. JOHNSON. Gray Matter Correlates of Set-Shifting in Neurodegenerative Disease.**

**Objective:** There is increasing recognition that set-shifting represents not one unitary construct, but rather a set of higher-level cognitive skills that are mediated by different neural structures and networks. However, these networks have not been carefully identified as many studies do not account for the influence of component cognitive processes (e.g., motor speed, visual complexity). In the present study, we aimed to elucidate gray matter correlates of set-shifting performance while controlling for fundamental cognitive processes.

**Participants and Methods:** We selected the set-shifting tasks of Design Fluency, Trail Making Test, and Color Word Interference from the Delis-Kaplan Executive Function System (DKEFS). Using voxel-based morphometry (VBM), we performed multiple regression analyses to investigate the correlation between set-shifting performance in all three tasks and gray matter volume in 164 subjects with neurodegenerative diseases, mild cognitive impairment, and healthy controls.

**Results:** Our results demonstrated that each set-shifting task correlated with multiple, widespread gray matter regions. However, after controlling for the component cognitive processes, set-shifting performance correlated with focal regions in prefrontal and posterior parietal cortices. In addition, we identified bilateral dorsolateral prefrontal cortex as a common site for set-shifting across the three DKEFS tasks. We also found a high degree of multicollinearity between the set-shifting conditions and the component cognitive processes in the Trail Making Test and Color Word Interference subtests, but not for Design Fluency.

**Conclusions:** Overall, these findings highlight the neuroanatomical correlates of set-shifting and the importance of controlling for component processes when investigating complex cognitive tasks. Further, Design Fluency may best isolate gray matter structures involved in set-shifting.

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**H.M. CONKLIN, T.E. MERCHANT, W.E. REDDICK, R.J. OGG, J.M. ASHFORD, T.N. SKINNER, S. WU & X. XIONG. Working Memory Performance in Childhood Brain Tumor Survivors.**

**Objective:** Longitudinal studies of children treated for a brain tumor (BT) have revealed declines on measures of intellectual functioning. Greater specification of cognitive changes following treatment is imperative for isolating vulnerable neural pathways and developing interventions. Working memory depends on frontal brain areas that are protracted in developmental myelination. Given children treated with radiation therapy for a BT demonstrate loss of white matter, working memory may be particularly vulnerable to treatment effects.

**Participants and Methods:** Childhood BT survivors treated with conformal radiation therapy (25 males, 25 females; mean age =  $13.18 \pm 2.88$  years; mean age at irradiation =  $7.41 \pm 3.41$  years) and healthy siblings (20 males, 20 females; mean age =  $12.91 \pm 2.62$  years) completed measures of working memory (computerized self-ordered tasks and digit span) and recognition memory (computerized forced choice recognition tasks). Parents completed the Behavior Rating Inventory of Executive Function (BRIEF).

**Results:** Linear mixed models revealed significantly worse performance by BT survivors relative to siblings on verbal and object self-ordered tasks, digit span backward, and face recognition but not digit span forward or verbal recognition ( $p < .05$ ). The McNemar test indicated a greater deficiency in working memory than recognition memory when comparing BT survivors to siblings ( $p < .05$ ). Children with supratentorial tumors tended to outperform children with infratentorial tumors. Parents rated BT survivors significantly more impaired than siblings on the BRIEF Working Memory, Initiate, and Plan/Organize subscales ( $p < .01$ ).

**Conclusions:** Despite mounting evidence for better preserved cognitive functioning following conformal versus conventional radiation therapy approaches, working memory impairments were revealed, consistent with proposed vulnerability in prefrontal brain regions. These findings may assist in refining radiation delivery methods, designing cognitive interventions and educating caregivers.

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**V.A. ANDERSON, M. SPENCER-SMITH, L. COLEMAN, P. ANDERSON, J. WILLIAMS, M. GREENHAM, R. LEVENTER & R. JACOBS. Children's Executive Functions And Age at Brain Insult.**

**Objective:** Traditionally early brain insult (EBI) has been considered to have better outcome than injury later in life, consistent with the notion that the young brain is flexible and able to reorganize. However such disruption may cause impairment in adaptive skills and the acquisition of knowledge, the consequences of which may persist into adolescence and adulthood. The aim of this study was to investigate executive functions (EF) in children sustaining EBI at different developmental stages, from gestation to late childhood.

**Participants and Methods:** Six groups of children (Total  $N = 164$ ), with a history of brain insult and documented focal brain pathology on MRI scan, aged 10–16 years at recruitment, were compared on a range of neurobehavioral measures. Groups were based on age of EBI: (1) Congenital; (2) Peri-natal; (3) Infancy; (4) Preschool; (5) Middle Childhood; and (6) Late Childhood. Groups were matched for lesion characteristics and demographics.

**Results:** As a group, children with EBI performed significantly poorer than age peers on measures of EF. Further, EBI group differences were evident on cognitive tests of EF, with children sustaining EBI before age 2 years demonstrating greater impairment than those injured later in childhood. Children sustaining EBI late in childhood performed closer to age expectations. On behavioral measures of EF, age at insult differences were less clear.

**Conclusions:** These results question the advantages of early brain plasticity, demonstrating poorer outcome from very early insults, and increasingly better function with lesions later in childhood. Findings also indicated that cognitive and behavioral outcomes may be differentially impacted by age at brain insult.

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### Poster Session 3: Cognitive Intervention/Rehabilitation, Stroke/Aneurysm, TBI (Adult)

11:30 a.m.–1:00 p.m.

#### Cognitive Intervention/Rehabilitation

**J.C. ARANGO, M.C. QUIJANO, M. APONTE, A. RINCON, M. CUERVO & H. ROGERS. Cognitive rehabilitation to improve learning and memory in Spanish-speaking individuals with traumatic brain injury.**

**Objective:** To examine the effect of self-generation on learning and memory in Spanish-speaking individuals with traumatic brain injury (TBI). **Participants and Methods:** thirty Spanish-speaking individuals with moderate to severe TBI and 31 healthy controls were recruited to read 32 individual sentences and required to remember the last word in each sentence. Target words were presented both in a self-generated and provided condition for each subject. Recall and recognition of the words were examined immediately, after 30 minutes, and after one week.

**Results:** The control group recalled significantly more words than the individuals with TBI. Although the words in the generated condition were recalled at a significantly higher rate than words in the provided condition at each time point, participants recalled significantly more words from immediate to 30 minutes in the provided condition while participants recalled the same number of words at immediate and 30 minutes in the generated condition. Both groups recalled significantly less words at the one week follow-up. Although the controls and individuals with TBI recognized similar numbers of words at each time point, the rate of decline in word recognition was much steeper in the individuals with TBI compared to the controls. A condition x group interaction was also found such that controls tended to recognize more words in the generated condition than individuals with TBI and tended to recognize more words compared to the number of words recognized in the provided condition.

**Conclusions:** The self-generation technique effectively improves learning and memory in Spanish-speaking individuals with TBI.

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**A.M. DIAS & A. VAN DEUSEN. Intentional Blood flow Perfusion in the Prefrontal Cortex, Cognitive Performance and Aging.**

**Objective:** Several studies suggest that executive functions heavily rely on prefrontal cortex (PFC) anatomical dimensions, such as thickness and connectivity; as well as on PFC functional dimensions, such as sustained blood flow perfusion (SpO<sub>2</sub> levels) and high oscillatory frequencies (> 15 Hz). **Objective:** From that standpoint, we ran an initial trial of a planned study about the PFC SpO<sub>2</sub> dynamic of a wide age range of individuals, in order to provide answers to the following questions: what are the differences in SpO<sub>2</sub> dynamic in cognitive task in youngest and elderly? Do elderly lose the volitional control of that oxygenation level, in association with the well-known cognitive decay?

**Participants and Methods:** A population of 8 subjects (aged 30-87) underwent a cognitive testing and infrared spectrophotometry measurement of the PFC while engaging in a neurofeedback training computer paradigm in which they could directly interact with PFC SpO<sub>2</sub> level.

**Results:** These initial results suggest that elderly persons do not lose the ability to increase their own PFC SpO<sub>2</sub> levels intentionally, despite the loss of global performance.

**Conclusions:** Although preliminary, these results open an exciting avenue for research and clinical applications.

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**. FYRBERG & G. HORNEMAN. The effect of cognitive sequelae on communication skills in adolescents with Acquired Brain Injury (ABI).**

**Objective:** The objective of this study was to explore interdependent aspects between cognitive functioning and everyday communication skills. It focuses on the possible gains of adapting a multidisciplinary approach in the rehabilitation process.

**Participants and Methods:** This is an interdisciplinary study that uses a multiple approach model of assessing the effects of ABI on everyday communication skills.

Thirty adolescents with serious ABI were examined with an extensive neuropsychological and speech pathology assessment battery one to three years post injury.

Statistical nonparametric methods were used in order to analyze the effect of cognitive sequelae on communicative skills.

**Results:** There seems to be a discrepancy between traditional methods of describing severity of injury related to outcome. Preliminary data shows that severity of cognitive sequelae impairs communicative skills.

All subjects showed cognitive impairment, with intellectual levels one to two standard deviations below the mean, impaired attention and memory. Visual perceptual disorders were also frequent. Almost all were impaired in everyday communication, which were primarily related to memory, attention and auditory perception and to a lesser degree related to language deficiencies.

Thus underlying cognitive factors seems to play an important role in understanding concurrent communicative functions.

**Conclusions:** It is evident that an extensive analysis of interdisciplinary data is fruitful in the process of exploring the underlying effects of cognitive functions on communicative skills. Such an analysis will also have valuable implications on designing rehabilitation programs.

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**M.D. GRILLI & E.L. GLISKY. Improving Prospective Memory with Self-Imagining in Individuals Who Have Neurologically-Based Memory Deficits.**

**Objective:** Prospective memory (PM), remembering to perform a task after a delay, is commonly impaired in individuals with neurological damage. In an attempt to discover a method for improving PM in this population, the present study investigated the effect of “self-imagining” – or the imagining of an event from a self-relevant perspective – on a laboratory-based task of PM.

**Participants and Methods:** Twelve individuals with neurological damage of mixed etiology (9 TBI) took part in a computerized, ongoing task of general knowledge. The PM component required pressing the “1” key whenever a target word (i.e. state or president) appeared in a question. The study was separated into two sessions spaced two weeks apart. Each session involved a different pre-experiment encoding strategy. In session 1, half the participants imagined seeing the target word imbedded in a question and imagined immediately pressing the “1” key, and half the participants rehearsed the experimental instructions. In session 2, participants engaged in the other encoding strategy.

**Results:** Findings revealed a “self-imagination effect” as PM accuracy was greater for self-imagining (.38) than rote-rehearsing (.07). In fact,

while only two participants benefited from rote-rehearsing, 7 participants benefited from self-imagining. Further analysis showed that those individuals ( $n = 5$ ) who did not benefit mnemonically from self-imagining had, on average, more severe memory deficits as characterized by the General Memory Index from the Wechsler Memory Scale – III.

**Conclusions:** These results suggest that self-imagining is a successful strategy for improving PM and may be adapted for memory rehabilitation, although the severity of one's memory deficit may moderate benefits.

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**R.H. HAMILTON, L. SANDERS, J. BENSON, O. FASEYITAN, C. NORISE, M. NAESER, P. MARTIN & H.B. COSLETT. Stimulating Conversation: Enhancement of Spontaneous Speech in a Patient with Chronic Nonfluent Aphasia Following Transcranial Magnetic Stimulation.**

**Objective:** Evidence suggests that patients with left hemisphere strokes and nonfluent aphasia who receive 1-Hz repetitive transcranial magnetic stimulation (rTMS) over the right inferior frontal gyrus (RIFG) may experience persistent benefits in naming. We tested the hypothesis that the effects of TMS to the RIFG generalize to include spontaneous speech.

**Participants and Methods:** The subject was a 61-year-old right-handed man who had a left middle cerebral artery stroke seven years prior to this investigation. He had nonfluent aphasia with stable deficits of spontaneous speech documented by serial evaluation over five years with the Western Aphasia Battery (WAB). The subject received 1200 pulses of 1-Hz rTMS for 10 days to a site identified as optimally responsive to TMS with respect to naming ability. Evaluation using the Cookie Theft picture description task occurred at baseline and 2, 6, and 10 months after TMS. Post-TMS testing on the WAB occurred 10 months after stimulation.

**Results:** Significant improvement on the Cookie Theft picture description was demonstrated on several measures including the number of different nouns employed ( $t[2]=6.0, p=0.027$ ) and the mean length of utterances ( $t[17.2]=-2.328, p=0.032$ ). There was a strong correlation between performance and time for the number of narrative words uttered ( $r=.910, p=.030$ ) and the number of words used per sentence or topic comment ( $r=.982, p=.009$ ), indicating increasing improvement over time. There was significant improvement on the spontaneous speech subtest score of the WAB ( $t[2]=-5.5, p=0.032$ ).

**Conclusions:** The benefits of RIFG rTMS in patients with nonfluent aphasia may generalize beyond naming to include other aspects of language production.

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**E.M. HICKEY & J. SAUNDERS. Strength-based Rehabilitation for Adolescents with Chronic Acquired Brain Injury: Participant Profiles and program satisfaction.**

**Objective:** Adolescent survivors of acquired brain injury (ABI) often suffer devastating long-term psychosocial ramifications due to cognitive, communicative, physical, and behavioral deficits. While expert opinion about suggested intervention strategies is available, rigorous outcome measures for adolescents and a good understanding of their strengths and needs are nonavailable. This descriptive-exploratory study describes the social communication profiles of adolescents with chronic ABI, and to evaluate participants' and families' satisfaction with a social communication rehabilitation program.

**Participants and Methods:** Four adolescents with chronic behavioral and social communication challenges chose to participate in this study. They participated in a project-oriented, strength-based rehabilitation

program that met 10 times over two semesters. The intervention used art projects and community activities to target individual and group goals. Quantitative and qualitative data were collected to describe participants' self-awareness and social communication skills, as well as to evaluate the participants' and families' satisfaction with the program.

**Results:** There was significant variability across participants in cognitive and language profiles. All reported an increase in confidence in social situations. Results coincide strongly with the recommendations by Ylvisaker and Feeney (1998) that promote strength-based, project-oriented interventions. Art projects provided an excellent rehabilitation or learning tool, as well as a means for obtaining valuable information on self-perceptions of functioning and identity. Participants' responsibility for and ownership of the activities and projects was likely an essential element of the program.

**Conclusions:** A group profile of participants, program satisfaction, clinical quality of measures used, limitations of the study, and directions for future research are discussed.

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**R. KESSLER & T. GIOVANNETTI. Comparing Error Patterns on Two Different Versions of the Naturalistic Action Test.**

**Objective:** Strategic object placement is an effective way to reduce action errors in individuals with schizophrenia. However, it is unknown which specific errors are reduced by this intervention. This study compared the number of errors committed, and the error patterns demonstrated, when performing everyday tasks with and without strategic object placement.

**Participants and Methods:** Forty one individuals with schizophrenia were administered the Naturalistic Action Test (NAT) under two conditions: Standard (S-NAT) and User-Centered (U-NAT). In the U-NAT, all objects were placed on the tabletop in the order that they should be used. In the S-NAT, the objects were arranged randomly according to manual instructions. Errors were coded according to an established taxonomy which includes: omissions, sequencing errors, perseverations, substitutions, off-task behaviors, quality errors, and "other" errors. The numbers of errors committed on both versions of the NAT were compared using Wilcoxon Signed Ranks Tests. Error patterns were compared using Chi-square analyses.

**Results:** Only omissions were significantly reduced by the UC-NAT ( $Z = 2.65, p = .008$ ). However, chi-square analyses revealed that the error patterns for the two versions of the NAT were nearly identical, with the exception of a greater proportion of substitution errors on the S-NAT (17% versus 12%;  $X^2 = 3.76, p = .05$ ).

**Conclusions:** Environmental interventions appear to specifically target omissions, possibly by making task performance more streamlined and automatic. However, the specific decline in omissions did not markedly shift the distribution of errors when strategic object placement was employed. Thus, the user-centered intervention may address a wide variety of everyday action difficulties exhibited by people with schizophrenia.

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**D.M. LÓPEZ LOZANO. Neuropsychological Rehabilitation in a Case of Pure Alexia and Visual Search-field Disease.**

**Objective:** The main objective of this intervention was the rehabilitation of the reading ability and the visual search-field improvement.

**Participants and Methods:** In this work, the case of GEP is presented, a patient that as a consequence of a cerebral vascular hemorrhage infarct presented a right homonymous hemianopia, pure alexia and alteration of language.

The patient was evaluated before and after treatment with a neuropsychological examination of general cognitive function (Barcelona

Test); and reading deficit was evaluated on the basis of specific test (Dyslexias and Disgrafías test); stimulus of the test were not treated on therapy. Additionally a baseline was established for each phase of treatment. The rehabilitation program consisted of identify single letters, whole word, and sentences with a multisensorial and a phonemic segments method with repeated presentations using computer controlled devices that made each phonemes appear and disappear consequentially. At the same time the patients received training to improve visual search and reading strategies working on computer-based tasks.

**Results:** Post-assessment testing revealed that the program successfully increased accuracy and speed of reading.

**Conclusions:** This phonemes segmentation of the words method demonstrated to be effective; this process reached a generalization effect even in not worked words on therapy. Results corroborate to syllable like the sub-lexical unit determinant for the reading aloud.

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**J. MACSWEEN, V. GRUPPUSO & K.A. KERNS. Evaluation of a Computerized Attention Training Program in Children with Fetal Alcohol Spectrum Disorder (FASD): A Pilot Feasibility Study**

**Objective:** Deficits in attention and concentration are common in children with FASD. Given studies with demonstrated efficacy for attention training in children with ADHD and TBI, this type of intervention may be effective for children with FASD. However, this population often has difficulty accessing clinic-based services. This pilot study examined the feasibility of using computerized attention training materials (CPAT, Shalev et al, 2006) within a school program and evaluated the effectiveness of this training program for children with FASD.

**Participants and Methods:** Ten children with FASD ages 8-15 were included in the study. Pre-testing with measures of attention, working memory, and academic efficiency were completed. The CPAT intervention included 16 hours of training, delivered by a trained research assistant, 4 times weekly in 30 minute sessions. Post-testing was completed 2-3 weeks following intervention.

**Results:** This study demonstrated that providing a computer based intervention to FASD children was feasible within the school setting. Pre and post tests indicated statistically significant gains on several measures of distractibility, working memory, reaction time and academic efficiency, but not on all measures of attention and working memory. Parents' qualitative reports indicated improvements on several functional activities that have high attention demands.

**Conclusions:** Due to recruitment issues and subsequent lack of a control group, this study is only a pilot. The results do provide some support for attention training within the school as a feasible treatment vehicle for children for FASD. Future investigations should focus on controlling for practice effects and examining the long-term effects of such interventions.

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**E. MENDOZA-GONZALEZ & M. GONZÁLEZ RAMÍREZ. Mental imagery techniques in movement training of paretic superior limb.**

**Objective:** Motor performance in paretic patients has been commonly treated with traditional physical therapy that involves repetitions, passive flexion and extension exercises as well as occupational therapy once the patient can move the limb. A functional movement in daily life activities involves a purpose, a goal, a plan and mental representation or internal images, and finally a sensory input. In paretic patients these processes are disorganized or absent.

The present paper shows the effect of a variety of mental imagery methods in the daily living activities using the superior paretic limb.

**Participants and Methods:** After a base line measure, mental imagery techniques like guided imagination and other visual aids like mirror box were used in a 20 year old woman that suffered a hemorrhagic stroke in middle artery territory and had among other symptoms a right spastic hemiparesis and somesthetic disorders.

**Results:** Patient is still in treatment. This paper presents a partial analysis of her results using the techniques described previously that includes acquisition of basic movements like open and close hand, and more complex movements such as those involved in eating behavior, drinking and opening a door.

**Conclusion:** As a conclusion, the functionality of the movements acquired by the patient in her superior limb suggests that the use of techniques that involve restoring mental representations of movement would be a helpful tool in the complete rehabilitation process.

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**S. MEZA-CAVAZOS, R. SALINAS, R. BARBOSA & J.C. VALENZUELA. Memory Improvement Workshops in a Mexican Academic Geriatric Centre.**

**Objective:** To know the effects of the Memory Improvement Workshops in a Mexican elderly population.

**Participants and Methods:** In this study, there have been 35 participants involved within four Memory Improvement Workshops (MIW) (25.7% Male, 74.3% Female). Such study has been made according to the model from the Tallers de Millora de la Memòria (name in Catalan for the Memory Improvement Workshop) of the AVAN (Associació Vallès Amics de la Neurologia). The following scales and tests have been used: the Mini Mental State Examination (MMSE) for cognitive screening, the Geriatric Depression Scale (GDS-15), the Subjective Memory Complaints Questionnaire (Cuestionario de Quejas de Memoria; Maroto, 2001), and two Life Quality Scales (WHOQoL-BREF and EQ-5D).

This program is directed to people over 50 years old with subjective complaints of memory loss but not completed criteria for mild cognitive impairment or dementia. It is worked in groups structured on 12 sessions of an hour and a half once per week. Techniques for attention and memory function improvement are taught and trained during all the sessions.

**Results:** After reviewing the scores pre- and post- MIW, significant differences were found at the total scoring mean from the Subjective Memory Complaints Questionnaire ( $p=0.027$ ), describing how participants experienced less subjective memory complaints after workshops were finished. However, the scores at the Life Quality Scales were not significantly different (pre vs. post).

**Conclusions:** The obtained results show how training techniques and strategies for memory improvement decrease significantly subjective complaints for memory loss. This improvement is product of the increase of consciousness of the deficits and the usage of the mnemotechniques in the daily life.

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**P.A. PHILLIPS, A.Y. STRINGER, A. AMARANENI, K. SATHIAN & B.M. HAMPSTEAD. Explicit Memory Training Facilitates Learning and Retention of Object-Location Associations in Patients with Amnesic Mild Cognitive Impairment.**

**Objective:** We previously demonstrated that explicit memory training (EMT) can effectively improve memory for a large number of face-name associations in patients with amnesic mild cognitive impairment (aMCI) (Hampstead et al., 2008). Here, we present results from a randomized-controlled study wherein aMCI patients were assigned to either EMT ( $n=10$ ) or an exposure only group ( $n=11$ ). We predicted EMT would facilitate learning and memory more than exposure alone.

**Participants and Methods:** Patients received training on 45 object-location associations during three sessions (15 associations each session; 2.5-2.8 days between sessions). Associations were initially presented in small sets of 5 (SS) for 3 trials, followed by a 3 trial same day review of all 15 associations (SDR). Subsequent sessions began with a 3 trial review of the 15 associations from the previous session (Delayed review: DR). During each trial, participants were asked to recall the location of the object with corrective feedback provided as necessary. The EMT group also recalled mnemonic cues associated with each object-location association.

**Results:** The EMT group was significantly more accurate in recalling the location at each time point (all  $p < .05$ ). Specifically, EMT facilitated single trial learning as well as within session (SDR) retention. Between session retention (DR) tended to be better in the EMT group ( $p = .07$ ). Additionally, there was a strong relationship between memory for the location and the associated mnemonic cues in the EMT group (all  $p < .001$ ).

**Conclusions:** EMT is superior to exposure-based training in patients with aMCI. These findings increase our knowledge about the conditions under which EMT is effective in aMCI.

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### L.J. RITCHIE & S.L. CARTER. A Case Study of Goal Management Training in an Inpatient Rehabilitation Setting Following ACoA Aneurysm Rupture.

**Objective:** Studies evaluating formal interventions for “goal neglect” (i.e., Goal Management Training [GMT]) are generally restricted to high functioning, community dwelling individuals, limiting their utility for clinicians working in inpatient settings. Our objective was to investigate the feasibility of cognitive training based on the GMT model (Levine et al. [2000]) in an inpatient rehabilitation setting. We report cognitive, emotional, and functional outcomes for an inpatient treated with a GMT-based intervention program.

**Participants and Methods:** A 49-year-old, right-handed Caucasian woman 9 months post Grade 4 subarachnoid hemorrhage secondary to a ruptured left anterior communicating artery aneurysm completed a neuropsychological evaluation and standardized pre- and post-treatment assessments of behavioral memory, executive functioning, and frontal systems behavioral syndromes. Intervention consisted of 18 one-hour intervention sessions emphasizing compensatory strategies for executive dysfunction (GMT), memory (daytimer), and emotional lability (relaxation training).

**Results:** The neuropsychological profile revealed low average general intellectual functioning, diminished self-monitoring, severe learning and memory impairment, and variable working memory and executive skills. Social and emotional disinhibitions were prominent. After treatment, she was unable to independently implement all GMT stages without prompting. Despite an absence of clinically meaningful improvement in memory and executive function post-treatment, improved mood coincided with fewer self-reported cognitive, physical, and psychological symptoms. Memory aids proved useful in managing memory deficits.

**Conclusions:** Successful use of GMT training with prompting was achieved, supporting previous findings of improved goal neglect with verbal prompting. Outcomes were consistent with reports of improved emotional control and subjective view of improved cognitive functioning following GMT.

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### J. AZULAY, C.M. SMART, T. MOTT & K.D. CICERONE. An Open Trial of Mindfulness-Based Stress Reduction for Individuals with Mild Traumatic Brain Injury/Post-Concussive Syndrome.

**Objective:** Of the 1.4 million traumatic brain injuries (TBI) sustained in the U.S. each year, approximately 75% of those are considered to be

mild (mTBI). While most mTBI symptoms resolve quickly, a significant minority of individuals have persistent symptoms, referred to as post-concussive syndrome (PCS). These symptoms include cognitive and emotional dyscontrol that can often be quite treatment-resistant. Mindfulness meditation has already been demonstrated to reduce affective distress including depression and anxiety, and has been shown to improve attention in healthy adepts. As such, the aim of the current pilot study was to ascertain whether mindfulness-based stress reduction (MBSR) could reduce cognitive and neurobehavioral symptoms in individuals with PCS.

**Participants and Methods:** Eighteen individuals with PCS were consecutively enrolled in MBSR groups. Groups were run following as closely as possible to Kabat-Zinn’s MBSR model, involving 9 weekly 1-hour sessions with a half-day intensive at week 8. Participants were introduced to several practices including body-scan and sitting meditation and gentle yoga. Participants underwent brief attention and memory testing, in addition to completing self-report measures, at baseline and immediately post-intervention.

**Results:** Program participants showed a significant increase in self-efficacy ( $t = -4.0$ ,  $p < .01$ ), perceived quality of life ( $t = -2.7$ ,  $p < .05$ ) and new learning on the CVLT-II ( $t = -2.7$ ,  $p < .05$ ) from baseline to post-intervention.

**Conclusions:** This open trial of MBSR for PCS demonstrates encouraging findings regarding symptom reduction. Implications for future research and clinical applications are discussed, including tailoring of the treatment for a brain-injured population.

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### J.F. SUMOWSKI, H. WOOD, N. CHIARAVALLOTTI & J. DELUCA. Retrieval Practice Improves Memory in Persons with Traumatic Brain Injury.

**Objective:** Memory dysfunction is common across neurologic diseases, including Traumatic Brain Injury (TBI). Despite this, literature on memory rehabilitation remains sparse and underdeveloped. The ‘testing effect’ is a robust cognitive phenomenon whereby retrieval practice (i.e., testing) during encoding leads to greater delayed memory than massed or spaced restudy (i.e., reexposure). This has been demonstrated in healthy undergraduates (e.g., Karpicke & Roediger, 2008) and persons with Multiple Sclerosis (Sumowski et al., in press), but not in persons with TBI. This study investigated whether retrieval practice improves memory in persons with TBI.

**Participants and Methods:** Twelve persons with a history of TBI participated (Median: Age = 36; Education = 14; Years since TBI = 5.9). Objective memory functioning of the sample was severely impaired (CVLT-II LDFR Median Z = -3.0). In a within-subjects design, subjects were asked to learn 48 verbal paired-associates across three learning conditions: 16 massed restudy, 16 spaced restudy, and 16 retrieval practice (i.e., spaced testing). The dependent variable was delayed cued recall after 45 minutes.

**Results:** There was a large effect of learning condition ( $F = 5.8$ ,  $p < .01$ ,  $\eta^2 = .35$ ), such that retrieval practice ( $M = 5.8$ ) resulted in greater recall than massed restudy ( $M = 3.3$ ,  $p < .01$ ). In contrast, spaced restudy ( $M = 4.0$ ) was not reliably better than massed restudy ( $p > .10$ ).

**Conclusions:** Retrieval practice during encoding produced the best memory functioning, and may represent a useful mnemonic among persons with TBI-related memory impairment. Results have important implications for memory rehabilitation research.

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A. VAN DEUSEN & A.M. DIAS. Improved EEG Neurofeedback Protocol for the Treatment of Major Depression.  
**Objective:** Major depression is the most prevalent psychiatric disorder of the world, affecting ~ 10% of the world’s population. Currently, there

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are several studies suggesting the strategic use of EEG neurofeedback as a complementary therapy for the disorder. The current literature on neurofeedback protocols for depression comprises three different protocols: Alpha waves interhemispheric asymmetry, reduction of high Beta (Beta-3) ratios, and increase in low Beta/Theta ratio. Unfortunately, these protocols are sold by practitioner and companies, and there are no courses teaching how to build them. Objective: We aim to introduce a new neurofeedback protocol that integrates these three protocols, as well as to present the basic principles of an intuitive programming language that can be used to create new protocols.

**Participants and Methods:** The new program/protocol was developed in Bioexplorer, which allows the organization of complex digital signal algorithms in flowcharts. It can be used with several types of oscilloscopes.

**Results:** The proposed integration is based on the association between each of the original protocols (Alpha asymmetry  $\uparrow$ , Beta-3  $\downarrow$  and Beta/Theta  $\uparrow$ ) with a specific type of feedback on a video-game based task. In order to present a comprehensive picture of the programming groundwork, the flow chart that implements this new protocol is presented (signal diagram), so that each of the basic protocols can considered in light of the complex associations that were designed.

**Conclusions:** We show how to create a neurofeedback protocol without prior programming knowledge.

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#### **D. VANCE, J. MARCEAUX & P.L. FAZELI. Improving Speed of Processing in Adults Aging with HIV: A Pilot Study.**

**Objective:** Speed of processing (SOP) decreases as a normal part of aging, affecting performance on neuropsychological measures. Within HIV, there are SOP declines independent of aging. Previous studies of SOP training have been effective at increasing processing in nonpathological older adults (Ball et al., 2002). The purpose of the current study is to evaluate SOP training among HIV-positive adults and examine its affect on SOP.

**Participants and Methods:** Twenty-six adults with HIV (26-70 years old; mean age = 46.27 (SD = 9.14)) were assigned to either no-contact control (n = 9) or SOP training groups (n=17). Pre-test assessment included background/covariate information in addition to the Useful Field of View (UFOV®), a measure of processing speed and attention. Using the Posit Science Insight software, the SOP training group completed 10 hours of self-administered training. Post-test assessment was conducted 4 to 6 weeks following training. Intent-to-treat analyses were used to examine the effects of SOP training.

**Results:** Those in the SOP training group had significantly greater improvement in UFOV® scores (M = 209.65 milliseconds (ms), SD = 161.11) than the control group (M = 14.67 ms, SD = 189.08),  $F(1,25) = 7.66$ ,  $p = .01$ . While older adults typically performed worse on the UFOV® ( $r = .33$ ,  $p = .02$ ), this was not significantly related to treatment gains ( $r = .22$ ,  $p = .40$ ).

**Conclusions:** Results suggest that SOP training is effective in adults with HIV, regardless of age. This is an important preliminary finding, given that SOP underlies other cognitive and functional abilities and it is responsive to intervention. Future studies should examine factors maximizing durability of treatment gains.

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#### **A. WELFRINGER, G. LEIFERT-FIEBACH, R. BABINSKY & T. BRANDT. Visuomotor Imagery in Chronic Neglect Patients.**

**Objective:** A new approach in neuropsychological therapy involving visuomotor imagery techniques for the treatment of visuospatial and representational neglect symptoms is evaluated.

**Participants and Methods:** Ten chronic neglect patients absolved a four weeks' imagery intervention based on the mental practice of posi-

tions and movements of the contralesional upper limb during half-hour sessions twice a day. Feasibility was assessed using verbal feedback protocols, electromyographic recordings and an extensive neuropsychological test battery at four measuring times within a baseline design. After the intervention period, every patient received a CD with imagery instructions for individual home training, which was evaluated by a telephone interview.

**Results:** Therapy protocols revealed high compliance and various subjective gains in the awareness of their left side. Kinaesthetic imagery was accompanied by sensations and muscular activity. All patients were able to perform visuomotor imagery and evaluated the therapy as highly beneficial. One patient regained arm functions after three years of non-use. Depressive moods interfered with therapy effects. Outcome measures showed significant improvements in letter cancellation ( $t=4.69$ ,  $p=.01$ ), star cancellation ( $t=3.33$ ,  $p=.01$ ) and kinaesthetic imagery tasks ( $t=-4.98$ ,  $p=.01$ ). Patients evaluated the individual training with CD as less exertive and intense than with personal assistance.

**Conclusions:** Visuomotor imagery is a feasible practice for neglect patients. Functional improvements are possible even in a chronic state. In a therapeutic setting, detailed instructions and a first person perspective are appropriate for kinaesthetic imagery including the mental manipulation of a neglected/hemiparetic upper limb. Future research is warranted to better specify in-/exclusion patient criteria and examine the underlying mechanisms of visuomotor imagery. **Support:** Dietmar Hopp Stiftung, Luxemburg's National Research Fund

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### **Stroke/Aneurysm**

#### **A.N. CERNICH, M. DUX, S. FOSTER, R.L. KANE, G. WITTENBERG & R.F. MACKO. Initial Findings from a Controlled Trial of Aerobic Exercise to Effect Cognition in the Chronic Stroke Population.**

**Objective:** Engaging in exercise has been shown to affect attention, working memory, and executive function across studies in the aging population and emerging evidence demonstrates potential effects of exercise to enable neuroplasticity and neuroprotection. The objective of this study is to extend those findings to the chronic stroke population. We hypothesized that aerobic exercise would improve cognitive function, specifically aspects of working memory and executive function.

**Participants and Methods:** Participants were at least 6 months post-stroke and had chronic hemiparesis (N=11; 64% male; mean age=63; 55% Caucasian, 36% African-American, 9% Hispanic). Stroke location varied in the sample; all participants had normal mental status at baseline (MMSE corrected for age and education). The exercise protocol included treadmill walking (3 times per week, 1/2 hour per session) for a total of 6 months. Participants were administered a battery of measures before and after the 6-month exercise intervention that included cognitive tests; alternate forms of measures were used where possible.

**Results:** Initial results from 11 participants indicate a significant improvement on a list-learning task using a Wilcoxon signed-rank statistic (RBANS List learning,  $z=-2.04$ ,  $p<.05$ ). Trends were noted on a phonemic fluency task and the Working Memory Index from the WAIS-III.

**Conclusions:** Initial findings suggest that aerobic exercise improves cognitive function after stroke. Future studies will determine the impact of exercise interventions on specific tests of neuroplasticity and motor learning. Research was supported by the Department of Veteran's Affairs, Veteran's Health Administration, Rehabilitation Research and Development Service, Alison Cernich, Ph.D., Career Development Awardee, VAMHCS, Baltimore, MD.

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**C.A. HAJEK, K.O. YEATES, V. ANDERSON, M. MACKAY & W. I.O. Cognitive Outcomes Following Ischemic Stroke in Children.**

**Objective:** To investigate the cognitive outcomes of children with ischemic strokes, and to determine whether a relationship exists between neurological status and cognitive outcomes.

**Participants and Methods:** Participants included 30 children with ischemic stroke, which occurred from the perinatal period to childhood but at least 1 year prior to assessment. A comparison group of 12 children with asthma were included to control for acute medical illness requiring hospital admission. Participants ranged from 6-12 years of age at the time of the study. Children completed measures of general cognitive ability, attention and executive functions, and processing speed. Children also were assessed using the Pediatric Stroke Outcome Measure (PSOM), a standardized assessment of neurological function.

**Results:** Mean cognitive scores fell within the average range for both groups. Compared to children with asthma, children with stroke performed significantly worse on a measure of processing speed. Group differences for the remaining cognitive measures were in the same direction but did not reach statistical significance. The PSOM total severity score was significantly negatively correlated with scores on measures of general cognitive ability and cognitive-executive functions, but not processing speed; greater neurological impairment was associated with poorer cognitive functioning.

**Conclusions:** Results suggest that following ischemic stroke, children perform more poorly on measures of processing speed than children with chronic medical illnesses that do not affect neurological functioning. In the stroke group, overall neurological status is strongly related to general cognitive ability, as well as attention and executive functions.

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**S. HEVERLY-FITT, T.F. FLOYD, E. STAMBROOK, A.C. LYON, O. SELNES, S. RATCLIFFE & T. GIOVANNETTI. The Effect of Aortic Valve Replacement Surgery on Cognitive Functioning: Prospective Neuropsychological Comparison to Disease-Matched Controls.**

**Objective:** Aortic valve replacement (AVR) surgery may impact cognition via embolic or more occult pathophysiological processes. This prospective longitudinal study compared the effect of AVR on cognition with that of a disease-matched control group, employing a comprehensive neuropsychological protocol scored by raters blinded to group membership.

**Participants and Methods:** Sixty older adults (n = 21 AVR group; n = 39 disease-matched control group) were administered a neuropsychological protocol before surgery (Baseline) and again after 4-6 weeks (Time 2). Participants with a history of recent stroke, TIA or addiction, and any history of mental illness were excluded from the study.

**Results:** The groups did not differ in age, education, premorbid IQ, or baseline MMSE. A significant Group x Time interaction was observed for two measures of executive control (Mental control,  $p = .01$ ; Trails B -  $p = .04$ ). The AVR group showed a tendency for lower performance at Time 2; however, post hoc comparisons were nonsignificant. A main effect for Time was noted for measures of episodic memory and naming, with both groups showing improvement at Time 2 (HVLT delay -  $p < .01$ ; Rey Osterrieth Complex Figure Delay -  $p < .01$ ; BNT-  $p < .01$ ). There were no significant changes in performance on tests of visuospatial processing (JOLO), verbal fluency (FAS, Animals) or attention/processing speed (Digit Span/Digit Symbol).

**Conclusions:** Individuals who undergo AVR do not exhibit marked cognitive decline after surgery. However, AVR may place individuals at higher risk for postoperative deficits in executive control. Ongoing follow-up study will determine whether these preliminary results remain stable with a larger sample size.

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**C. HSU, K. HUANG, M. HO, T. LEE, H. LIU, Y. CHANG, S. RYU & T. CHANG. The Effects of Carotid Artery Stenting on Neuropsychological Performance in Taiwanese Male Samples: A Preliminary Study.**

**Objective:** The carotid artery stenting (CAS) is believed to be less invasive than the carotid endarterectomy in treating carotid artery stenosis. However, the beneficial effects of the CAS on neuropsychological functions have been controversial. The present study aimed to examine if any improvement in neuropsychological performance can be detected following the CAS.

**Participants and Methods:** Thirty-seven male patients with carotid artery diseases were recruited. Twenty patients (age:  $M = 67.45$ ,  $SD = 7.84$ ) underwent the CAS. A comprehensive neuropsychological battery was administered before and 6 months after the CAS. Seventeen patients (age:  $M = 68.18$ ,  $SD = 8.33$ ) without having the CAS served as the control group. They also underwent the same assessment twice with 6 months apart. The testing data were analyzed by two way (group x phase) ANOVA with repeated measures on the latter factor.

**Results:** The results did not reveal significant changes on most neuropsychological measures for both groups. However, the narrative recall performance appeared to enhance more evidently in the CAS group, as being reflected by a significant main effect of phase,  $F(1, 33) = 8.90$ ,  $p < .01$ , and a significant interaction,  $F(1, 33) = 4.49$ ,  $p < .04$ . In addition, the CAS group also seemed less vulnerable to retroactive interference effects on a word-list learning test,  $F(1, 33) = 6.73$ ,  $p = .01$ .

**Conclusions:** Although the results of this preliminary study suggest the CAS may have some beneficial effects on verbal memory, they also indicate most conventional neuropsychological measures are perhaps not sensitive enough to detect any subtle cognitive changes.

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**C.A. SCOTT, L.J. RAPPORT, R. COLEMAN BRYER, J. PELLERITO, J.A. GRIFFEN, L. BIELIAUSKAS & R. WHITMAN. Awareness of Deficit and Driving Simulator Performance after Stroke.**

**Objective:** To examine stroke survivors' awareness of deficit and its correlates to predictions and performance on a driving simulator.

**Participants and Methods:** Fifty-three stroke survivors completed a driving evaluation. Outcome measures included predicted and actual performance on a driving simulator evaluation and a modified Biber Cognitive Estimation Test. Survivors nominated a significant other to serve as a knowledgeable informant about their abilities. Awareness of deficit was assessed via survivor-significant other difference scores on the Awareness Questionnaire.

**Results:** Unawareness of cognitive and motor/sensory deficits predicted poor performance on the driving simulator, whereas unawareness of behavioral/emotional deficits was unrelated. Awareness of deficit moderated the accuracy of survivors' self-evaluations of their simulator performance (predicted and actual): Among survivors aware of their deficits, simulator prediction and postdiction scores were modestly related to actual simulator performance; among survivors unaware of their deficits, only postdiction correlated with simulator performance. General cognitive estimation skills were positively correlated with prediction of performance on the simulator in both the aware and unaware survivor groups, with stronger prediction for the unaware participants. However, cognitive estimation scores were not related to the accuracy of self-evaluations of driving skills on the simulator.

**Conclusions:** Stroke survivors who overestimated their cognitive and motor/sensory abilities made less accurate estimates of their driving ability and performed worse in a driving simulator than did survivors who were aware of their deficits; however, the accuracy of their self-ratings improved significantly after the simulator evaluation. The driving simulator may be a useful tool in raising survivors' awareness of their deficits as it relates to driving ability.

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**J. SZAFIARSKI, J. VANNEST, A. BALL, C. BANKS, S. PAGE, J. ALLENDORFER, K. EATON & S. HOLLAND. Post-stroke aphasia recovery assessment in chronic stroke using repetitive fMRI and picture naming test.**

**Objective:** To evaluate the patterns of post-stroke language recovery using fMRI at 4T and a picture naming task.

**Participants and Methods:** 4 healthy and 4 left MCA stroke subjects with chronic (>1 year) aphasia. Ten fMRI scans were performed for each subject over a ten-week period using a picture naming task. Active condition involved presenting subjects with a panel of 4 figures (e.g., drawings of 4 animals) every 6 seconds; subjects indicated which figure matched the written name in the center. Control condition was same/different judgment task of pairs of geometric figures (squares, octagons or combination) presented every 6 seconds. Thirty seconds active/control blocks were repeated 5 times each; responses were recorded.

**Results:** Patients and controls had similar demographic characteristics: age (46 vs. 53;  $p=0.39$ ), personal handedness (EHI; 89 vs. 95;  $p=0.13$ ), familial handedness (93 vs. 95;  $p=0.52$ ) or years of education (14.3 vs. 14.8;  $p=0.6$ ). Patients presented with apraxia of speech, mixed, thalamic and Broca's aphasia. For the active condition, controls performed better than patients (97.7% vs. 89.1%,  $p<0.001$ ); performance was similar for the control condition (99.5% vs. 98.8%,  $p=0.23$ ). fMRI: controls showed bilateral, L>R increases in BOLD contrast in frontal and temporal language areas and symmetric retro-splenial and posterior cingulate areas and symmetric deactivations in bilateral fronto-temporal language networks. Patients showed different activation patterns with BOLD signal increases seen predominantly in peristroke areas and minimal activations noted in non-dominant (right) hemisphere.

**Conclusions:** This study reinforces the notion that adult stroke patients require functional peristroke areas to perform language functions. This pattern is different from the stroke recovery pattern observed in children with perinatal and early postnatal stroke.

This study was supported in part by a grant from The Neuroscience Institute in Cincinnati (JPS), OH and in part by R01 NS048281 (JPS)

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**M.W. VAN RIJSBERGEN, R.E. NIEUWENHUIS-MARK, P.L. DE KORT, R.W. PONDS & M.M. SITSKOORN. Cognitive Complaints after Stroke: No Differences with the Healthy Population.**

**Objective:** While subjective cognitive complaints are common after stroke, little is known about how these differ in their prevalence and profile in daily life from healthy controls. The present study is the first which aimed to explore this in detail.

**Participants and Methods:** The current study is part of a larger project, the so called CompAS (Complaints After Stroke) study. In a case-control matched design, 72 ischemic stroke patients in the early phase (three months post-stroke), who were living at home were compared to 72 healthy controls on total scores, subscales and individual items of the Cognitive Failures Questionnaire (CFQ).

**Results:** Between group differences were assessed using paired samples t-tests and McNemar tests. No significant differences were found between patients and controls on CFQ total scores: cognitive complaints were experienced infrequently in daily life. On the subscales, the profile was the same for both groups. The highest scores were seen on the subscale 'forgetfulness', followed by 'distractibility', while the lowest were found on 'false triggering'. Patients however, reported a larger increase in incidence of complaints during the past five years than controls ( $p=0.01$ ). At the item level, only item 24 (drop things) differed between the groups: patients reported dropping things more than controls did ( $p=0.001$ ).

**Conclusions:** We found no evidence that subjective cognitive complaints of home-living patients three months after stroke deviate in prevalence or profile from the healthy population. Patients however experienced a larger increase in incidence of complaints and more clumsiness than controls did. Our results suggest that clinicians can reassure patients eval-

uated three months after their strokes that their complaints do not differ from those reported in the general population. Follow-up remains important however as the time course of complaints is largely unknown. We aim to investigate how complaints change over time in the stroke population as part of the ongoing CompAS-study.

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## TBI (Adult)

**J.C. ARANGO, M.C. QUIJANO, M. APONTE, A. RINCON, M. CUERVO & H. ROGERS. Neuropsychological and neurobehavioral profile of a group of individuals with Traumatic Brain Injury from Colombia, South America.**

**Objective:** The objective of the present study was to determine the neuropsychological and neurobehavioral functioning of a group of individuals with TBI in Cali, Colombia.

**Participants and Methods:** A neuropsychologist administered a comprehensive neuropsychological evaluation (NEUROPSI) and the Spanish-language version of the Neurobehavioral Functional Inventory (NFI) to 30 individuals with TBI from Valle University Hospital and 30 healthy controls. The patient group was 73% male with a mean age of 34.0 (11.1). The individuals with TBI had had TBI for 32.6 months (56.47) and had a mean GCS of 10.0 (3.3) upon hospitalization.

**Results:** Compared to controls, the patients performed significantly worse on the backward digit test, short- and long-term verbal memory, and semantic and phonologic verbal fluency. 40% of individuals with TBI had cognitive deficits compared to published norms for Spanish-speaking individuals. The patients also scored significantly lower than controls on four subscales of the NFI: depression, somatic symptoms, attention and memory, and communication problems. There were no significant differences between patients and controls in aggression or motor functioning. 40% of patients reported symptoms of depression, 40% reported memory/attention problems, 27% indicated having communication problems, 17% had somatic problems, 17% reported aggression, and 17% had motor problems.

**Conclusions:** Effective cognitive rehabilitation programs in Spanish are needed to improve attention, memory, and language deficits post-TBI. Furthermore, cognitive behavioral intervention targeting depressive and somatic symptoms as well as communication problems may improve quality of life in Colombian individuals with TBI.

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**S.B. ASMUSSEN & C. BOYD. Mild Traumatic Brain Injury: Personality Assessment in the Military Population.**

**Objective:** To examine the Personality Assessment Inventory (PAI) in a group of service members (SMs) with a history of mild Traumatic Brain Injury (TBI). To compare profiles on the Personality Assessment Inventory (PAI) in SMs with a history of TBI age 18-21 (likely in their first enlistment) to SMs age 22+.

**Participants and Methods:** Ninety-nine SMs with a history of TBI were examined (Mean age=26). A t-test examined SMs age 18-21 to SMs age 22+ on the PAI. PAI profiles were examined for each group.

**Results:** (1) Noted subscale elevations for the overall group were Thought Disorder (SCZ-T), Traumatic Stress (ARD-T), and Physiological Depression (DEP-P). (2) SMs age 22+ endorsed symptoms related to Persecution, Phobias, and Affective Anxiety at a higher rate than SMs age 18-21 (approaching clinical significance). (3) Profiles: SMs age 22+ endorsed 14 PAI scales at  $T>70$  (clinically elevated) and SMs age 18-21 endorsed 6 PAI scales at  $T>70$ .

**Conclusions:** The PAI is a face valid measure which highlights Axis-I psychopathology. When examining SMs who sustained a TBI, symptoms associated with SCZ-T, ARD-T, and DEP-P were elevated. SMs

age 22+ elevated several subscales compared to SMs age 18-21. Both groups endorsed multiple PAI scales at/above clinical level. The PAI may assist with understanding psychopathology in SMs with a history of TBI, at various ages, to guide in the establishment of effective psychotherapeutic treatment. Further evaluation (e.g., MANOVAs) will include analysis of comorbid factors (e.g., PTSD diagnosis, number of deployments).

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**J.H. BANOS, D.C. KNIGHT, D. LABBE & T.A. NOVACK. Impact of Traumatic Brain Injury on Ratings of Emotion-Invoking Photographs: Preliminary Data.**

**Objective:** Preliminary case series data are reported from a pilot study examining ratings of emotion-invoking photographs by individuals with moderate to severe traumatic brain injury (TBI).

**Participants and Methods:** Photographs were drawn from the International Affective Picture System (IAPS), focusing on the dimensions of affective valence (pleasant-unpleasant) and arousal (calming-exciting). Forty-five images from categories reflecting moderately pleasant to moderately unpleasant affective valence (holding arousal constant), and moderately high to moderately low arousal (holding affective valence constant) were presented in one of four random orders to individuals with TBI recruited at a rehabilitation hospital. Ratings were obtained using an adaptation of the original IAPS normative procedures. Nine reliability items were included. Additional clinical data included behavioral ratings using the Frontal System Behavioral Scale (FrSBe). Case series data are presented for four inpatients (ages 20-46 years, 41-49 days post-injury) and one outpatient (age 22, 102 days post-injury) with TBI. Initial examination focuses on the participants' ability to reliably distinguish the dimensions, and the relationship of their ratings to normative and clinical data.

**Results:** Only one inpatient showed a significant correlation between dimensions (suggesting difficulty differentiating dimensions). Affective valence was rated most reliably. Arousal ratings were less stable and tended to be elevated relative to normative ratings.

**Conclusions:** Although findings may be due to cognitive deficits or failure to understand the arousal dimension, they may reflect more erratic (and elevated) arousal to stimuli in this population. Scatterplots suggest a stronger relationship between arousal ratings and the FrSBe Disinhibition scale (compared to Apathy or Executive Dysfunction) among inpatients.

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**S. BELKONEN, S. SEROVA, C. HIRSHSON, J. CANTOR & T. TSAOUSIDES. The Relationship Between Performance on Neuropsychological Tests of Memory and Self-Reported Memory Difficulties in Older Adults with Traumatic Brain Injury (TBI).**

**Objective:** To examine the relationship between memory difficulties measured by neuropsychological tests and by subjective reports in older adults with and without TBI.

**Participants and Methods:** 122 older adults (age > 55, 31 with mild TBI, 33 with moderate/severe TBI, 58 with no TBI) were recruited at a large urban medical center. Participants completed several memory tests, including the CVLT-II Short and Long Delay Free Recall, WMS-III Logical Memory and WMS-III Visual Reproduction subtests. They also completed a 48-item cognitive symptom checklist. Five neuropsychologists with TBI expertise were asked to independently classify each symptom according to whether or not it assessed memory function. Using a .80 interrater-reliability cut-off, 12 "memory symptoms" were identified and were used to create the self-reported memory score.

**Results:** Correlations between z scores on each memory test and the total score on the cognitive-symptom checklist were computed, with no significant findings. Subsequently, correlations were conducted between the self-reported memory score and each memory test. After Bonferroni corrections, no significant correlations were found.

**Conclusions:** These results suggest that memory difficulties, as measured by neuropsychological testing, may not be related to checklist self-report of cognitive symptoms or memory symptoms for older adults with and without TBI, despite evidence for such a relationship in younger adults with TBI. Future studies may require the use of factor analysis (rather than expert ratings) to better understand potential relationships between self-reported cognitive difficulties and objectively measured neuropsychological function.

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**L.A. BIELIAUSKAS, R.J. SPENCER, L.L. DRAG, P.H. PANGILINAN & S.L. GAJEWSKI. Enough is Enough: Minimizing Redundancy When Assessing Emotional Function in Veterans with Traumatic Brain Injury.**

**Objective:** Structured self-report questionnaires are typically used in the assessment of anxiety and depression. This study examined the correspondence between single items in which patients quantified their depression and anxiety, with scores on a lengthier questionnaire of these symptoms.

**Participants and Methods:** Data were collected from 183 veterans seen in a traumatic brain injury (TBI) clinic. Participants quantified their anxiety and depression on 5-point scales corresponding to "none," "mild," "moderate," "severe," and "very severe." The items were "feeling anxious or tense" and "feeling depressed or sad." These responses were compared to scores from the Hospital Anxiety and Depression Scale (HADS), a 14-item instrument that quantifies the severity of depression and anxiety.

**Results:** Among patients who reported "severe" or "very severe" anxiety, 96% scored in the clinically significant range on the HADS-Anxiety scale (16% mild, 28% moderate and 52% severe). Of those who characterized their anxiety as "moderate," "mild," and "none," 49%, 19%, and 10% scored in at least the moderate range on the HADS. Among patients who reported "very severe" depression, 94% scored in the clinically significant range on the HADS-Depression scale (19% mild, 47% moderate and 28% severe). Of those who characterized their depression as "severe," "moderate," "mild," and "none," 34%, 26%, 16%, and 3% scored in at least the moderate range on the HADS.

**Conclusions:** Patients self-report of severe symptoms of depression and anxiety correspond closely to longer questionnaires, which may be unnecessary in screening.

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**F. BINEY, K.M. O'DELL & H.J. HANNAY. The Relationship Between BAL and Outcome at 6 Months Post Injury in Severe TBI Adults: Effects of Best Day 1 GCS and Age.**

**Objective:** Most studies examining the relationship between blood alcohol level (BAL) and TBI outcome control for injury severity using EC admission GCS, which is itself affected by BAL (Labi, et al., 2003; Turner, et al., 2006). The current study reexamined the relationship using Best Day 1 GCS as the injury severity measure. Patients with higher admission BALs and age were expected to have poorer outcome reflected by higher Disability Rating Scale (DRS) scores.

**Participants and Methods:** A sample of 283 consecutively admitted male severe TBI patients was tested for BAL upon admission to a Level 1 trauma center. The sample was divided into groups based on BAL (0-.001-.08, and .081-.48 mg/dL) and age (18-29, 30-39, 40-49, 50+). A 6 month post injury DRS score was determined.

**Results:** Data were analyzed using a 2 way ANCOVA. BAL group and age group were independent variables, and Best Day 1 GCS score was the covariate. The dependent measure was DRS score at 6 months post injury. The main effect of BAL group was non-significant. The main effect of age was significant. The BAL by age group interaction was not significant. Best Day 1 GCS score was highly related to the 6 month DRS score.

**Conclusions:** In our sample, BAL at admission was not related to long term outcome. Consistent with the literature, injury severity accounted for most of the variability in outcome, followed by age. (Thatcher, et al., 1991; Cifu, et al., 1997).

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#### **K.S. CHIOU, B.M. WARDECKER & F.G. HILLARY. Effects of Task Structure on Metacognition in Traumatic Brain Injury.**

**Objective:** Metacognition is a higher order process that involves the ability to reflect on cognitive abilities. Past research has demonstrated that task structure may affect self-regulatory processes and new learning. Well structured (WS) tasks often contain the presence of a linear, hierarchical routine, while ill structured (IS) tasks are more ambiguous and do not provide an obvious problem solving algorithm. Traditionally, WS tasks have been associated with greater awareness of performance; however, it is unclear if task structure has the same influence on metacognition after neurological injury. This study investigates the effect of task structure on metacognitive accuracy in adults with moderate to severe traumatic brain injury (TBI).

**Participants and Methods:** 17 adults with moderate to severe TBI and 20 healthy adults were administered a modified form of the Matrix Reasoning subtest from the WAIS-III. The subtest was modified by dividing the stimulus into two sets, a "WS" procedure where the difficulty of the items progressed linearly, and an "IS" procedure where the order of item difficulty was presented randomly. Retrospective confidence judgments with respect to performance were collected after each item.

**Results:** Results from the ANOVA reveal that the type of task structure used had a significant main effect on metacognitive accuracy ( $F(1, 68)=18.9, p=0.000$ ). Additionally, an independent samples t-test revealed that healthy adults had more accurate metacognitive judgments during the WS manipulation.

**Conclusions:** Results indicate that individuals with TBI showed greater task accuracy in the WS condition compared to the IS condition. However, healthy adults benefitted more from the WS manipulation than adults with TBI.

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#### **A. CLARK, L. OZEN, M. FERNANDES & E. ROY. Measuring Attention Impairments in Mild Head Injury.**

**Objective:** Repetitive tasks with minimal stimulation require considerable sustained attention and people who have experienced a head injury tend to find such tasks especially difficult. While traditional neuropsychological assessments often fail to identify attention impairments in this population, Robertson and colleagues (1997) reported that compared to controls, those with a head injury made more errors and responded slower on the Sustained Attention to Response Task (SART). Unlike previous studies of brain injury that used the SART, we were interested in measuring attention impairments in a mildly brain injured population.

**Participants and Methods:** We had 27 healthy young adults and 15 young adults, who had sustained a mild head injury (MHI), complete the SART which requires participants to refrain from responding to an infrequent target (the digit 3) in a series of distracter digits.

**Results:** Surprisingly, MHI participants did not differ from controls in the number of inhibition errors committed (when the participant erro-

neously responded to the infrequent target). However, MHI participants did respond significantly slower than controls on trials in which an error was made ( $t(40) = -2.59, p = 0.013$ ). We also compared response times on trials leading up to and following target trials where the participants either correctly inhibited their response or made an error. While control participants responded more slowly on trials leading up to a correctly inhibited trial than an error trial, this slowing was especially pronounced in the MHI participants.

**Conclusions:** Taken together, our results suggest that accuracy on the SART is not a sensitive enough measure to dissociate healthy controls from MHI participants. Instead, when investigating MHI, evidence of persistent attention impairments may only be found when assessing response times, information processing speed and patterns of responding. Correspondence: *Amanda Clark, Psychology, University of Waterloo, 200 University Ave. W., Waterloo, ON N2L 3G1, Canada. E-mail: aclark@uwaterloo.ca*

#### **J.A. CLARK, A.L. SHANDERA, J.P. HARP, R.E. SCHLEENBAKER & W.M. HIGH. Neuropsychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.**

**Objective:** The purpose of this study was to determine whether there is a persistent effect of mTBI on the neuropsychological profile of mTBI veterans over and above the effect of PTSD. It was hypothesized that veterans who experienced mTBI with loss of consciousness (LOC) would perform more poorly than those who experienced mTBI with only alteration of consciousness (AOC) on tests of executive functioning after controlling for PTSD symptoms.

**Participants and Methods:** Thirty-nine recent combat veterans were referred for neuropsychological evaluation following possible mTBI and combat-related stress. Of these, 14 were excluded from analyses because they lacked evidence of brain injury (6) or failed malingering tests (10). The remaining 25 veterans (25 Caucasian, 23 male) completed an extensive clinical interview, a battery of neuropsychological tests, emotional/behavioral measures, and a PTSD screen.

**Results:** T-tests indicated those who experienced mTBI with LOC ( $n=11$ ) performed significantly worse than those with just AOC on executive functioning tests (D-KEFS Trail Making, Verbal Fluency, Design Fluency, Color-Word Inhibition;  $p<.05$ ). Participants with PTSD ( $n=15$ ) also performed significantly worse than those without PTSD on 7 neuropsychological tests across several domains. Though the LOC and AOC groups did not differ significantly in prevalence of PTSD, the effect of PTSD was controlled in an ANCOVA procedure, and significant effects of LOC on executive functioning measures remained (D-KEFS Trail Making, Verbal Fluency, Design Fluency;  $p<.05$ ).

**Conclusions:** These results suggest that despite the significant effects of PTSD on cognitive functioning, the effects of mTBI can be detected on executive functioning measures over and above PTSD symptomatology. Correspondence: *Jordan P. Harp, Physical Medicine & Rehabilitation, University of Kentucky, 2050 Versailles Rd, Lexington, KY 40504, United States. E-mail: jordanharp@gmail.com*

#### **J.S. DESORMEAU & M. MCKERRAL. Quality of Life and Emotional Well-Being in People with a TBI 1 to 7 Years after Rehabilitation.**

**Objective:** To investigate factors associated with quality of life in people with a TBI who have completed a social and vocational rehabilitation program. This type of interdisciplinary rehabilitation program assists people who have suffered a mild or moderate/severe TBI in returning to their pre-injury activities—remunerated work, running a household, education, volunteering or any other activity deemed important to the individual. In this context, a global measure such as quality of life is preferred over single measures like return to work. Since these services are covered by a province-wide public health program all people who have suffered a TBI are offered the same services. Therefore, participants in this study are representative of the general TBI population. Furthermore, attention has been given to ethnic characteristics of the population studied.

**Participants and Methods:** 98 participants completed questionnaires measuring quality of life, emotional well-being, satisfaction with primary activity, severity of symptoms and demographic data. Multivariate regression analyses were performed to identify factors associated with quality of life and emotional well-being.

**Results:** Preliminary analyses suggest that employment, emotional well-being, and social support are related to higher quality of life ratings. Data also indicate that length of treatment is associated with emotional well-being.

**Conclusions:** These results may assist professionals in identifying people who are at increased risk of distress years after rehabilitation and may provide insight into factors that influence quality of life after TBI. It is further hoped that this information will contribute towards the development of ongoing support programs.

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### S. DIKMEN, J. MACHAMER & N. TEMKIN. Post Traumatic Symptoms in Patients with Complicated Mild TBI.

**Objective:** Prospectively examine the rates of post-traumatic symptoms and their interference in everyday functioning in patients with complicated mild TBI.

**Participants and Methods:** Design: Inception cohort longitudinal study  
Setting: Level I trauma center

Participants: 125 subjects with complicated mild TBI (GCS 13 – 15 with abnormal CT findings) consecutively enrolled and prospectively followed to 6 months after injury.

Main Outcome Measure: Subjects were asked about the occurrence of 17 symptoms and whether they impacted their everyday life.

**Results:** 72% said at least 1 symptom interfered with some activity of everyday life 6 months after the injury. Fatigue, trouble concentrating and memory problems most commonly were endorsed as causing problems in everyday functioning by 35% to 45 % of people. Fatigue caused difficulty with work, home management and leisure in 1/3 of the group. Trouble concentrating and memory problems also were reported to cause difficulty with work in about a third of the people. Problems with balance and dizziness caused difficulty with ambulation for about 30 %. Blurred vision caused difficulty with leisure activities for almost 20 % and with work and getting around outside the home in over 10% of people. Irritability caused some problems with social interactions in 30% and with work in almost 20% of people. Areas most effected by one or more of these symptoms were work and leisure activities.

**Conclusions:** Symptoms are commonly endorsed 6 months after a complicated mild TBI and they are often felt to still exert a negative impact on day-to-day functioning in representative cases.

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### C.H. DOMEN, R.J. SPENCER, L.L. DRAG & L.A. BIELIAUSKAS. Psychometrics of Timed Alphabet Writing Forward and Backward Among Veterans Suspected of Traumatic Brain Injury.

**Objective:** Timed Alphabet Writing Forward (AWF) and Backward (AWB) are used to screen for cognitive impairment. It is assumed that AWF performance relies on attention and processing speed, while AWB performance additionally relies on executive control. To examine whether AWF and AWB measure those cognitive abilities that are assumed, the current study's aim was to establish that AWF and AWB performance correlates more with performance on measures of attention and processing speed (Digit-Span Forwards, Trails-A), as well as executive control (Digit Span Backwards, Shipley-Abstraction, Trails-B), in the case of AWB, and with performance on measures of memory (RBANS Story Recall, Rey Figure Recall), verbal ability (Shipley Vocabulary), and visual-spatial construction (Rey Figure Copy).

**Participants and Methods:** Data were collected from 165 veterans seen in a traumatic brain injury clinic. Partial correlations were calculated between AWF and AWB, and Digit-Span Forwards & Backwards, Trails-A&B, Shipley-Abstraction & Vocabulary, RBANS Story Recall, and Rey Figure Copy & Recall, while controlling for age and education.

**Results:** Assumptions concerning AWF's psychometric properties were partially validated, as it correlated more strongly with Trails-A ( $r = .42$ ) than the other measures (median  $r = .34$ ). AWF's correlation with Digit Span Forward was weak to moderate ( $r = -.34$ ). The assumed psychometric properties of AWB were also validated, as it correlated more strongly with Trails-A & B, Digit Span Forwards & Backwards (median  $r = .41$ ) than the other measures (median  $r = .27$ ).

**Conclusions:** AWF relies on processing speed, whereas AWB relies additionally on executive control. Alphabet Writing may be a useful screening measure.

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### J.E. FAIR, M.J. LARSON & W.M. PERLSTEIN. Negative Affect Predicts Performance-Monitoring Dysfunction beyond Cognitive Performance in Survivors of Severe Traumatic Brain Injury.

**Objective:** Performance monitoring is a cognitive control process modulated by both cognitive and affective variables. No studies to date have examined the relative contribution of cognitive abilities and negative affect (NA) to performance-monitoring dysfunction following severe traumatic brain injury (TBI). The current study used the error-related negativity (ERN) component of the scalp-recorded event-related potential (ERP) to test the hypothesis that NA would predict performance-monitoring dysfunction beyond cognitive performance and injury severity following severe TBI.

**Participants and Methods:** Participants included 19 survivors of severe TBI who completed a battery of neuropsychological tests, measures of NA, and a computerized Stroop task. We acquired high-density ERPs while the Stroop task was completed. Scores on neuropsychological tests and measures of NA were standardized and combined to form "cognitive performance" and "negative affect" variables. Hierarchical regression analysis with ERN amplitude as the dependent variable and injury severity, cognitive performance, and negative affect variables as independent variables tested the study hypothesis.

**Results:** The overall regression model was statistically significant,  $R^2 = .52$ ,  $p < .03$ , with no significant effect of injury severity,  $\Delta R^2 = .07$ ,  $\beta < .13$ , or cognitive performance,  $\Delta R^2 < .01$ ,  $\beta = .34$ , in the first two steps. There was a significant effect of NA in the third step,  $\Delta R^2 = .45$ ,  $\beta = .80$ ,  $p < .003$ , suggesting that increased levels of NA were associated with decreased ERN amplitudes when injury severity and cognitive performance were controlled.

**Conclusions:** These results indicate electrophysiological measures of performance monitoring are more influenced by affective factors than cognitive factors and injury severity following severe TBI. Results have considerable implications for the role of NA in performance-monitoring dysfunction and highlight the need for accurate assessment of affective symptoms in TBI-related neuropsychological evaluations.

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### J.A. RESTREPO, T. HAMMEKE, T. CASSINI & M. MCCREA. Measurement of Response Bias in a Postconcussion Symptom Scale.

**Objective:** Assessment of symptoms after concussion is an essential part of determining the physical and cognitive readiness of an athlete to return to active play. The Graded Symptom Checklist (GSC) is a self-report measure of 20 symptoms that commonly occur following head injuries. To this scale, four additional symptoms that were thought unrelated to concussion were added as validity items (VI): teeth hurting, skin rash/itching, joint stiffness, and burning feet.

**Participants and Methods:** A preliminary study was done to determine the psychometric properties of VI before and after concussion in a sample of 4,760 high school football players who completed preseason evaluations and a subgroup of 104 players who sustained concussions during the season.

**Results:** In preseason evaluations, the VI were endorsed with approximately equal frequency to other symptoms of the GSC (Mean % endorsement = 13) when three high frequency items (headache, fatigue, drowsiness) were excluded and severity ratings correlated with overall GSC ratings, suggesting that the base rate of endorsement of VI is comparable to other symptoms. Immediately following concussion, complaints of teeth hurting and joint stiffness correlated with GSC while skin rash and burning feet did not.

**Conclusions:** The study findings indicate that select VI have more value than others in their potential to detect response bias in symptom report. Discussion and suggestions for use of VI will be presented.

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**J.A. RESTREPO, T. HAMMEKE, T. CASSINI & M. MCCREA. Dizziness After Concussion Is Associated with Attentional Problems.**

**Objective:** Complaints of dizziness and vertigo are common after concussion, as are symptoms of headache, fatigue, concentration difficulty and poor memory. Because coping with dizziness often requires engagement of attentional resources, it is hypothesized that complaints of dizziness should be associated with more complaints of concentration difficulty and weaker performances on tests of attention.

**Participants and Methods:** In a sample of 4,760 high school football players who completed preseason evaluations and a subgroup of 104 players who sustained concussions during the season, complaints of dizziness were found to correlate highly with complaints of concentration and memory difficulties, and lower performance on an index of concentration.

**Results:** These correlations were particularly high on the day following concussion. Moreover, in the concussed sample, complaints of dizziness predicted poorer performances on select tests of verbal working memory and information processing speed. Curiously, weaker performance on a test of positional steadiness and balance (Balance Error Scoring System) did not predict weaker performances on tests of attention.

**Conclusions:** These findings indicate that individuals who complain of dizziness or vertigo are likely to have complaints about concentration difficulties and perform more poorly on tests of attention than individuals who do not make this complaint. The shared variance in these variables increases substantially in the interval immediately following concussion.

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**J.P. HARP, J.A. CLARK, A.L. SHANDERA, R.E. SCHLEENBAKER, D.T. BERRY & W.M. HIGH. Neuropsychological Profile Patterns of Combat Veterans Feigning Mild Head Trauma.**

**Objective:** Many returning veterans report symptoms of PTSD and mild traumatic brain injury (mTBI) resulting from blasts and other combat. It was hypothesized suspected malingerers (those with invalid Letter Memory Test or MMPI-2 validity scale scores) would exhibit more deficient performance on neurocognitive and psychiatric measures than honest responders.

**Participants and Methods:** Thirty-nine recent combat veterans were referred for neuropsychological evaluation following possible mTBI and combat-related stress. Of these, 6 were excluded from analyses because they lacked evidence of brain injury. Of the remaining 33 veterans, (25 Caucasian, 23 male), all had reported injuries consistent with mTBI. All participants were given an extensive clinical interview, a battery of neuropsychological tests, neurocognitive malingering test (LMT), emotional/behavioral measures, and a PTSD screen.

**Results:** T-tests indicated that suspected malingerers ( $n=8$ ) performed significantly worse on neurocognitive and psychological testing ( $p<.05$ ). This group scored significantly lower than the honest responders on neurocognitive measures including CVLT-II, D-KEFS, Iowa Gambling Task, and WAIS-III Digit-Symbol Coding. Suspected malingerers produced significantly greater elevations than the honest responders on psychological measures including the MMPI-2 Fake Bad Scale, scales 2 and 8, and PK scale, the PTSD Checklist, and measures of anxiety and depression.

**Conclusions:** These results suggest that veterans who feign or exaggerate deficits due to mTBI or PTSD perform significantly more poorly on measures of memory, executive functioning, and processing speed than those who produce valid profiles. Additionally, suspected malingerers endorsed more psychiatric symptoms than the honest responders. This sample produced a base rate estimate of 32% for feigning among outpatient referrals of OIF/OEF veterans.

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**L.C. HENRY. Metabolic disturbances in the concussed brain: Acute and post-acute findings using MRS.**

**Objective:** Sports concussion is a major problem affecting thousands of people in North America every year. Despite negative neuroimaging findings in most cases many athletes display neuropsychological deficits and post-concussion symptoms such as headaches and sensitivity to light and noise. It is suspected that neurometabolic changes may underlie the neuropsychological changes in the concussed brain. However, very little is known as to how sports concussions affect metabolic processes in the brain and how these processes are affected even after the athlete is fully recovered. The current study investigated the effects of sports concussion on brain metabolism using MRS Spectroscopy.

**Participants and Methods:** All participants were university level athletes who were either controls ( $n=12$ ) or concussed ( $n=12$ ). Concussed athletes were scanned 1-6 days post-concussion and 6 months post-concussion in a 3T Siemens MRI in 3 different brain areas in each hemisphere for a total of six regions, as well as administered a symptom scale to evaluate post-concussion symptomatology.

**Results:** Our results demonstrate significant decreases in NAA across prefrontal regions as well as M1 and in glutamate in M1 in the acute post concussion phase and continued glutamatergic depression in M1 6-months post injury. The metabolic changes correlated with reported symptoms.

**Conclusions:** These results confirm cortical neurometabolic changes in the acute postconcussion phase and demonstrate for the first time a correlation between subjective self-reported symptoms and objective physiological changes which may be related to increased vulnerability in the concussed brain.

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**L.M. HIMANEN, P. HÄMÄLÄINEN, O. TENOVUO, H. HIEKKANEN, V. KAIRISTO & R. PORTIN. COGNITIVE FUNCTIONS AND APOLIPOPROTEIN GENOTYPES IN CHRONIC TRAUMATIC BRAIN INJURY.**

**Objective:** The aim of the study was to evaluate the role of different ApoE genotypes on cognition in chronic traumatic brain injury (TBI)

**Participants and Methods:** The study group ( $n=60$ , mean age at injury=29 years) was originally assessed between 1966-1972 in Turku University Hospital (Finland) and the follow-up examination with the determination of ApoE genotyping was conducted on average 30 years after the TBI. In both examination, the patients were assessed with 5 subtests of the Wechsler Adult Intelligence Scale, 3 tests for episodic memory and the cognitive overall deterioration was determined. Information processing speed was assessed only in the follow-up examination by a computerized method

**Results:** Significant differences in the cognitive performances were found between the groups with ApoE 4 and ApoE 3 in both assessments. Difference was found in verbal memory in the first assessment, and in the cognitive overall level as well as in the verbal working memory in the follow-up assessment. Although our study support the protective role of Both ApoE2 and ApoE3, the group with ApoE2 seemed to have the most gentle curve of deterioration during the follow-up of 30 years.

**Conclusions:** ApoE genotypes mediate different memory processes in TBI during the long-term longitudinal follow-up of 30 years.

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**N.W. NELSON, J. HOELZLE, K.A. MCGUIRE, S.R. SPONHEIM, A.G. FERRIER-AUERBACH & M.J. CHARLESWORTH. Blast-Related Concussion (mTBI): Preliminary Neuropsychological Findings.**

**Objective:** A vast concussion literature documents the favorable course of cognitive recovery that typically follows non-blast-related concussion among civilians. Less is known about cognitive outcomes following blast-related concussion. Psychological and emotional symptoms may further complicate cognitive recovery after blast. The current study examines cognitive outcomes among four groups of OEF/OIF veterans: (a) Controls, (b) Blast-concussion only, (c) Co-morbid Blast and Psychological symptoms, and (d) Psychological symptoms only to better understand factors that may impact cognitive recovery following deployment.

**Participants and Methods:** OEF/OIF veterans were invited to participate in a research study addressing cognitive outcomes following blast exposure. The sample was categorized according to concussion status through team consensus of veterans' descriptions of blast events. Psychological status was determined according to premorbid psychiatric history, clinical interviews (SCID-I, CAPS), and current psychological symptoms (MMPI-2 profiles). The sample completed a complete neuropsychological evaluation and an overall test battery mean (OTBM) was generated across 13 measures to assess overall level of cognitive function.

**Results:** As expected: (1) the Concussion only group performed comparably with the Control group, (2) the Co-morbid group performed significantly worse than the Control group, and (3) the Psychological symptoms group performed significantly worse than the Control group. Psychological symptoms correlated significantly with OTBM regardless of group status. Overall blast exposure history was not significantly correlated with OTBM

**Conclusions:** Preliminary data suggest that (1) blast-related concussion alone does not contribute to objective cognitive impairment months/years after blast exposure, and (2) psychological symptoms associated with deployment or post-deployment stressors contribute significantly to objective cognitive performances.

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**M. HOLCOMB & K.Z. DONNELLY. How Is Sleep Disturbance Related to TBI Status, Cognitive Performance, and Affective Symptoms in OEF/OIF Veterans?**

**Objective:** Define relationships among sleep disturbance and psychological symptoms in OEF/OIF veterans who screened positive for TBI vs. those who did not. We expected that sleep problems would be more prevalent and problematic in the TBI (+) group.

**Participants and Methods:** 135 OEF/OIF veterans were examined. 96 screened positive for TBI. All completed the Neurobehavioral Symptom Inventory (NSI), California Verbal Learning Test (CVLT-II), Trail Making Test (TMT), Months backward, Beck Depression Inventory (BDI-2), Beck Anxiety Inventory (BAI), and the PTSD Checklist (PCL). All tests were administered in a single session at the Buffalo VAMC, as part of a larger study.

**Results:** 63% of TBI (+) veterans endorsed severe or very severe sleep problems, in contrast to 33% of those who were TBI (-) ( $t=-4.10$ ,  $p<.0001$ ). In both groups, sleep disturbance was highly correlated with depression ([+]:  $r=.53$ ,  $p<.0001$ , [-]:  $r=.39$ ,  $p<.05$ ), anxiety ([+]:  $r=.50$ ,  $p<.0001$ , [-]:  $r=.34$ ,  $p<.05$ ), and PTSD ([+]:  $r=.58$ ,  $p<.0001$ , [-]:  $r=.55$ ,  $p<.0001$ ).

Most cognitive performance was within normal limits for both groups, excepting TMT-B and Months Backward (both -1 SD). Group differences were only significant for CVLT -II long-delayed recall ( $t=2.07$ ,  $p<.05$ ). TBI (+) veterans scored lower, but still within normal limits.

The TBI (+) group endorsed more depression ( $t=-2.30$ ,  $p<.05$ ), anxiety ( $t=-2.74$ ,  $p<.001$ ), and PTSD symptoms ( $t=-4.57$ ,  $p<.0001$ ) than did the TBI (-) sample, but both groups had clinically significant mean scores on all three measures.

**Conclusions:** Sleep disturbance and affective symptoms were pervasive in both groups, but more severe in the TBI (+) group.

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**J. HOLDNACK & L. DROZDICK. Social Perception Deficits after Moderate to Severe Traumatic Brain Injury.**

**Objective:** The current research tests the hypothesis that patients suffering moderate to severe Traumatic Brain Injury (TBI) exhibit deficits in social cognition on measures from the Advanced Clinical Solutions for the WAIS-IV/WMS-IV.

**Participants and Methods:** A sample of 24 patients with moderate to severe TBI, completed the social perception subtest within three years of injury. The Social Perception subtest measures multiple abilities related to perceiving the emotional expression of others. Affect naming requires the ability to recognize and correctly name facial expressions of emotion. The prosody score indicates the examinee's ability to understand how tone of voice conveys affect or sarcasm and can change the meaning of a statement, and relate that information to facial expressions of emotion. The pairs items measure the ability of the examinee to identify how facial expressions and body language convey information about a social interaction

**Results:** The TBI group performed in the borderline to low average range across the social perception measures: total social perception (SS=5.0), affect naming (SS=5.5), prosody (SS=6.0), and pairs (SS=5.8). Compared to matched controls, the TBI sample performed significantly lower on all measures ( $p < .01$ ) with effect sizes ranging from 1.22 (total score) to .95 (pairs). The deficits were still significant after controlling for general cognitive functioning. In the TBI sample, social perception scores significantly correlated with caregiver ratings of social functioning ( $r=.67$ ).

**Conclusions:** Individuals suffering TBI show marked deficits in social perception which relate to actual behavioral deficits in interpersonal relationships. The results validate the importance of assessing social perception after TBI.

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**A. HULL, L. GREENBERG, B. BELSHER, L. HUTSON, C. SKILLIVAN, D. THOMANDER & J. POOLE. Comparison of the Repeatable Battery for Assessment of Neuropsychological Status (RBANS) and Neuropsychological Assessment Battery Screening Module (S-NAB) in Veterans Who Screened Positive for History of TBI.**

**Objective:** This study compares the RBANS and S-NAB in the initial assessment of VA patients who screened positive for possible traumatic brain injury (TBI).

**Participants and Methods:** Subjects were 41 outpatient veterans, ages 20-58, who screened positive for possible TBI on a standard VA screen, and whose histories suggested possible mild to moderate TBI. Subjects were given the S-NAB and RBANS as part of a standard assessment battery. Analyses compared S-NAB and RBANS standard scores for attention, memory, language, and visuospatial skills.

**Results:** S-NAB and RBANS Attention and Memory indices were significantly correlated ( $r = 0.8$  and  $0.7$ ); their Language and Spatial indices were not ( $r < 0.3$ ). RBANS scores were significantly lower than S-NAB scores for Memory ( $-0.9$  SD) and Language ( $-1.2$  SD). RBANS Anxiety and Depression indices correlated significantly with S-NAB and RBANS Attention, S-NAB Memory, and S-NAB Spatial indices ( $r = 0.4$  to  $-0.5$ ).

**Conclusions:** This study indicates that the RBANS and S-NAB are not equivalent. Their attention and memory tests perform similar functions, but their language and spatial tests do not. The S-NAB includes an executive index, but the RBANS does not. Furthermore, patients in our TBI clinic obtained lower memory and language scores on the RBANS than the S-NAB. Possible reasons include differences in the RBANS and NAB normative samples, floor/ceiling effects, and the sensitivity/specificity of items, which will be discussed in this presentation. Understanding the content constructs, and relative difficulty of these two popular screening batteries can help clinicians select appropriate tests for specific patient populations.

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#### L. HUNGERFORD & D. KELLY. Comparison of Mechanism of Injury in Soldiers with Mild Traumatic Brain Injury.

**Objective:** To date, there has been only one published article examining neuropsychological functioning in veterans who sustained blast versus non-blast brain injuries (Belanger et al., 2009). In this study, only an interaction effect was found with regard to visual memory. The objective of the current study was to further examine differences and similarities between these two mechanisms of injury in a military population who have sustained an mTBI.

**Participants and Methods:** Participants included all Soldiers who were seen for neuropsychological evaluation, following mTBI, at a large military base between the years of 2000 and 2007 ( $N = 123$ ). Mild traumatic brain injury was defined using AAN guidelines for concussion grading.

Participants were compared on demographic variables and a core neuropsychological battery (CVLT, Trails A and B, WASI, RCFT) using MANOVA.

**Results:** Statistically significant differences between groups were found only on demographic variables as the non-deployed, non-blast mTBI was significantly younger and less educated than the other two groups. In corroboration with Belanger (2009), very little difference was seen between blast versus non-blast injury with regards to performance on neuropsychological measures.

**Conclusions:** The present study corroborates earlier research on blast versus non-blast brain injuries. While there were very few significant differences between groups in the present study, the stage is set for future prospective efforts with a larger sample size and more robust neuropsychological battery.

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#### L. HUNGERFORD, F. FLYNN & D. KELLY. Multi-Tiered Approach To Evaluation and Treatment of Mild Traumatic Brain Injury In A Military Environment.

**Objective:** Since the beginning of Operation Iraqi Freedom, there has been increasing focus on the sequelae of mTBI, especially related to blast injuries. At one of the largest bases on the west coast, a multi-tiered screening and treatment program was created in order to quickly and accurately identify, educate, and treat returning soldiers who have sustained a concussion as defined by AAN guidelines.

The objective of this poster is to describe the nature and development of this program along with providing incidence and prevalence data. The first tier is done via a kiosk in which all returning Soldiers answer questions related to loss or alteration of consciousness by either blast or

blunt force. If answered in the positive direction, Soldiers are then seen for a 45 minute evaluation by a member of a multi-disciplinary staff comprised of behavioral neurologist, neuropsychologists, internal medicine doctors, and nurse practitioners. If necessary, following the secondary evaluation, Soldiers will be seen for tertiary neuropsychological evaluation.

Lastly, appropriate treatment recommendations, referrals, and education are provided to the Soldier. Two cognitive rehabilitation programs have been created for individuals with attention and memory complaints and/or impairments. For individuals without objective weakness or impairment, an educational component is administered called MEMO (Memory Education MOdule). For those individuals with objective weakness and/or impairment, a 6 week cognitive remediation program is provided with pre and post data collected (SMART-Sytematic Memory and Attention Rehabilitative Training).

Through the creation of this multi-disciplinary program, Soldiers are provided with comprehensive evaluation and care and, ultimately, return to productive service or expedited through the medical board process.

**Participants and Methods:** Participants include all Soldiers returning from deployment at a large military base in the western region.

**Results:** N/A

**Conclusions:** N/A

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#### A. JACKSON, R. PERNA & S. ROY. Full Scale IQ and Independent Living after ABI: More than just a Number.

**Objective:** Full Scale IQ (FSIQ) measures a broad range of abilities and has been shown to be predictive of numerous life circumstances, such as quality of life (Bain et al., 1997). Unfortunately, IQ is often not discussed in the rehabilitation of brain-injured individuals. IQ may provide valuable information, such as predicting independent living. Our research hypothesis is that FSIQ would significantly predict independent living skills as measured by the Mayo Portland Adaptability Inventory (MPAI-4).

**Participants and Methods:** Individuals ( $N=36$ ) with ABI in an outpatient neurorehabilitation program completed the MPAI-4 and a neuropsychological evaluation. Individuals were bracketed by FSIQ: Group 1: 70-79 ( $n=17$ ); Group 2: 80-89 ( $n=12$ ); Group 3: 90-109 ( $n=9$ ). Mean ages were 39, 47, and 39; mean educational levels were 11, 12, 13, respectively. All participants were rated on vocational status, Residence, Transportation, and Money Management at admission. All variables are rated on scales of 0-4, 0 signifying independence and 4 signifying total dependence.

**Results:** FSIQ correlated significantly with all functional variables and predicted significant variance in all but money management: Residence ( $r=.38$ ,  $R^2=.15$ ), Transportation ( $r=.43$ ,  $R^2=.22$ ), and Money Management ( $r=.33$ ,  $R^2=.12$ ), Employment ( $r=.42$ ,  $R^2=.28$ ). Significant group differences were found in Residence, Transportation, and Money Management, but not in employment status. Cross tabulation found that Group 1 had significantly more individuals rated as a "4" for all functional variables.

**Conclusions:** Group 1 needed more residential assistance, was less able to drive safely, and needed more assistance with money management. All groups were similar in employment status.

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#### E. KELLEY, J. LOUGHLIN, L. HUTSON & J. POOLE. Patient-Informant (PI) Discrepancy Ratings 5 – 15 years Post-Injury After Moderate to Severe Traumatic Brain Injury (msTBI): Relation to Injury Severity and Vocational Outcome.

**Objective:** (1) Determine PI rating discrepancies of symptom severity and social

functioning, creating intellectual awareness indices for each domain (2) Examine the relationship between injury severity and awareness, controlling for time post-injury and education. (3) Examine the relationship between awareness, time post-injury, and vocational outcome, controlling for injury severity and education.

**Participants and Methods:** Subjects were 62 veterans who previously received acute inpatient rehabilitation for mTBI. A comprehensive telephone interview, developed by the Centers for Disease Control and including the Community Integration Questionnaire, was conducted 5-15 years post-injury (median 9) with both the patient and informant, assessing social re-entry, as well as neurological, psychological, and cognitive symptoms.

**Results:** (1) Strong agreement between PI was found on the CIQ ( $ICC = .724$ ), while moderate agreement was found for symptom ratings ( $ICC = .572$ ). (2) Greater injury severity predicted impaired symptom awareness ( $r = -.416, p = .015$ ). (3) Length of time post-injury did not correspond to awareness level. Symptom awareness correlated with vocational outcomes ( $r = -.376, p = .026$ ), being driven primarily by cognitive intellectual awareness ( $r = -.425, p = .008$ ).

**Conclusions:** Patients showed intact awareness of symptoms and social re-entry. Results indicate awareness levels may plateau prior to the 5-15 year post-injury mark, nullifying the relationship between awareness level and time post-injury at long-term follow up. In addition, awareness of cognitive deficits may be essential in successful employment, supporting cognitive vocational rehabilitation efforts. Current knowledge of awareness in mTBI will be discussed, focusing on impairments of declarative knowledge.

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**M.A. KELLY, S. MCDONALD & D. KELLETT. Decision Making after Traumatic Brain Injury: Attempting to Identify Impairments in Social Functioning Using a Novel Task.**

**Objective:** Decision making forms an important part of our everyday lives and is commonly impaired after a severe traumatic brain injury (TBI). This study aimed to develop and pilot a social decision making task.

**Participants and Methods:** The Social Gambling Task (SGT) requires the participant to play a game of 'catch and throw' with four pseudo players over the internet, with the aim of 'winning as many throws as they can'. Two pseudo players are regarded 'good choices' as they return the ball at a probability of 60% or 30%; the other two players are 'bad choices', returning the ball at a probability of 10% or 0%. Preliminary data are presented for 13 adults (2 female, 11 male) with severe TBI (PTA  $M = 59.3$  days), aged between 24 and 66 years ( $M = 44.07$ ) tested at least 8 months post-injury ( $M = 5.5$  years). These were compared to 8 control participants aged between 25 and 55 years ( $M = 32$ ).

**Results:** Preliminary results indicate that control participants made better decisions than TBI participants, thus, winning more throws overall ( $t = 2.38, p = .029$ ). A significant interaction between group and choice type was observed with control participants making more good choices and less bad choices than the TBI group ( $F = 8.61, p = .009$ ). Furthermore, control participants' choices approximated the probability of return more directly than did the TBI group.

**Conclusions:** Evidence for the reliability and validity of this novel task is currently being collected.

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**K. KRISHNAN, D. WU, S. DE, A. NGUYEN, J. WANG, E. SHOKRI, C. MOORE, R. DIAZ-ARRASTIA & C. MARQUEZ DE LA PLATA. Structural And Functional Connectivity of Hippocampal Circuits after Diffuse Axonal Injury.**

**Objective:** Resting state fMRI has shown compromise in the synchrony of BOLD signal between interhemispheric regions in certain brain-in-

jured populations. DTI has found that degree of white matter injury after DAI is associated with decreased outcome. This study will explore interhemispheric hippocampal connectivity (IHC) in patients with DAI, examine whether reduced functional connectivity (FC) is associated with degree of injury to white matter tracts, and investigate its correlation to outcome.

**Participants and Methods:** Resting state fMRI scans from 4 controls and 10 patients were obtained six-months post-injury. To examine FC, BOLD signal for each hippocampus was correlated with all voxels in the brain for the entire sample. Centroraxial white matter tracts including Corpus Collosum (CC), Fornix (Fx), and Perforant Path (PP) were reconstructed using diffusion tensor tractography; Fractional Anisotropy (FA) and Mean Diffusivity (MD) values were obtained. Immediately after the scans, neurocognitive measures of processing speed (PS), executive function (EXEC), and learning and memory (LM) were administered.

**Results:** Integrity of white matter tracts in patients was compromised in CC, PP, and Fx. FC for left and right hippocampus was associated with structural integrity of MD in PP. IHC correlated with MD in CC and PP. Significant correlations were found between IHC, EXEC and LM. ( $p < 0.05$ )

**Conclusions:** The results indicate an association between compromised white matter integrity and compromised IHC. Furthermore, the degree of compromise in IHC correlated with performance on EXEC and LM. This study provides preliminary evidence that there is a relationship between brain structure and function that can be examined through novel neuroimaging techniques.

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**A. KROL & M. MRAZIK. Does an Athlete's Level of Fitness Impact the Report of Concussion Symptoms?**

**Objective:** Explore the relationship between level of athlete fitness and report of post-concussion symptoms.

**Participants and Methods:** Subjects were 21 male collegiate athletes who completed baseline assessment with the Standardized Concussion Assessment Tool (SCAT) at 3 distinct time periods. Following collection of baseline SCAT scores, athletes underwent the Leger (beep) test to measure cardiovascular fitness and provide measures of estimated V02 maximum levels. Athletes completed the SCAT 10 minutes following exertional activity and again within 24 hours.

**Results:** A step-wise regression analysis revealed baseline SCAT accounted for 62.7% of SCAT symptoms reported within 24 hours  $F(1,20) = 32.01, p < 0.01$ . Of importance, estimated V02 maximum levels was not a significant predictor of either post-activity SCAT or under 24 hour SCAT.

**Conclusions:** Results indicate that an athlete's level of fitness is not implicated in the report of symptoms following exertional activity. It appears an athlete's initial (baseline) self-report of symptoms appears to be a good predictor of subsequent reports and does not change as a function of exertional activity. Further study measuring the impact of fitness level on recovery from mild head injury is merited.

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**D. LABBE, J. BAÑOS, L. VOGTLE & T. NOVACK. Body Mass Index Following Traumatic Brain Injury.**

**Objective:** Obesity rates have been found to be greater across several disability groups as compared to the non-disabled general population. Little is known, however, about the prevalence and risk factors leading to obesity in the TBI population.

**Participants and Methods:** A total of 189 participants with moderate-severe TBI were interviewed at 1 or 5 years post-injury regarding height and weight.

**Results:** Obesity rates increased from year 1 (22.7%) to year 5 (28.6%) and were greater than the Center for Disease Control's 2001 averages

for non-disabled Americans (18.7%). Analysis of variance revealed that participants in the normal BMI range were significantly younger than obese individuals at year 1 ( $F_{2,96}=3.09, p=.05$ ) but not at year 5. Severity of injury as measured by post-traumatic amnesia was significantly greater for obese individuals as compared to those in the normal BMI range ( $t_{125}=2.19, p=.03$ ). Further investigation revealed that 6.7% of the first year participants fell in the underweight category ( $BMI < 18.5$ ). At year 5, this number decreased, matching the CDC underweight figures at 1.4%. The distribution of participants across BMI classifications differed between time points such that more individuals fell in the underweight and normal range groups at year 1. By contrast at year 5, a majority of individuals fell in the overweight and obese groups.

**Conclusions:** These results expand upon previous research suggesting that restoration of trauma related weight loss extends beyond the acute phase of recovery for some TBI survivors. However, increased risk for obesity is similar to other disability groups at 5 years post injury.

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**R.T. LANGE, G.L. IVERSON & A. ROSE. Influence of Depression on Postconcussion Symptom Reporting Following Mild Traumatic Brain Injury.**

**Objective:** Depression following a mild traumatic brain injury (MTBI) is relatively common and can have multiple causes. Theoretically, it can relate to the neurobiological consequences of the injury, psychosocial factors, or both. The purpose of this cross-sectional study is to try to isolate and examine the depressive experience in a cohort of patients who are slow to recover from an MTBI.

**Participants and Methods:** Participants were 53 patients referred to a concussion clinic following MTBI, 58 outpatients with SCID diagnosed depression, and 72 healthy control subjects. The MTBI group was divided into two groups using selected hallmark symptoms of depression from the British Columbia Major Depression Inventory (23 MTBI-Depressed, 30 MTBI-No Depression). The majority of MTBI patients (83.8%) were evaluated within three months following their injury ( $M=53.1$  days,  $SD=58.9$ , range=2-295). All participants completed ratings on the British Columbia Postconcussion Symptom Inventory (BC-PSI).

**Results:** There were significant differences in postconcussion symptoms between all four groups (all  $p < .001$ ; Cohen's  $d=.76$  to  $d=5.27$ , large to very large effect sizes). BC-PSI total score were highest in the MTBI-Depressed group ( $M=32.0$ ), followed by the Depressed outpatient ( $M=22.8$ ), MTBI-No Depression ( $M=15.6$ ), and Healthy control ( $M=2.3$ ) group. When all 13 individual symptoms were considered simultaneously, there were significant differences in the number of symptoms endorsed (all  $p < .05$ ). The percentages of each sample endorsing eight or more symptoms were: MTBI-Depressed=95.7%, Depressed outpatients=70.7%, MTBI-No Depression=30.0%, and Healthy controls=2.8%.

**Conclusions:** Patients who experience MTBIs who have a post-injury course complicated by a significant depressive experience report more symptoms, and more severe symptoms, than (a) outpatients with depression, and (b) patients with MTBIs who do not have significant symptoms of depression.

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**R.T. LANGE, G.L. IVERSON, B.L. BROOKS & V.L. ASHTON RENISON. Influence of Poor Cognitive Effort on Self Reported Symptoms and Neurocognitive Test Performance Following Mild Traumatic Brain Injury.**

**Objective:** When considering a diagnosis of post-concussion syndrome, clinicians must systematically evaluate and eliminate the possible contribution of many differential diagnoses, co-morbidities, and factors that may cause or maintain self-reported symptoms long after mild traumatic

brain injury (MTBI). One potentially significant contributing factor is symptom exaggeration. The purpose of this study is to examine the influence of poor effort on self-reported symptoms (post-concussion symptoms and cognitive complaints) and neurocognitive test performance following MTBI.

**Participants and Methods:** The MTBI sample consisted of 62 referrals to a concussion clinic, evaluated within 5 months post injury ( $M=2.0$ ,  $SD=1.0$ , Range=0.6-4.6), who were receiving financial compensation from the Worker's Compensation Board. Participants completed the Post-Concussion Scale (PCS), British Columbia Cognitive Complaints Inventory (BC-CCI), selected tests from the Neuropsychological Assessment Battery Screening Module (S-NAB), and Test of Memory Malingering (TOMM). Participants were divided into two groups based on TOMM performance (15 Fail, 43 Pass).

**Results:** There were significant main effects and large effect sizes for the PCS ( $p=.002$ , Cohen's  $d=.79$ ) and BC-CCI ( $p=.011$ ,  $d=0.98$ ) total scores. Patients in the TOMM Fail group scored higher than those in the TOMM Pass group on both measures. Similarly, there were significant main effects and/or large effect sizes on the S-NAB. Patients in the TOMM Fail group performed more poorly on the Attention ( $p=.004$ ,  $d=1.26$ ), Memory ( $p=.006$ ,  $d=1.16$ ), and Executive Functioning ( $n/s, d=.70$ ) Indexes.

**Conclusions:** These results highlight the importance of considering the influence of poor effort, in conjunction with a growing list of factors, that can influence, maintain, and/or mimic the persistent post-concussion syndrome. Correspondence: *Rael T. Lange, Ph.D., Research, BC Mental Health and Addiction Services, 201-601 West Broadway, Vancouver, BC V5Z 4C2, Canada. E-mail: rlange@bcmhs.bc.ca*

**R.T. LANGE, A. ROSE & G.L. IVERSON. Examination of the 'Good Old Days' Bias Following Mild Traumatic Brain Injury: A Retrospective Rosy View of the Past.**

**Objective:** Some researchers have suggested that people who sustain an injury tend to view themselves as healthier in the past, and often underestimate past problems (i.e., 'good old days' bias), which can impact their perceived level of current problems and recovery. The purpose of this study was to examine the influence of the 'good old days' bias on symptom reporting following mild traumatic brain injury (MTBI).

**Participants and Methods:** Participants were 77 patients (62.3% male) referred to a concussion clinic following MTBI. The majority of patients (83.1%) were evaluated within three months following their injury ( $M=58.4$  days,  $SD=60.3$ , range=2-295 days). Patients provided post-injury ratings and pre-injury retrospective ratings on the British Columbia Postconcussion Inventory (BC-PSI). Ratings were compared to 177 healthy controls recruited from the community and a local university.

**Results:** MTBI retrospective ratings were significantly lower than the control group (BC-PSI total score: Mann-Whitney U test:  $p < .01$ ;  $d = .37$ , small-medium effect sizes). Higher rates of endorsed symptoms were found in the control group compared to MTBI retrospective ratings on seven of the 13 symptoms (Chi-square analyses: all  $p < .05$ ). When all measures are considered simultaneously, there was a greater number of symptoms endorsed by the control group compared to the MTBI retrospective ratings (e.g., six or more symptoms: Controls = 22.6%; MTBI = 5.3%,  $p = .001$ ).

**Conclusions:** Consistent with the 'good old days' bias, patients with MTBI appear to misperceive their pre-injury functioning as better than the average person. This misperception can negatively impact their perception of current problems, recovery from injury, and return to work. Correspondence: *Rael T. Lange, Ph.D., Research, BC Mental Health and Addiction Services, 201-601 West Broadway, Vancouver, BC V5Z 4C2, Canada. E-mail: rlange@bcmhs.bc.ca*

**S.M. LIPPA, N.J. PASTOREK, J.F. BENGE & G.M. THORNTON. Blast and Non-blast Related Traumatic Brain Injuries in Afghanistan and Iraq War Veterans: An Analysis of Post-concussive Symptom Report.** **Objective:** Blast injury is a common cause of traumatic brain injury (TBI) in modern warfare. Although the sequelae of non-blast related TBI are well established, less is known about the effects of blast related TBI.

**Participants and Methods:** Post-concussive symptom (PCSx) report was collected from returning veteran outpatients ( $n = 370$ ) with histories of TBI secondary to blast only, non-blast only, and both blast and non-blast injury mechanisms. Profile analyses were conducted to identify differences in PCSx severity and PCSx cluster profiles associated with these injury mechanisms, after controlling for posttraumatic stress symptoms, injury severity, time since injury, and age.

**Results:** Veterans with histories of blast related TBIs were younger, had longer time since injury, and reported more severe posttraumatic stress symptoms than veterans with histories of TBI secondary only to non-blast injuries. Veterans with histories of blast injury reported more severe hearing difficulty than veterans with histories of non-blast injuries only, but this relation lost significance after accounting for covariates. The groups did not differ in PCSx severity or PCSx cluster profiles. Post-concussive symptom report did not vary by the number of blast injuries or proximity to blast. Overall, posttraumatic stress symptoms accounted for a large proportion of the variance in PCSx report.

**Conclusions:** In veteran outpatients with remote histories of TBI, distal factors (e.g., injury mechanism) may be risk factors for anxiety symptoms, but do not clearly result in differential PCSx report. Proximal factors are highly associated with PCSx report and may be important targets for intervention in returning veterans with histories of TBI.

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**J. LOUGHLIN, E. KELLEY, L. HUTSON & J. POOLE. The Relationship Between Patient Community Integration, Caregiver Burden, and Caregiver Life Satisfaction 5-15 Years After Moderate to Severe TBI.**

**Objective:** (1) Assess whether caregiver burden is correlated with life satisfaction among caregivers of patients who sustained moderate to severe TBI (msTBI) at least 5 years ago. (2) Explore the relationship between caregiver burden, caregiver life satisfaction, and patient community integration at least 5 years after msTBI.

**Participants and Methods:** 49 veterans who sustained msTBI and their caregivers completed a follow-up telephone interview at least 5 years post-injury. Participants completed the Community Integration Questionnaire (CIQ). Caregivers completed the Caregiver Burden Inventory and the Satisfaction with Life Scale.

**Results:** Caregiver burden and life satisfaction were significantly correlated ( $r = -.61, p < .001$ ). Community integration was significantly associated with caregiver burden ( $r = -.393, p = .005$ ). No relationship was found between caregiver life satisfaction and community integration ( $p = .140$ ). However, a subscale of the CIQ assessing social integration was significantly related to both caregiver burden ( $r = -.429, p = .002$ ) and life satisfaction ( $r = .316, p = .027$ ). Hierarchical regression analysis was used to assess whether CIQ could predict caregiver burden and life satisfaction after controlling for injury severity (PTA) and age. CIQ total score accounted for an additional 16% of the variance after controlling for these factors. While CIQ total score made a unique contribution to the model ( $p = .026$ ), PTA and age did not.

**Conclusions:** Higher community integration was related to lower ratings of caregiver burden but not to caregiver life satisfaction. However, greater patient social integration was related to lower caregiver burden and higher life satisfaction. Results suggest that by directing post-acute rehabilitation towards patients' societal participation, some of the burden placed on their caregivers could be relieved.

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**N. LUC, S. SORG, E. LANNI, M.W. BONDI, D. SCHIEHSER, A.J. JAK, Y.L. CHANG, S. DEV, D.C. DELIS, L.R. FRANK & L. DELANO-WOOD. Quantitative Tractography of the Fornix and Associations with Working Memory in Veterans with Traumatic Brain Injury.**

**Objective:** White matter (WM) changes have been reported in mild-moderate TBI, although few diffusion tensor imaging (DTI) tractogra-

phy studies exist in the literature. This study investigated the fornix, a WM limbic structure that is particularly vulnerable to TBI-related diffuse axonal injury. Given this structure's connectivity and cholinergic input to the medial temporal lobe (MTL), we investigated associations between fornix microstructural integrity and cognition in TBI.

**Participants and Methods:** Seventeen OEF/OIF veterans (blunt/blast force; 15/17=male; mean age=29) were administered 3T DTI scans (61 directions) and a comprehensive neuropsychological evaluation. WM tracking was employed by seeding ROIs in bilateral contiguous slices on a registered T1 image and mean DTI values were derived from individual fractional anisotropic (FA) and mean diffusivity (MD) maps.

**Results:** Fornix fiber tracts significantly correlated with WAIS-III Digit Span age-scaled score (FA:  $r = .67, p = .006$ ; MD:  $r = -.53, p = .04$ ), and this relationship was driven by the backward condition (FA:  $r = .62, p = .01$ ; MD:  $r = -.49, p = .05$ ). Fornix FA also related significantly to WMS-III Logical Memory I age-scaled score ( $r = .57, p = .028$ ) and first recall age-scaled score ( $r = .66, p = .01$ ), while MD related significantly to WAIS-III Symbol Search scaled score ( $r = -.75, p = .05$ ).

**Conclusions:** Findings indicate that, in our sample of OEF/OIF veterans with TBI, WM integrity of the fornix is associated with performance on neuropsychological tasks tapping working memory. Results suggest an association between connectivity within MTL and limbic structures and working memory in individuals with blast/blunt force trauma.

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**S. MEACHEN, L.J. RAPPORT, B. WALDRON-PERRINE & P. HUBBARTH. Awareness of Deficit and Cortisol Stress Reactivity in Persons with TBI and Their Caregivers.**

**Objective:** Awareness of deficit is paradoxically associated with low subjective stress in persons with TBI but high subjective stress in their caregivers. This study tested whether a similar pattern is shown in physiologic correlates of stress in response to psychosocial challenges.

**Participants and Methods:** Participants were 52 adults with moderate to severe TBI and 51 caregivers. Salivary cortisol was measured at baseline, following a stress task (videotaped speech), and after recovery. Awareness of deficit was assessed via the Awareness Questionnaire.

**Results:** Mixed-model ANOVA tested between-group factors Group (TBI Survivor, Caregiver) and Awareness (Impaired, Not impaired), and a within-subject factor, Time (cortisol at three timepoints). Main effects for Group ( $p = .045$ ) and Time ( $p < .001$ ) indicated TBI-group cortisol was higher than caregiver-group cortisol, and Time 1 cortisol was higher than Times 2 and 3 cortisol. A two-way Awareness \* Time interaction ( $p = .014$ ) indicated that, across group, survivors with impaired awareness and their caregivers had higher baseline cortisol and steeper drop than did those with intact awareness. TBI awareness groups did not significantly differ on injury severity or current neuropsychological functioning.

**Conclusions:** Salivary cortisol was higher in persons with TBI than their caregivers, but contrary to expectation, impaired awareness was associated with higher cortisol in both survivors and caregivers. There appears to be dissociation of subjective and physiological well-being as they relate to impaired awareness of deficits. Among persons with TBI, impaired awareness may have beneficial effects on the former but adverse effects on the latter. Among caregivers of those survivors it takes a toll on both subjective and physiologic well-being.

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**J.D. MEDAGLIA, B.M. WARDECKER, D. RAMANATHAN, K.S. CHIOU, J. VESEK, D. GOOD, E.C. HILLS & F.G. HILLARY. Involvement of the Cerebellum in Task Proceduralization and Speeded Performance in Adult TBI.**

**Objective:** Activation in the cerebellum during working memory (WM) has been shown to be positively correlated with task load. In addition,

task practice increases cerebellar activation in a cortico-cerebellar network in healthy adults. To date, the effects of practice on cerebellar activation and the cerebellum's relationship to the dorsolateral prefrontal cortex (DLPFC) in WM has not been conducted in an adult TBI sample. The aim of the current study is to examine cerebellar activation with respect to reaction time (RT) and the DLPFC before and after practice in a N-back WM paradigm using fMRI in an adult TBI sample.

**Participants and Methods:** Participants were nine adults with moderate to severe TBI at least one year post-injury and 6 healthy adult controls. Participants performed two 2-back trials, separated by task practice. Percent signal change measurements were extracted from group contrast defined ROIs in the right cerebellum and left DLPFC for all subjects using the MarsBar SPM toolbox and regressed against RT.

**Results:** Percent signal change in the right cerebellum exhibited a weak negative correlation with RT before practice (non-significant,  $R^2=.14$ ), but was positively correlated with RT after practice ( $R^2=.48$ ,  $p=.037$ ). The right cerebellum and left DLPFC showed a high correlation of % signal change before practice ( $R^2=.61$ ,  $p=.012$ ) that reduced after practice ( $R^2=.29$ ,  $p=.131$ ).

**Conclusions:** The right cerebellum's role during a task may shift from support of the contralateral DLPFC during task proceduralization before task practice to a role facilitating speeded task performance after practice during verbal WM in TBI.

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**S.K. MEETH, S. MEARES, J. BATCHELOR, A. SHORES, J. CHAPMAN, I. BAGULEY, J. GURKA & J.E. MAROSSZEKY. Prediction of Return to Productivity 3 Months Following Hospitalisation for Trauma.**

**Objective:** This study aimed to identify variables that could accurately predict return to full productivity at three months post-injury in hospitalised individuals with and without mild traumatic brain injury (mTBI). Return to productivity was defined as a full return to pre-injury employment, home duties and/or study.

**Participants and Methods:** Participants comprised 56 mTBI patients and 57 trauma controls (TC). Assessments were conducted a mean 5 days (SD 2.8), and again 102.7 days (SD 14.2) post-injury. Logistic regression analyses examined whether pre-injury, injury related, and post-injury variables and neuropsychological function (including verbal learning, attention and information processing) were associated with return to productivity.

**Results:** At 3-month follow up 35 (62.5%) of mTBI and 20 (35.1%) of TC reported a full return to productivity. Of these, 27 (77.1%) of mTBI and 20 (100%) of TC returned to pre-injury work level, 7 (20%) of mTBI and 3 (15%) of TC returned to pre-injury study level, and 35 (100%) of mTBI and 19 (95%) of TC returned to pre-injury home duties. Individuals with a shorter length of hospital stay were more likely to have returned to productivity (OR: .75, 95% CI: .60-.96). With each unit increase in verbal learning, individuals with mTBI were 1.06 times more likely to report full productivity (95% CI: 1.01-1.11) whereas for TC there was no significant relationship between verbal learning and return to productivity (OR: 1.00, 95% CI: .98-1.03).

**Conclusions:** Individuals with a shorter length of hospital stay may return to full productivity as they are less likely to require rehabilitation. Screening of verbal learning may help predict return to early productivity when performed prior to discharge.

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**K.M. O'DELL, F.O. BINEY & H.J. HANNAY. Ethnic, Gender, and Age Differences in Blood Alcohol Level upon Admission to a Level 1 Trauma Center in a Sample of Severe TBI Patients.**

**Objective:** Drinking patterns vary between the three major ethnic groups in the US. In general, Hispanics drink alcohol in noticeably larger quantities

than Anglo-Caucasians and African Americans (Neff, 1986; Neff and Hoppe, 1992). Patterns in alcohol consumption may also vary within ethnicity by gender and/or age group (Caetano, 1984). Such patterns have not been studied in TBI individuals at all or as a function of blood alcohol level (BAL) upon admission to a Level 1 trauma center.

**Participants and Methods:** A sample of 396 severe TBI patients (336 males; 60 females) was tested for BAL upon admission. Ethnicity, gender, and age were determined by patient or family self-report. Group differences in BAL were examined using a two-way ANOVA, the female sample being too small to include in subsequent analyses.

**Results:** An ethnic x age groups ANOVA produced significant main effects for ethnic and age groups in males. Hispanics had a significantly higher BAL than Anglo-Caucasians. Other ethnic group comparisons were non-significant. Males aged 40-49 years had significantly higher BALs than males 18-29 and males 50+ years. Males aged 30-39 years had significantly higher BALs than males 50+. The age x ethnicity interaction was not significant.

**Conclusions:** BAL on admission in male patients with a severe TBI partially mirrors the general finding that Hispanic drink much higher quantities of alcohol than do Anglo-Caucasians but this was not the case for a comparison with African-Americans. Clearly there are age differences in pre-injury BAL with 40-49 year old males having the highest level.

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**L.J. OZEN, A. CLARK, E. ROY & M.A. FERNANDES. Persistent Attention and Memory Impairments in Young Adults With a Mild Head Injury.**

**Objective:** Attention and memory problems are the most common and persistent complaints made by individuals with mild head injury (MHI), yet these deficits often go undetected on standard neuropsychological tests. Our objective was to identify these subtle deficits using more sensitive experimental measures. We hypothesized that individuals with MHI would not only report more attention and memory problems, but also show impaired performance on our computerized working memory (WM) and attention tasks.

**Participants and Methods:** Thirty-one undergraduate students with self-reported MHI, occurring at least 6 months ago, and 39 undergraduates with no history of head injury participated in this study. All participants completed an attention and memory questionnaire, a neuropsychological test battery, and a computerized version of the Stroop task. A subset of participants completed a computerized WM task where they were instructed to make a response when any two digits were repeated within a string of digits (baseline condition). In the more complex condition (the supervision condition), participants were asked to make a response only when the repeated number was enclosed in the same color square.

**Results:** Independent t-tests revealed a trend, such that MHI participants reported more everyday attention problems on the Attention-Related Cognitive Errors Scale compared to controls. MHI participants also had significantly longer mean reaction times, but comparable accuracy, on the Stroop task and on both conditions of the WM task compared to controls.

**Conclusions:** The persistent attention complaints reported by MHI individuals may be explained by a general slowing of information processing speed. This slowing may be a result of the additional cognitive resources required to maintain accurate performance, which may make it more difficult for MHI individuals to simultaneously store and manipulate information, as well as concentrate for extended periods of time. Correspondence: *Lana J. Ozen, University of Waterloo, 200 University Ave West, Waterloo, ON N2L 3G1, Canada. E-mail: lozen@uwaterloo.ca*

**S. PENNA, T.A. NOVACK, M. GROTE, N. CARLSON, J. CORRIGAN & T. HART. Residence Following Traumatic Brain Injury: A Longitudinal Study.**

**Objective:** As a potential measure of independent living, residence is an area of interest following traumatic brain injury (TBI). Change in residence, relative to pre-injury status, was examined in this study, as well as variables important in determining residence.

**Participants and Methods:** This was a prospective, observational study of 7,925 patients with moderate or severe TBI receiving acute rehabilitation and enrolled in the TBI Model Systems National Database. Pre-injury and discharge residential status was determined during rehabilitation, and at 1, 2, and 5 years post-injury by telephone interview. Change over time in residence was the main outcome. In addition, variables potentially associated with residential status were examined including injury severity, demographic information, and functional status variables.

**Results:** There was significant change in residence across 5 years characterized by a return to pre-morbid residential status. The most significant transition took place in the first year after injury. Prior residence, age, and race all significantly contributed to residence, with prior residence having the strongest association. Severity of injury had little impact, although functional status at rehabilitation discharge was associated with residence.

**Conclusions:** The findings are consistent with other literature indicating the greatest amount of functional recovery occurs within the first year (e.g. return to work, return to driving). The degree of change varied based on pre-injury residence. The most substantial change was for those living alone, or without another adult who could take responsibility, at the time of injury.

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**D. RAMANATHAN, B.M. WARDECKER, J.D. MEDAGLIA, K.S. CHIOU, J. SLOCOMB, J. VESEK, J. WANG, E. HILLS, G. DAVID & F.G. HILLARY. Axial Diffusivity and Fractional Anisotropy Correlate With Performance Following Traumatic Brain Injury.**

**Objective:** Diffusion tensor imaging (DTI) measures the direction of water diffusion in white matter thus providing information about pathophysiology following traumatic brain injury (TBI). Water diffusion is commonly measured by quantifying fractional anisotropy (FA), but diffusivity can also be indexed by quantifying axial diffusivity (AD) and radial diffusivity (RD). The current study aimed to examine the relationship between these related but distinct measures of diffusivity and change in working memory task performance at 3 and 6 months post moderate and severe TBI.

**Participants and Methods:** This study used DTI methods to examine white matter change in the anterior corpus callosum in individuals sustaining moderate and severe TBI. DTI data were collected for participants at two time points and values for fractional anisotropy, axial, and radial diffusivity were calculated. In addition, change in reaction time in a non-verbal working memory task was calculated at a 3 and 6 month post-injury follow-up.

**Results:** Correlational analyses revealed strong relationships between measures of diffusivity ( $r(5) = .962, p < .002$ ). When examining the relationship between diffusion indices and reaction time, change in FA and AD were correlated with change in reaction time at follow-up ( $r(5) = -.733, p < .159$ ) and ( $r(5) = -.815, p < .093$ ), respectively.

**Conclusions:** The current results show that indicators of white matter integrity differentially predict measures of reaction time. Measurements of water diffusivity in early recovery could improve the understanding of behavioral change following TBI.

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**D. RAMANATHAN, J.D. MEDAGLIA, B.M. WARDECKER, J. PARDINI, M. LOVELL, J. WELLING & F.G. HILLARY. A Longitudinal fMRI Investigation of Recovery From Concussion.**

**Objective:** Concussion, compared to moderate and severe traumatic brain injury, has been described as a condition where cerebral dysfunction can be fully restored over time. Research now shows that these mild injuries can result in chronic neuropsychological deficits and

frontal lobe dysfunction. Functional magnetic resonance imaging (fMRI) is useful in detecting subtle neural activity related changes that occur on a metabolic level as a result of the injury, and could characterize functional brain pathology during recovery. What remains unclear is what basic changes in the BOLD signal indicate with respect to recovery. In the current study, fMRI was utilized longitudinally in individuals sustaining concussion to investigate the relationship between involvement in left and right prefrontal cortex (PFC) during recovery.

**Participants and Methods:** An N-back working memory task was administered during fMRI data acquisition to individuals sustaining concussion, at two time points during the post-injury recovery period.

**Results:** LPFC showed decreased involvement over time during a period of concussion resolution. Activation in LPFC and RPFC were significantly correlated at each of the early time points and there was a significant relationship in BOLD signal change between hemispheres.

**Conclusions:** The results indicate that PFC involvement diminishes during the recovery process following concussion and that change in left and right PFC is largely consistent. These data are consistent with a literature documenting decreased, as opposed to more elaborate, involvement of PFC resources during recovery.

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**M. RAMIREZ & F. OSTROSKY-SOLIS. RELATIONSHIP BETWEEN SELF-AWARENESS, COGNITION AND OUTCOME IN TRAUMATIC BRAIN INJURY.**

**Objective:** To analyze the changes on cognitive and self-awareness in moderate and severe TBI's patients.

**Participants and Methods:** 10 moderate (mean age:  $34.80 \pm 14.45$ ; mean educational level:  $13.20 \pm 2.52$ ) and 16 severe TBI's patients (mean age  $32.17 \pm 9.42$ ; mean educational level:  $12.11 \pm 4.15$ ) were evaluated with the Memory and Attention Neuropsychological Battery and the Patient Competency Rating Scale (PCRS) on the acute (minor to 6 months) and chronic (more than 1 year) stage; both groups were matched with a healthy control group.

**Results:** Statistical analysis show significant lower scores in the acute TBI's patients. The Moderate TBI showed lower performance on Memory and Severe TBI had a lower performance on Attention measures. With regard to self-awareness, moderate patients had deficits on emotional control while severe patients had deficits on daily activities and cognitive areas. A significant negative correlation between memory test and PCRS was found.

**Conclusions:** Some studies have suggested that during the patients during the chronic stage showed severe deficit on cognition, however our data revealed that the acute patients are the ones who showed the poorest cognitive performance. Cognition had a significant influence on cognitive performance. Discussion is related to the development of rehabilitation programs for TBI patients.

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**G.L. SARAH, R.J. SPENCER, L.L. DRAG, P.H. PANGILINAN & L.A. BIELIAUSKAS. Reliability and Validity of the Hospital Anxiety and Depression Scale Among Veterans Suspected of Having a Traumatic Brain Injury.**

**Objective:** Depression and anxiety are common among soldiers suspected of having a traumatic brain injury (TBI). This project examines the psychometrics of a brief self-report measure of emotional status, the Hospital Anxiety and Depression Scale (HADS).

**Participants and Methods:** Individual item responses on the HADS were collected from 199 veterans seen in a traumatic brain injury (TBI) clinic. An exploratory factor analysis was conducted on the 14 items of the HADS and the internal consistency of the depression and anxiety

scales were examined using Chronbach's alpha coefficients. Twenty-seven patients also completed the Beck Anxiety Inventory (BAI) and the Beck Depression Inventory-II (BDI-II). The scores on the HADS were compared to moderate or severe elevations on the BAI and BDI-II to examine concurrent validity.

**Results:** The HADS had acceptable internal consistency ( $\alpha = .84$  for Anxiety and  $.82$  for Depression), and concurrent validity. A cut-off of moderate anxiety on the HADS had 85% positive predictive power and 93% negative predictive power. Similarly, a cut-off of moderate depression on the HADS had 73% positive predictive power and 75% negative predictive power. The Exploratory factor analysis demonstrated two factors that accounted for 52% of the total variance. Seven items were unambiguously related to a depression factor and six items were related to an anxiety factor. One item that was part of the original anxiety scale was related to both factors.

**Conclusions:** The HADS is a reliable measure of depression and anxiety that is strongly associated with self-reported psychiatric symptoms on other inventories.

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**D. SCHIEHSER, J. FILOTEO, L. DELANO-WOOD, S. HAN, A.J. JAK, A.I. DRAKE, D.C. DELIS & M.W. BONDI. Different Maladaptive Behaviors Are Associated With Specific Patterns Of Emotional And Cognitive Changes Following TBI.**

**Objective:** Traumatic brain injury (TBI) is frequently associated with changes in cognition, emotion, and behavior. This study aimed to examine retrospective pre- and post-injury changes in behaviors associated with apathy, disinhibition, and subjective executive dysfunction in the early stages of recovery from TBI. We further examined the ability of cognitive performances and psychiatric symptoms to predict these behavioral changes. It was hypothesized that (1) maladaptive behaviors involving apathy, disinhibition, and subjective executive dysfunction would be retrospectively rated as having significantly increased in severity from pre-injury to present (post-) injury levels; and (2) these behavioral changes would be associated with greater levels of post-injury depressive symptoms, as well as deficits on cognitive tasks specific to executive function.

**Participants and Methods:** Participants were 71 non-combat military personnel who were in early recovery (< 3 months post-injury) from mild to moderate TBI. Pre- and post-injury behaviors were assessed with the Frontal Systems Behavior Scale (FrSBe) and correlated with levels of depressive symptoms and objective measures of attention, executive function, and memory.

**Results:** Results revealed depression and attention to be the best predictors of pre- to post-injury changes in apathy and subjective executive dysfunction, whereas performance on objective tests of executive function was the best predictor of pre- to post-injury changes in disinhibition.

**Conclusions:** Our findings demonstrate that TBI survivors in the early stages of recovery experience increases in maladaptive behaviors from pre-injury levels, and different patterns of emotional and cognitive functioning tend to predict changes in specific behaviors associated with TBI.

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**A.L. SHANDERA, J.P. HARP, J.A. CLARK, R.E. SCHLEENBAKER & W.M. HIGH. Psychological Profiles of Combat Veterans Exposed to Mild Head Trauma and Combat-Related Stressful Events.**

**Objective:** Many veterans are returning with symptoms of PTSD and mild traumatic brain injury (mTBI) resulting from blasts and other combat. It was hypothesized that the MMPI-2 PTSD scale (PK) would differentiate between mTBI veterans who met DSM-IV-TR criteria for PTSD and those who did not. Group differences on screens for PTSD, anxiety, depression, and overall stress were also examined.

**Participants and Methods:** Thirty-nine recent combat veterans were referred for neuropsychological evaluation following possible mTBI and combat-related stress. Of these, 14 were excluded from analyses because

they lacked evidence of brain injury (6) or failed malingering tests (10). Of the remaining 25 veterans, (25 Caucasian, 23 male), all had reported injuries consistent with mTBI. All participants completed an extensive clinical interview, a neuropsychological test battery, emotional/behavioral measures, and a PTSD screen.

**Results:** 60% of the sample met DSM-IV-TR criteria for PTSD. T-tests indicated the PTSD group had significantly greater elevations on MMPI-2 scales 1, 2, 3, 7, 8, and several validity scales. Validity scale scores, while higher than the non-PTSD group, were still within acceptable limits. Significant differences in mean scores on PK were found between groups, but the recommended cutting score only identified 26.7% of the PTSD group. A cutting score of 50 on the PCL-C correctly identified 93.3% of the PTSD group. Group differences on other screening measures are discussed.

**Conclusions:** These results suggest that recommended cutting score for the PCL-C provides greater sensitivity to PTSD than the current PK cut-off. In addition, co-morbid mTBI & PTSD may alter the MMPI-2 profile. Correspondence: *Jordan P. Harp, Physical Medicine & Rehabilitation, University of Kentucky, 2050 Versailles Rd, Lexington, KY 40504, United States. E-mail: jordanharp@gmail.com*

**R.J. SPENCER, L.L. DRAG, P.H. PANGILINAN, C.H. DOMEN & L.A. BIELIAUSKAS. Mild Traumatic Brain Injury has a Small Effect on Cognitive Performance among Returning Soldiers: Preliminary Findings.**

**Objective:** There is a growing debate regarding lasting effects of mild traumatic brain injury (mTBI), with research suggesting that self-reported cognitive impairments can be explained by psychiatric causes (e.g. Hoge et al., 2008). This study examined the extent to which mTBI contributes to both subjective and objective cognitive functioning after controlling for depression and anxiety.

**Participants and Methods:** Data were collected from 130 veterans with mTBI seen in the traumatic brain injury (TBI) clinic. Participants estimated the number and duration of losses of consciousness, post-traumatic amnesia, and times they were dazed. Participants completed self-report measures of cognitive and emotional functioning and completed a battery of neuropsychological tests. Principle components analyses were used to calculate composite measures of attention, memory, emotional functioning, and mTBI severity. Separate hierarchical regression analyses were performed with subjective and objective attention and memory as criterion variables and emotional functioning entered as the predictor variable in step one and injury severity entered in step two.

**Results:** Both emotional functioning and self-reported mTBI severity uniquely explained 3% ( $p < .05$ ) of the variance in performance on tests of attention and memory. When self-reports of attention and memory are considered, emotional functioning explained 43% of the variance, with mTBI severity contributing no additional significant variance.

**Conclusions:** mTBI has a small, but measurable effect on objective cognitive performance but not self-reported cognitive functioning after accounting for psychiatric symptoms. This difference illustrates the importance of using objective measures of cognitive functioning in both research and clinical settings when examining the effects of mTBI on cognition.

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**M.D. SWARTWOUT, A.M. SANDER, A.N. CLARK, M. SHERER, R. NAKASE-RICHARDSON, J.F. MALEK & A. MOESSNER. Relationship of Pre-Injury Family Environment to Community Integration in Adults with Traumatic Brain Injury.**

**Objective:** Researchers have documented that adults with traumatic brain injury (TBI) show decreased community integration in a variety of areas, including productivity and socialization, and that significant predictors include age and injury severity. Research in pediatric TBI indicates that pre-injury family functioning impacts outcome, but this relationship has received limited attention in adults. The present study hypothesized that higher pre-injury levels of family and caregiver functioning would be associated with higher levels of community integration.

**Participants and Methods:** Upon admission to inpatient rehabilitation, caregivers of 141 persons with complicated mild to severe TBI were assessed regarding pre-injury family functioning, emotional distress, and perceived social support. The outcome of the person with injury was assessed 1-2 years later, using the Community Integration Questionnaire (CIQ) and the Social and Occupation scales of the Craig Handicap Assessment and Reporting Technique (CHART). The caregiver measures were used to predict outcome in the person with injury, after controlling for injury severity.

**Results:** There were significant interactions of several caregiver variables with injury severity. For persons with complicated mild/moderate injury, better family functioning was associated with greater home integration, and less caregiver distress was associated with better social integration. For persons with severe injuries, greater perceived social support was associated with higher productivity and social integration.

**Conclusions:** Pre-injury caregiver characteristics interact with injury severity to impact outcomes in the person with injury. Research on outcomes should include measures of family functioning. Early interventions targeted toward increasing caregiver distress, increasing support, and improving family functioning may have a positive impact on later outcomes.

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**A. SWIER-VOSNOS, R. SPENCER, P. PANGILINAN, L. DRAG & L. BIELIAUSKAS. Factors Influencing Clinical Decision-Making in a VA TBI Clinic.**

**Objective:** Mild traumatic brain injury (mTBI) is a common diagnosis in returning veterans, who often report a variety of cognitive, physical, and emotional symptoms. An important part of a clinician's assessment process is deciding whether these symptoms can be attributed to mTBI. The current study explores which sources of information significantly influence this decision-making process.

**Participants and Methods:** Data were collected from 124 veterans diagnosed with mTBI seen in a VA TBI Clinic. Veterans completed a structured interview and brief neuropsychological screen. Clinicians then made dichotomous ratings as to whether reported symptoms were associated with their head injury (mTBI attribution). Using principle components analysis, composite scores were created for self-reported mTBI severity variables, self-reported cognitive functioning, and performance on neuropsychological measures of attention and memory.

**Results:** A logistic regression analysis indicated that higher mTBI severity ( $B = 0.92$ ), poorer memory performance ( $B = 1.12$ ), and better attention performance ( $B = -1.15$ ) were the only significant predictors of an attribution of symptoms to mTBI.

**Conclusions:** These findings suggest that clinicians are more likely to consider reported symptoms to be secondary to mTBI if there is a higher degree of injury severity and poorer memory performance. Interestingly, better performance on measures of attention was associated with non-mTBI attribution, suggesting that clinicians may ascribe problems of attention to alternative etiologies such as psychiatric disorders or stress. Self-report of cognitive problems was not a significant predictor of mTBI attribution, possibly because self-report has been shown to be an unreliable predictor of objective measures of cognitive functioning.

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**S. TARTAR, C. PECK, H. BOORSTEIN, D. LOVEJOY, R. KAPLAN, D. FEIN, J. HOLDNACK & K. TREADWELL. Neuropsychological Functioning Following Mild Traumatic Brain Injury: Complicated versus Uncomplicated Injury Outcomes.**

**Objective:** The purpose of the present study was to expand upon the growing literature reported regarding intellectual and neuropsycholog-

ical profiles of individuals with complicated and uncomplicated mild traumatic brain injury (mTBI), and to determine patterns of cognitive functioning that may differentiate mTBI subgroups from normal controls in a matched subject research design that carefully controls for important confounds.

**Participants and Methods:** This study compared WAIS-III and WMS-III scores of participants with mild traumatic brain injury (mTBI,  $n=50$ ) referred for neuropsychological evaluation to normal control participants ( $n=49$ ) matched on intellectual ability, gender, age, and education. Further, within subject variability was tested post-hoc via dissociation analyses to determine whether individuals demonstrated relative impairment not seen in group analyses.

**Results:** Results indicated that no WMS-III variables and only the Perceptual Organization Index score and the Matrix Reasoning subtest of the WAIS-III distinguished individuals with complicated mTBI from individuals with uncomplicated mTBI and normal control participants, with the uncomplicated mTBI group performing better on the PO Index than the complicated mTBI group ( $p < .05$ ). Post hoc analyses comparing scores between the complicated mTBI group and control group indicated an unusual finding of worse performance by the control group on the Matrix Reasoning subtest ( $p < .05$ ). Individual differences were not found with dissociation analyses to be contributory.

**Conclusions:** This study supports previous findings that the performances on measures of intellectual and learning/memory tasks by individuals with mTBI are largely similar to normal controls, but does provide emerging evidence for differences between complicated/uncomplicated mTBI outcomes in a symptomatic mTBI population.

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**J.B. MIELKE, M. WOLDE, A.L. JANOS, M.E. HOFFER & J.W. TSAO. Trail Making Test A and B and Verbal Fluency Performance in Military Personnel Following Blast Exposure In-Theater.**

**Objective:** Explosive blast is the primary cause of concussion or mild traumatic brain injury (mTBI) in deployed military personnel. Developing reliable and sensitive screening methods will help improve diagnostic accuracy as many service members present with subtle symptoms and determine the effects of combat-related blast exposure on neurocognitive function.

**Participants and Methods:** 78 military personnel deployed to Iraq who were free of physical injury but exposed to explosive blasts were evaluated using Trail Making Tests A & B, Controlled Oral Word Association test, and animal naming. 57 (73%) were tested within 24 hours of exposure. Test scores following z-score transformations of raw data into percentiles based on normative data were correlated with distance from blast.

**Results:** 18% of the subjects were borderline or abnormal on the Trail Making tests versus 9% borderline or abnormal on either the COWA or animal naming tests. 92% of abnormal scores were in service members in close proximity to the blast.

**Conclusions:** Neurocognitive testing administered to military personnel exposed to explosive blast forces while in-theater revealed scores consistent with normative data for verbal fluency but increased numbers of borderline to impaired scores on tests of attention, sequencing, and processing. These findings should be viewed cautiously given the many factors experienced in combat that also contribute to deficits in attention and processing speed including sleep deprivation and mood disorders. Further research is needed to determine whether Trail Making tests may be useful objective measurements of cognitive performance in concussion examinations following blast.

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**S. TUN. Interim findings on diagnosis of PTSD predicting subjective cognitive complaints, and not objective cognitive performance in blast-exposed Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) veterans.**

**Objective:** Preliminary findings from an ongoing study of blast-exposed OIF/OEF veterans at the Portland VA Medical Center suggested that PTSD is associated with increased reporting of subjective cognitive problems. Additionally, it has been established that PTSD is associated with cognitive changes.

**Aims:** To compare subjective cognitive complaints in OIF/OEF veterans with and without diagnosis of PTSD, and to examine the objective cognitive performance in these two groups.

**Participants and Methods:** Forty-six participants were drawn from an ongoing study of neuropsychological functioning in blast-exposed OEF/OIF veterans. Data analyzed consisted of PTSD diagnosis status as measured by a structured diagnostic clinical interview (the MINI), subjective cognitive complaints as measured by the Ruff Neurobehavioral Inventory (RNBI), and objective cognitive performance as measured by the memory, attention, spatial, and executive functioning measures of the Neuropsychological Assessment Battery (NAB).

**Results:** An independent-samples t-test was conducted to compare the subjective cognitive complaints and objective cognitive performance in veterans with ( $N = 25$ ) and without ( $N = 21$ ) diagnosis of PTSD. Significant group differences were found on subjective measures of cognitive complaints of attention, executive functioning, and memory. However, no significant group difference was found on objective measures of cognitive performance.

**Conclusions:** Findings suggest that although PTSD is associated with increased subjective reporting of cognitive problems in blast-exposed OIF/OEF veterans, it does not appear to be associated with objective cognitive performance.

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**A. VINCENT, T.M. ROEBUCK-SPENCER, R. SCHLEGEL & K. GILLILAND. Cognitive Functioning Following Military Deployment.**

**Objective:** The frequency of TBI has been higher in the Iraq/Afghanistan conflicts than in any other armed conflict. To aid assessment of this injury, the Automated Neuropsychological Assessment Metrics (ANAM4) has been administered as a baseline to over 360,000 armed service members prior to deployment. To increase its validity to detect cognitive insult, knowledge of the effects of deployment on ANAM4 performance is needed.

**Participants and Methods:** The current study examined ANAM4 performance at pre- and post-deployment in a repeated measures design. Individuals were divided into three groups based on self-report of mild TBI sustained during deployment: 1) No reported injury ( $n=400$ ); 2) Reported injury with ongoing symptoms ( $n=214$ ); and 3) Reported injury without ongoing symptoms ( $n=329$ ). Seven ANAM4 tests were administered including measures of simple and complex reaction time, learning, working memory, and recognition memory. ANAM4 was administered prior to deployment and within 6 days post-deployment.

**Results:** Group by time interactions were seen for all tests. Groups showed no significant differences at pre-deployment. The active-symptoms injury group performed worse than the other two groups at post-deployment. This group also showed the greatest changes in performance between pre- and post-deployment while the other groups demonstrated improved performance or changes with very small effect sizes.

**Conclusions:** This study revealed minimal to no significant changes in cognitive functioning based on the rigors of deployment alone. Cognitive decrements were seen for individuals reporting an injury during deployment with ongoing symptoms. This study supports the use of ANAM4 as a screening tool for detecting cognitive change in service members reporting mild-TBI.

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**B. WALDRON-PERRINE, L.J. RAPPORT, S. MEACHEN & P. HUBBARTH. Predicting Functional Outcome After TBI: Unique Contributions of Facets of Religion/Spirituality.**

**Objective:** Substantial research has focused on the relationship between religion/spirituality and health in general, though little work has assessed this relationship among persons with cognitive impairment. This study assessed the relative contributions of religious/spiritual well-being and activities to functional outcome, after accounting for demographic and injury-related characteristics.

**Participants and Methods:** Participants were 83 adults with moderate to severe TBI and 83 significant others familiar with their current level of function, assessed via the Patient Competency Rating Scale (PCRS). Injury severity was estimated from duration of post-traumatic amnesia; current neuropsychological functioning was estimated via Symbol Digit Modalities Test (SDMT); awareness of deficit was assessed via the Awareness Questionnaire (AQ). Religious and Existential Well-Being were assessed using the Spiritual Well-being Scale (SWBS), and participants reported on current religious activities. Benefit finding and perceived negative impact from injury were assessed via the Perceived Benefit Scale (PBS).

**Results:** Hierarchical multiple regression assessed the contributions of education, injury severity and neuropsychological functioning (Step 1), awareness of deficit (Step 2), and existential and religious well-being, religious practices, perceived benefit from trauma and perceived negative impact from injury (Step 3) in predicting general functioning. All steps added significant variance to the model, accounting for 36% of the total variance in PCRS. Squared semipartial correlations indicated that injury severity, awareness of deficit, and religious well-being each explained unique variance in current functioning, whereas education, neuropsychological functioning, existential well-being, religious practices and perceived benefit/detriment did not.

**Conclusions:** Religious well-being (i.e., belief of having a personal relationship with a higher power) meaningful contributes to functional rehabilitation outcome.

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**B.M. WARDECKER, D. RAMANATHAN, J.D. MEDAGLIA, K.S. CHIOU & F.G. HILLARY. The Influence of Cognitive Functioning and Dispositional Optimism on Psychological Distress After Traumatic Brain Injury.**

**Objective:** Individuals sustaining moderate and severe traumatic brain injury (TBI) are at an increased risk for developing psychological illness compared to healthy adults (Rogers & Read, 2007). Common measures of injury severity, such as the Glasgow Coma Scale (GCS), are poor predictors of psychiatric symptomatology following TBI. The current study examined cognitive functioning and dispositional optimism in relation to TBI to determine their relationships with post-injury psychological distress (PD).

**Participants and Methods:** Fifteen individuals with chronic moderate to severe TBI (at least 1-year post injury) were recruited to complete the Telephone Interview for Cognitive Status, the Craig Handicap Assessment Technique, and the Symptom Checklist Questionnaire-Revised. Current levels of optimism were also measured using the Life Orientation Test-Revised.

**Results:** Analyses indicated a strong negative correlation between psychological distress and current cognitive functioning ( $r(14) = -.719, p < .003$ ) and dispositional optimism was the best predictor of PD ( $r(14) = -.577, p < .024$ ). These relationships were compared to traditional measures of injury severity (e.g., GCS), which were not significantly related to PD. Dispositional optimism and cognitive dysfunction showed a positive correlation ( $r(14) .613, p < .015$ ).

**Conclusions:** Results revealed that increased cognitive functioning and dispositional optimism strongly correlate with decreased psychological distress after TBI. In the current study, the GCS did not show a meaningful relationship with psychological distress among individuals with TBI, indicating that injury severity may not be an informative predictor of PD after brain injury.

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**T.C. WU, E.D. BIGLER, S. HALSEY, R. YALLAMPALLI, Z. CHU, X. LI, J.V. HUNTER, C.A. VASQUEZ, H.S. LEVIN & E.A. WILDE. Alterations of the Cerebral Peduncle Following Severe Traumatic Brain Injury.**

**Objective:** Altered mental status, ranging from disorientation to loss of consciousness, is commonly observed following traumatic brain injury (TBI) with all severities. Recent studies have demonstrated the relation between disrupted consciousness and brainstem pathology. Diffusion tensor imaging (DTI) has been useful in characterizing white matter alteration following TBI. This study examined changes in the cerebral peduncle (CP) using DTI at a chronic phase in patients with severe TBI.

**Participants and Methods:** 13 (11 males, 2 females) young adults (mean age = 23.08 years) with severe TBI (GCS score < 8) and 16 (14 males, 2 females) healthy controls underwent DTI on Philips 3T scanners three to six months post injury. Essential demographic features (e.g., age, gender, handedness, and years of education) did not differ between the groups. Three of the participants with TBI had focal structural lesions at the brainstem level identified on acute CT. The two major DTI metrics, fractional anisotropy (FA) and apparent diffusion coefficient (ADC), were analyzed with quantitative tractography using Philips fiber tracking software.

**Results:** In comparison to the control group, the TBI group had significantly lower FA and higher ADC in both right and left CPs. (all  $p$ 's < 0.01). The three patients with focal brainstem lesions had significantly lower FA in the right ( $p < 0.001$ ) but not left CP compared to TBI patients without brainstem lesions. ADC did not differ significantly between patients with and without brainstem lesions.

**Conclusions:** DTI is a promising tool to further investigate white matter changes that are less evident on conventional structural imaging.

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**Assessment/Psychometrics/Methods  
(Adult)**

**K. DAMS-O'CONNOR, A.S. YI, L.A. SPIELMAN, C.I. HIRSHSON, T.A. ASHMAN & W.A. GORDON. The Factor Structure of the Brain Injury Screening Questionnaire (BISQ).**

**Objective:** The purpose of the study was to determine the factor structure of the 100-item Brain Injury Screening Questionnaire (BISQ).

**Participants and Methods:** An exploratory factor analysis (EFA) was conducted on a sample of 391 individuals. Next, a confirmatory factor analysis (CFA) was conducted on an independent sample of 395 individuals. Participants in both samples were individuals with documented TBI ranging from mild to severe.

**Results:** The results of EFA ( $N=391$ ) yielded 6 factors with eigenvalues greater than 2. An oblique rotation improved the interpretability of the factors, but because of high cross-factor loadings, one factor was dropped, yielding a theoretically meaningful 5-factor solution with all items loading  $\geq .35$ . Factors were labeled: Memory/Attention, Mood, Impulsivity, Physical Symptoms, and Executive Functioning. Prior to conducting the CFA ( $N=395$ ), items that loaded  $>.40$  on a second factor were dropped, thereby eliminating the Executive Functioning factor.

The resulting model contains 45 items in four factors. Fit indicators were adequate: CFI (comparative fit index) = .83, RMSEA (Root Mean Square Error of Approximation) = .054, the NFI (Normed Fit Index) = .71. The Mood and Physical Symptoms factors were highly correlated. Internal consistency of the factor scales ranged from .8-.93 (Cronbach's alpha).

**Conclusions:** A psychometrically sound and theoretically meaningful factor structure for a validated TBI-symptom inventory emerged. The lack of a distinct index of executive functioning suggests the need for identifying symptoms uniquely related to this domain, which will result in improved screening and measurement of the constellation of symptoms that affect individuals with TBI.

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**K. DAMS-O'CONNOR, A.S. YI, L.A. SPIELMAN, C.I. HIRSHSON, J.B. CANTOR & W.A. GORDON. Ethnic Group Differences in Symptom Reporting on the Brain Injury Screening Questionnaire (BISQ).**

**Objective:** Differences among ethnic groups in symptom-reporting have been documented for depressive disorders, physical symptoms, and symptoms related to medical conditions. This study investigates whether there are ethnic group differences in reporting symptoms related to a TBI.

**Participants and Methods:** 576 individuals with documented TBI ranging from mild to severe completed the BISQ, a brain injury-related symptom self-report measure. ANOVA and ANCOVA were used to explore differences among ethnic groups in symptom reporting on four previously identified factors of the BISQ (Memory/Attention, Mood, Impulsivity, Physical Symptoms).

**Results:** One-way ANOVA and post-hoc analyses revealed that Hispanics reported significantly more symptoms than Whites on the Mood ( $F(df1,df2)=3.01, p=.05$ ) and Physical Symptoms ( $F(df1,df2)=4.58, p=.01$ ) factors. Blacks reported significantly more symptoms than Whites on the Impulsive/Aggressive ( $F(df1,df2)=3.45, p=.03$ ) and Physical Symptoms ( $F(df1,df2)=4.58, p=.01$ ) factors. However, both age and income were significantly associated with ethnic group membership, as Whites were older and had greater incomes than both Blacks and Hispanics ( $F(df1,df2)=8.86, p<.001$  and  $F(df1,df2)=33.52, p<.001$ , respectively). When these demographic variables were controlled for, ANCOVA analysis revealed that all ethnic differences in factor scores were eliminated.

**Conclusions:** Ethnic group membership did not account for any differences in reporting brain injury-related symptom once age and income were taken into account. These variables should be considered when exploring differences in symptoms between ethnic groups. Further investigation of the relationship between demographic factors and symptom reporting after TBI can improve the understanding of how various ethnic groups experience symptoms, and hence guide treatment.

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**K. DAMS-O'CONNOR, T. TSAOUSIDES & H. NEWVILLE. The Relative Utility of the URICA-TBI and the SADI as a Rehabilitation Readiness Screening Tool.**

**Objective:** The purpose of this study is to compare the relative utility of the University of Rhode Island Change Assessment for TBI (URICA-TBI) and the Self Awareness of Deficits Interview (SADI) as a tool for determining readiness for cognitive rehabilitation.

**Participants and Methods:** 49 individuals with documented TBI ranging from mild to severe completed the URICA-TBI and the SADI at the beginning of a comprehensive 3-5 day/week cognitive rehabilitation program. The URICA-TBI is a validated self-report measurement of readiness to engage in cognitive rehabilitation after TBI, and the SADI is a commonly used interview-based measurement of awareness. Pearson's correlations and ANOVAs were used to explore the relative benefits of these measures.

**Results:** No significant correlations were found between URICA-TBI and SADI scales. One-way ANOVA reveals no significant difference in SADI scores across URICA-TBI subscales. Closer inspection revealed an extremely restricted range of SADI scores, whereas participants were widely dispersed across stages of change as measured by the URICA-TBI (Coefficients of Variation= 0.882 and 7.081, respectively).

**Conclusions:** Given the ceiling effect of the SADI in this treatment-seeking TBI population, this measure has limited utility as a pre-treatment screening tool, and may be insensitive to detecting changes in

awareness with treatment. The URICA-TBI is a promising assessment that meaningfully distinguishes between levels and stages of readiness for cognitive treatment. Valid assessment of treatment readiness can maximize correspondence between readiness for change and intervention in order to improve outcomes and reduce attrition. Further validation is needed to establish its utility in clinical settings.

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## THURSDAY AFTERNOON, FEBRUARY 4, 2010

### Paper Session 4: Cancer

12:00–1:30 p.m.

**K.H. MOYER, J. ASHFORD, L. KAHALLEY, S. WU, X. XIONG, A. GROSS & H. CONKLIN. Clinical Significance and Ecological Impact of Attention Deficits in Pediatric Cancer Survivors.**

**Objective:** Research findings indicate attention deficits in pediatric cancer survivors based on group-level statistical impairment demonstrated on performance- and rater-based measures. This study investigates the rate of occurrence and ecological impact of clinically significant attention deficits (CSAD). We hypothesize the following: CSAD will be present in a significant proportion of survivors, attention deficits will be predicted by clinical risk factors (e.g., intensity of CNS-directed therapy) and attention deficits will be associated with behavioral dysfunction (e.g., social problems).

**Participants and Methods:** Childhood cancer survivors (N=469; brain tumor=211; acute lymphoblastic leukemia=258) were screened for attention and behavioral dysfunction. Measures of attention [Conners' Rating Scales - Parent, Teacher, and Adolescent versions (CRS)], social skills [Social Skills Rating System - Parent version (SSRS)], behavioral adjustment [Child Behavior Checklist (CBCL)] and estimated intelligence [Wechsler Intelligence Scale for Children, third edition or Wechsler Adult Intelligence Scale, third edition] were administered.

**Results:** The proportion of childhood cancer survivors with CSAD (T >60, CRS) was elevated relative to a normative sample (e.g., CRS-T Cognitive/Inattentive Problems 36.4% vs. 15.9%,  $P < 0.0001$ ) and was observed across settings. Linear and logistic regression analyses identified female gender, brain tumor diagnosis and lower IQ as predictors of attention and social skills (SSRS <85) deficits. Chi-square analysis revealed a greater likelihood of social skills deficits in children with CSAD ( $p < .0001$ ).

**Conclusions:** CSAD across childhood settings are a notable outcome of pediatric cancer treatment and are associated with ecological impairment. Attention and social skills deficits are associated with one another and are predicted by clinical indicators of cognitive impairment, factors that may assist in planning intervention.

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**D. VON AH, P. MONAHAN, V. CHAMPION, L. MOSER, Q. ZHOA & F. UNVERZACT. Effect of Cognitive Impairment on Quality of Life Among Breast Cancer Survivors.**

**Objective:** Research has documented significant cognitive impairment among women treated for breast cancer, yet little is known about its impact on quality of life. Therefore, the purpose of this study was to examine the impact of cognitive impairment on psychological (depressive symptoms, overall well-being, post-traumatic stress and personal growth) and physical well-being (physical functioning and fatigue) of breast cancer survivors (BCS) compared to a healthy control group.

**Participants and Methods:** 444 BCS who were 3 to 8 years post-chemotherapy treatment and 355 healthy women completed a one-time neuropsychological assessment. Cognitive impairment was defined as scoring 1.5 standard deviations (SD) below the mean of the control group on a test. An overall composite impairment score was also calculated for each individual patient as the average of the standard Z scores over all five cognitive tests. Impairment on the standardized composite score was defined as a standardized score less than 1.5 SD below the healthy control mean. Linear regression models were used controlling for age, education, and income.

**Results:** Small percentages of BCS (< 11% across tests) evidenced deficits in immediate memory, delayed recall, processing speed, attention, and verbal fluency. However, breast cancer survivors who were identified as having overall cognitive impairment had both significantly greater post-traumatic stress and less personal growth. In addition, those survivors who had attention deficits had greater post-traumatic stress and BCS who had deficits in immediate memory experienced significantly less personal growth.

**Conclusions:** Cognitive impairment may be subtle yet have significant impact on psychological well-being among BCS.

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**N.R. CLANTON, B. MORRIS, Z. PAN, D. MULROONEY, N. JAIN, D.K. SRIVASTAVA, L. ZELTZER, M. STOVALL, L.L. ROBISON & K.R. KRULL. Fatigue, Vitality, Sleep Quality, and Neurocognitive Functioning in Adult Survivors of Childhood Cancer: A Report From the Childhood Cancer Survivor Study.**

**Objective:** To examine the impact of fatigue, vitality, and sleep quality on neurocognitive outcomes among adult survivors of childhood cancer.

**Participants and Methods:** Participants included 1,426 adult survivors from the Childhood Cancer Survivor Study (CCSS). Neurocognitive outcome included measures of task efficiency, emotional regulation, organization, and memory using the CCSS Neurocognitive Questionnaire (CCSS-NCQ). Survivors also completed the FACIT-Fatigue Scale, the Short Form-36 Vitality Scale (SF-36-V), the Pittsburgh Sleep Quality Index (PSQI), and the Epworth Sleepiness Scale (ESS).

**Results:** Neurocognitive impairment was reported in over 20% of survivors, using sibling based norms for comparison. Multivariable logistic regression models revealed that decreased vitality and increased sleepiness predicted impaired task efficiency (RR=1.84,  $p < .0001$ ; RR=1.17,  $p < .0001$ , respectively) and impaired organization (RR=1.68,  $p = .002$ ; RR=1.61,  $p = .002$ , respectively). Impaired emotion regulation was associated with increased fatigue (RR=1.61,  $p = .008$ ), decreased vitality (RR=2.85,  $p < .0001$ ), and poor sleep quality (RR=1.38,  $p = .02$ ). Likewise, impaired memory was associated with increased fatigue (RR=1.42,  $p = .04$ ), decreased vitality (RR=1.91,  $p = .0002$ ), and poor sleep quality (RR=1.35,  $p = .05$ ). The impact of fatigue, vitality, daytime sleepiness, and poor sleep quality on neurocognitive outcomes was independent of the significant effects of cranial radiation therapy, antimetabolite chemotherapy, CNS tumor, leukemia, and Hodgkin's lymphoma on neurocognitive outcomes.

**Conclusions:** These findings suggest a unique contribution of fatigue and sleep quality to neurocognitive outcomes in long-term cancer survivors. This knowledge stresses the importance of good sleep hygiene in cancer survivors and may provide an additional avenue for neurocognitive interventions.

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**C.L. ARMSTRONG, D. SHERA, R. LUSTIG & P.C. PHILLIPS. Radiotherapy Damage Affects Semantic Memory Networks: A Group Controlled Prospective Study.**

**Objective:** Therapeutic irradiation (XRT) injury in the brain is based on susceptibility of cells with a moderate proliferation rate. Recent observations also implicate hippocampal neuroblast stem cells, because of high proliferation rate (positively related to radiosensitivity) and low degree of differentiation (inversely related to radiosensitivity). The cognitive effects of XRT should be specific to these mechanisms. In a series of within-group longitudinal studies, we reported a memory effect 6-8 weeks after XRT in retrieval of words, and double dissociation from visual memory. Perceptual and semantic components of this memory disorder were investigated.

**Participants and Methods:** To test our revised prediction, 48 patients with low-grade brain tumors who received XRT were compared with 34 similar patients without XRT. Patients with comorbidity, age <18>69, and subtentorial tumors were excluded. Cognition was tested pre-XRT, 1.5 mos, and 4.5 mos post XRT, controlling for medications, practice, and individual random effects.

**Results:** Hypothesis of a temporary depression and then rebound in retrieval from verbal semantic memory was confirmed, and the double dissociation from visual memory. Among cross-validating perceptual and semantic memory tests, only reaction time to recognize nameable pictures was affected.

**Conclusions:** The specificity of memory process affected by XRT is useful for characterizing XRT damage to brain function. The effects only on retrieval of verbal and semantic material suggest that XRT affects broad semantic networks. Mechanisms that can result in disruption of semantic networks are reduction in glial cell mitosis (oligodendrocytes), neural dysregulation (astrocytes), and capillary membrane changes (endothelial abnormalities). The lack of effects in configural and recognition memory do not support the idea of impairment exclusively from hippocampal damage.

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**S.G. KINKEAD, R.D. ANNETT, C.L. EMMONS, A.S. KUNIN-BATSON, L.A. HOLMQUIST, K.R. KRULL, L.E. SEGOVIA & R.B. NOLL. Acute And Long-Term Neuropsychological Impairment Associated With Chemotherapy And Whole Brain Radiotherapy For Children Treated For Intermediate Risk Leukemia.**

**Objective:** To prospectively determine 4-year change in neurodevelopmental effects associated with 1,800 cGy whole brain radiation treatment for children treated for intermediate risk acute lymphoblastic leukemia (ALL) and treated on CCG105.

**Participants and Methods:** Participants in this study were children, between the ages of 2 and 18, diagnosed with ALL who were randomly assigned to receive whole brain radiotherapy (XRT) with intrathecal methotrexate (IT) or IT alone in one of 4 chemotherapy regimens (standard therapy; delayed intensification; intensive induction and consolidation therapies; and intensive induction/consolidation and delayed intensification therapies). Neuropsychological assessments occurred at 9 months, 24 months, and 48 months post diagnosis and included measures of intelligence, attention, memory, language, executive functions, academic achievement and psychological functioning.

**Results:** 56 children (29 received XTR) were evaluated at 9 months, 76 (36 received XRT) at 21 months, and 48 (46 received XRT) at 48 months post diagnosis. The results indicate that children treated with methotrexate alone demonstrated less developmental disadvantages, as compared to those who were treated with methotrexate and whole brain radiation. Significant differences were observed between treatment groups on the Benton Visual Form Discrimination Test ( $p = .017$ ), Trail Making Test ( $p = .045$ ), Benton Visual Retention Test ( $p = .033$ ), Sentence Repetition ( $p = .041$ ), and Token Test ( $p = .005$ ).

**Conclusions:** Findings indicate that the whole brain radiation treatment for ALL results in significant neuropsychological deficits for children. Specific impairments occur with visual processing, memory, and executive functions.

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**Invited Address:  
Neurocognitive Endophenotypes for Bipolar Disorder Identified in Multiplex Multigenerational Families from Latin America**

**Speaker: Humberto Nicolini**

**2:00–3:00 p.m.**

**H. NICOLINI, D. GLAHN, L. ALMASY, M. BARGUIL, E. HARE, J. PERALTA, J. KENT, A. DASSORI, J. CONTRERAS, A. PACHECO, N. LANZAGORTA, H. RAVENTÓS & M. ESCAMILLA. Neurocognitive Endophenotypes for Bipolar Disorder Identified in Multiplex Multigenerational Families from Latin America.**

Although genetic influences on bipolar disorder are well established, localization of genes that predispose to the illness has proven difficult. Given that genes predisposing to bipolar disorder may be transmitted without expression of the categorical clinical phenotype, one strategy for identifying risk genes is the use of quantitative endophenotypes.

**Objective:** The goal of the current study is to adjudicate neurocognitive endophenotypes for bipolar disorder.

**Design, Setting, and Participants:** 709 Latino individuals from the central valley of Costa Rica, Mexico City, Mexico, or San Antonio, Texas participated in the study. 660 of these persons were members of extended pedigrees with at least two siblings diagnosed with bipolar disorder ( $n=230$ ). The remaining subjects were community controls drawn from each site and without personal or family history of bipolar disorder or schizophrenia. All subjects received psychodiagnostic interviews and comprehensive neurocognitive evaluations. Neurocognitive measures found to be heritable were entered into analyses designed to determine which tests are impaired in affected individuals, sensitive to genetic liability for the illness and genetically correlated with affection status.

**Main Outcome Measures:** The main outcome measure was neurocognitive test performance.

**Results:** Two of the 21 neurocognitive variables were not significantly heritable and were excluded from subsequent analyses. Patients with bipolar disorder were impaired on 6 of these cognitive measures compared to non-related healthy subjects. Non-bipolar first-degree relatives were impaired on five of these and three tests were genetically correlated with affection status: digit symbol coding, object delayed response, and immediate facial memory.

**Conclusions:** This large-scale extended pedigree study of cognitive functioning in bipolar disorder identified measures of processing speed, working memory and declarative (facial) memory as candidate endophenotypes for bipolar disorder.

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## Paper Session 5: Imaging

2:00–3:30 p.m.

**E. CASTILLO, D. MEN, H. GARZA, Z. LI, A.C. PAPANICOLAOU & A. PASSARO. Right Hemisphere Damage and Attentional Control: a MEG Study.**

**Objective:** The brain mechanisms supporting attentional control are frequently disrupted after right hemisphere stroke. We used magnetoencephalography (MEG) to test whether different levels of behavioral performance are associated to specific patterns of lobar activation in patients suffering right hemisphere stroke.

**Participants and Methods:** Eighteen post-acute right hemisphere stroke patients, presenting with different degrees of attention deficit, and sixteen aged-matched volunteers underwent evaluations including: behavioral assessment, high resolution MRI and whole-head MEG recordings. Patterns of brain activation (MEG-derived) were obtained in the context of an attention task (variation of Simon's paradigm) with two levels of difficulty (low-high). Sources of the recorded signals were modeled as equivalent current dipoles (ECDs) and co-registered onto the patient's MRI. ECDs in the lobes of the affected and non-affected hemispheres were estimated and related to the behavioral measurements obtained during the performance of the activation tasks.

**Results:** Performance at the low-difficulty level, showed a significant delay in reaction time of stroke patients while their accuracy was similar to controls. At the high-difficulty level, performance was significantly lower in the stroke group ( $p < 0.005$ ). Two regions (left frontal and right parietal) showed less activation in the stroke group; and the left basal temporal region was significantly more activate than in the control group. There was a positive and significant correlation ( $r = -0.63$ ,  $p < 0.01$ ) between the degree of activation of the right parietal region and the performance in the stroke group.

**Conclusions:** The results suggest that the right parietal lobe has a significant role in supporting cognitive operations that are essential for attentional control. Functional damage and/or disconnection of the right parietal lobe after stroke reduce patient's ability to inhibit irrelevant information.

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**V. KAMATH, R.M. ROTH, M.A. GARLINGHOUSE, L.A. FLASHMAN & A.J. SAYKIN. Orbitofrontal Morphology Correlates with Cognitive Flexibility and Memory in Bipolar Disorder.**

**Objective:** Patients with bipolar disorder (BPD) are reported to show deficits in cognitive flexibility and verbal memory, functions subserved partly by the orbitofrontal cortex (OFC). The relationship between OFC morphology and these cognitive processes in the disorder has, however, received little investigation. Therefore, we evaluated whether structural integrity of medial and lateral OFC is associated with cognitive flexibility and verbal memory in BPD.

**Participants and Methods:** Participants included 23 adults with BPD and 23 healthy adults matched on relevant demographic variables and intellectual functioning. Participants completed a battery of neuropsychological tests including measures of cognitive flexibility (DKEFS Trail Making Condition 4) and memory (CVLT-II). A high-resolution 1.5T MRI structural brain scan was performed, and volume (adjusted for total intracranial volume) and thickness of the left and right lateral and medial OFC were obtained using FreeSurfer.

**Results:** The patient group performed worse on Trail Making Conditions 1-4 and CVLT-II Total 1-5 and delayed recall trials. Groups did not differ on OFC volume or thickness. In the BPD group, poorer cog-

nitive flexibility was associated with lower left medial OFC volume and less thickness. Poorer memory was also correlated with lower left medial and lateral OFC volume and less thickness as well as right lateral OFC volume. No significant correlations were observed in the comparison group.

**Conclusions:** These results highlight the differential contribution of OFC subregions to cognitive flexibility and memory in BPD. Further, the findings suggest that heterogeneity of cognitive deficits in these patients may be related to variability in OFC morphology.

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**S.M. RUIZ, K. MARINKOVIC, M. OSCAR-BERMAN, K. SAWYER, M. VALMAS, R.L. ZONDERVAN, T. URBAN & G.J. HARRIS. Alcoholism and Gender Effects in Relation to Measures of Alcoholism Severity, Alcohol Craving, and Regional Brain Volumes.**

**Objective:** In this study, we sought to examine associations between brain volume abnormalities and measures of alcoholism severity and alcohol craving, and to assess whether alcoholic women manifest such effects differently from alcoholic men.

**Participants and Methods:** Structural magnetic resonance images obtained from abstinent alcoholic men ( $n = 15$ ) and women ( $n = 19$ ) and demographically-matched controls (15 men; 20 women) were segmented to measure gray and white matter volumes in cortical and subcortical regions of interest. Group and gender effects were examined while controlling for age and intracranial volume. Measures of alcoholism severity (duration of heavy drinking and Quantity Frequency Index/QFI) and alcohol craving (Penn Alcohol Craving Scale) were correlated with regional brain volumes.

**Results:** Among female alcoholics, bilateral hippocampus, ventral diencephalon, and cerebellar white matter volumes were negatively correlated with duration of heavy drinking; in alcoholic men only the right amygdala volume showed this relationship. Amount of drinking (QFI) was negatively correlated with bilateral nucleus accumbens and left ventral diencephalon volumes in female alcoholics, and with right orbitofrontal volume in male alcoholics. Self-reported alcohol craving was positively correlated with bilateral insula volumes in female alcoholics and with right subcallosal volume in male alcoholics. Control participants of both genders failed to show relationships between regional brain volumes and either QFI or craving.

**Conclusions:** These data provide preliminary evidence of a relationship between measures of alcoholism severity and alcohol craving with regional brain volume abnormalities in alcoholics, and further demonstrate that these variables have differential associations with brain volume measures in alcoholic men and women.

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**M. JERRAM, J.K. LEE, M.G. KARPEL, C. FULWILER, R. BHADLIA & D.A. GANSLER. Examining the Neural Correlates of the Color-Word Interference Test (CWIT) using Voxel-Based Morphometry.**

**Objective:** Most studies using the classic Color-Word Interference task (CWIT) focus on activation instead of volumetry and there are few studies that include errors in performance. Delis and colleagues (2001) modified the CWIT to include a condition focused on set switching (Condition 4) in addition to inhibition (Condition 3). The present study examined the relationship between measures of CWIT performance, including one that includes errors to neural correlates using VBM.

**Participants and Methods:** Twelve healthy male participants completed the CWIT and underwent brain MRI. Regression analyses in SPM8 were constrained to a priori anatomic masks of regions described by Colibazzi and colleagues (2007). To incorporate errors into CWIT performance, a Performance Deficit Score (PDS) was calculated in the following way:  $\log_{10}(\text{performance time} \times (1 + \text{total errors}))$ .

**Results:** Regressions with Condition 3 and Condition 4 performance time and Condition 4 PDS did not reveal significant associations with brain volume. A focus of significant correlation was found between brain volume and Condition 3 PDS in the orbitofrontal cortex (OFC) (MNI coordinates: 42, 16, -12; 18 voxels). When the Condition 3 PDS and Condition 4 PDS correlation maps were contrasted, a significant difference was found in the same region (MNI coordinates: 46, 16, -6; 11 voxels).

**Conclusions:** Results indicate that a region of OFC is related specifically to inhibition (CWIT Condition 3) and differentiates inhibition from the combination of inhibition and set switching. This is the first study demonstrating specific volumetric differences in relation to performance on Conditions 3 and 4 of the CWIT.

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**T.D. VANNORSALL, S.C. FIELDSTONE, K. LEDOUX, E. PICKETT, B. GORDON & D.J. SCHRETLEN. Neuroanatomic Correlates of Automatic and Controlled Processes in Verbal Fluency.**

**Objective:** On tests of verbal fluency, clustering refers to the automatic generation of words within a sub-category. Switching to a new cluster after exhausting a sub-category is a more controlled process. Evidence from patient populations suggests that clustering and semantically-guided fluency are related to temporal lobe functioning, whereas switching and phonemically-guided fluency depend more on frontal structures. Here we investigate the neuroanatomic correlates of automatic and controlled processes among healthy adults.

**Participants and Methods:** Participants ( $n = 25$ ) completed tests of phonemic and semantic fluency and underwent structural brain imaging. Protocols were coded to assess overall productivity, numbers of clusters/switches, and mean cluster size. We correlated these measures with regional grey matter (GM) densities using voxel-based morphometry after adjusting for age, handedness, and global GM volumes.

**Results:** More frequent clustering/switching during phonemic fluency was associated with greater GM densities in the left middle temporal gyrus ( $p < 0.001$ ). Overall productivity during semantic fluency correlated positively with GM densities in the left temporal pole and inferior temporal cortex, bilateral anterior prefrontal cortex, and inferior and middle temporal gyri ( $p < 0.001$ ).

**Conclusions:** In healthy adults, greater clustering/switching during phonemically-guided word fluency is related to increased tissue density in a region of the temporal cortex that subserves auditory processing and language, and not to tissue density in the frontal cortex. On tests of semantic fluency, overall productivity is associated with the integrity of cortical regions that are thought to subservise strategic memory retrieval processes, auditory processing and language, word recognition, and within-category identification.

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**Poster Session 4:  
Behavioral Neurology, Cancer, Cognitive Neuroscience, Electrophysiology/EEG/ERP, Epilepsy/Seizures, Language and Speech Functions/Aphasia**

**3:45–5:15 p.m.**

**Behavioral Neurology**

**S. ASSURAS, B. KOPALD, M. WEINER, M. MEAGER, M. LACY & D. FRIM. Neuropsychological Profile of Adults with Chiari I Malformation.**

**Objective:** Chiari I malformation (CMI) is a congenital condition characterized by herniation of the cerebellar tonsils through the foramen

magnum into the spinal canal, which can present with signs of increased intracranial pressure. Clinical presentation often includes headaches, numbness, weakness, and cognitive complaints. While research has extensively examined cognition in patients with Chiari II malformation and spina bifida, no studies have characterized the impact of CMI on adult cognition. CMI is an ideal model to examine how changes in intracranial pressure impact cognitive functioning, without the confounding variable of enlarged ventricles. The current study examined the neuropsychological functioning of adults diagnosed with CMI.

**Participants and Methods:** Eight patients (mean age=28.9, range 17-55) were administered the Wechsler Test of Adult Reading as an estimate of intellectual functioning, Grooved Pegboard to measure manual dexterity and speed, and the Repeatable Battery of Assessment of Neuropsychological Status to assess functioning in the following domains: Immediate Memory, Visuoconstruction, Language, Attention, and Delayed Memory.

**Results:** Analysis of cognitive variables revealed average estimated full scale IQ (mean  $SS=96.25$ ,  $SD=12.69$ ) yet impaired global cognitive functioning (RBANS Total Mean  $SS=75.75$ ,  $SD=17.08$ ). Examination of specific domains revealed mild to moderate inefficiencies in immediate and delayed verbal memory, speeded fluency, and bilateral manual dexterity.

**Conclusions:** The current results point to a specific neurocognitive profile associated with adult CMI, with altered intracranial pressure without dilation. Future studies integrating imaging data may prove beneficial in understanding the impact of increased intracranial pressure on cognition.

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**L. FELIX, E. HELDER, T. DROSSOS, J. TONSGARD & S. HUNTER. NF-2: A Case Study of Complex Neurobehavioral Disability.**

**Objective:** Neurofibromatosis Type 2 (NF-2) is an autosomal dominant genetic disorder resulting from a mutation on chromosome 22 band q11-13.1. Patients with NF-2 present with bilateral vestibular schwannomas and noncancerous tumors that develop along cranial nerve VIII. NF-2 is rare, occurring in 1 in 40,000. While patients with NF-2 are typically described as falling within normal limits, NF-2 is largely neglected in the literature and little is known about neurocognitive functioning. Tumor studies often reveal cognitive changes relative to location; frontal lobe tumors are associated with executive, mood, and personality changes.

**Participants and Methods:** We report on a patient diagnosed with NF-2 at age 7 with tumors in the left frontal-parietal, frontal midline, acoustic nerve, and upper spinal cord regions. Medically, the patient underwent a partial resection of a left fronto-parietal tumor and has intractable epilepsy. Neuroimaging data are presented.

**Results:** Results from a comprehensive neuropsychological assessment conducted at age 9 revealed decreased processing speed, impaired memory, and executive dysregulation. This profile is consistent with tumor location and the impact of a seizure disorder. The patient has shown development of significant psychiatric features, including behavioral impulsivity, social inappropriateness, perseveration, and suicidal/homicidal ideation. These symptoms follow a relapsing-remitting course.

**Conclusions:** Following inpatient hospitalizations, therapeutic day school placement was deemed necessary. Resulting response to neurological and psychiatric medication management and individual and family psychotherapy is described, demonstrating the need for and impact of multimodal intervention with this disorder.

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**A.P. HALEY, M. GONZALES, S. STAUTBERG, R.A. REED, F.O. BINEY & K. GOUDARZI. Subjective Cognitive Complaints, Blood Pressure, Mood, and Cerebrovascular Response to Cognitive Function in Midlife.**

**Objective:** Patients with cardiovascular diseases often report cognitive difficulties, including reduced cognitive processing speed and atten-

tion. On cross-sectional examination, such reports relate more closely to mood than to objective measures of cognitive performance; yet, these perceived difficulties are also associated with objective cognitive decline over time. The aim of this study was to examine the relationship between subjective cognitive complaints and sensitive neuroimaging measures of cognitive health, such as the cerebrovascular response to cognitive function in middle-aged adults with hypertension.

**Participants and Methods:** Thirty-two adults (ages 40 to 60 years) completed a medical history questionnaire, a measure of perceived cognitive dysfunction (Cognitive Difficulties Scale, CDS), a neuropsychological test battery which included measures of mood and cognition, a blood pressure check, and fMRI during a verbal working memory task.

**Results:** Increased report of cognitive difficulties was associated with higher levels of depression ( $r = .40$ ,  $p = .015$ ), but unrelated to age, education, IQ, current blood pressure or symptoms of anxiety. Independent of depressive symptoms, increased subjective cognitive complaints were associated with lower cerebrovascular response to working memory in the left middle frontal gyrus ( $F(3,24) = 3.153$ ,  $p = .043$ , CDS partial  $r = -.42$ ,  $p = .033$ ).

**Conclusions:** Self-reported cognitive difficulties may reflect early changes in cognitive aging that are difficult to detect using conventional screening measures; yet, these perceived difficulties correlate with reduced cerebral functional hyperemia as early as midlife. Therefore, they may provide important clinical information about early neurodegenerative processes that should be carefully monitored in patients with hypertension.

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#### T. KESAYAN, J. WILLIAMSON, F.M. SKIDMORE, A. KABASAKALIAN, J.I. SHENKER & K.M. HEILMAN. Allocentric vs Egocentric Spatial Performance in Normals.

**Objective:** Brain damage may impair mental representation of body parts, suggesting a faulty body schema. It has been suggested that these disorders are due to damage of functional cerebral systems that process general spatial relationships, and not necessarily to a specialized system that processes body schema. We predict that if there is a representation of body schema in the brain separable from external space computations, then people will make different estimates with egocentric versus allocentric distances, distance of body parts versus distance not related to body parts.

**Participants and Methods:** We tested 13 neurologically intact people with normal cognition and without depression. They stood in a white room with their midsagittal plane parallel to a blank wall, and arms at their sides. They were asked to move laterally to end up with the outside of their shoulders (left and right) one foot, two feet, three feet, or an arms length from the wall. Statistical analyses included a series of t-tests and a repeated measures of ANOVA.

**Results:** Participants made significant errors when estimating allocentric distances but were accurate in estimation of arm length (body schema) ( $p < .05$ ).

**Conclusions:** As predicted, subjects without neurological illness were more accurate in estimation of distances with egocentric reference than distances with no egocentric reference. Results are discussed in the context on the state of the literature on the laterality of spatial processing in ego- and allo- centric space.

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#### A. KOHL, J. WENDELL, T. KING, R. MORRIS & N. KRAWIECKI. Processing Speed Mediates the Relationship Between Increased Neurological Events and Academic Achievement in Adult Survivors of Childhood Brain Tumors.

**Objective:** Long term survivors of childhood brain tumors often experience academic deficits, thought to be secondary to decreased func-

tioning in information processing speed, working memory, and attention, with the main risk factors being younger age at diagnosis, time since diagnosis, and treatment modalities. Since few studies have assessed the causal relationship among these factors, we hypothesized that processing speed would mediate the relationship among the three risk factors and decreased academic functioning in long term survivors of childhood brain tumors.

**Participants and Methods:** Participants were 28 survivors, who were an average of 19.07 years post-diagnosis ( $SD = 4.03$ ) and 24.43 years ( $SD = 4.23$ ) at evaluation. Bootstrapping was used in order to test whether processing speed (Symbol Digit Modality Task) significantly mediated the relationship between the risk factors and subtests of the Woodcock-Johnson III Tests of Achievement: Letter-Word Identification, Calculation, Spelling, and Passage Comprehension.

**Results:** Mean academic achievement and processing speed scores fell in the low-average to borderline range. Processing speed revealed results consistent with full mediation. Increased treatment modalities and related medical conditions were significantly mediated by processing speed, resulting in decreased academic achievement scores on the Spelling (estimate  $-3.56$ ,  $CI = -11.32$  to  $-1.19$ ), Calculation (estimate  $-4.41$ ,  $CI = -12.43$  to  $-1.70$ ), and Passage Comprehension (estimate  $-3.48$ ,  $CI = -10.77$  to  $-1.17$ ). Younger age and time since diagnosis were not significant for mediation.

**Conclusions:** The current findings illustrate that processing speed mediates the relationship among increased treatment modalities/related medical conditions and decreased academic functioning in long term survivors of childhood brain tumors.

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#### B. KOPALD, S. ASSURAS, M. MEAGER, M. LACY, D. FRIM & M. WEINER. Cognitive Functioning in Children with Chiari Malformation Type I.

**Objective:** Children with Chiari Malformation Type I typically present with headaches, numbness, and cognitive complaints. While there is an extensive body of literature examining cognition in patients with CM Type II and Spina Bifida, there are only a few case reports examining the cognitive functioning of children with Chiari Malformation Type I.

**Participants and Methods:** Seventeen children (mean age of 139 months) diagnosed with Chiari Malformation Type I and 19 controls (mean age of 129 months) completed a battery of neurocognitive tests, while their parents completed the Behavior Inventory of Executive Function, a measure of executive functioning at home.

**Results:** There was no differences between groups on measures of intellectual functioning, yet children with CMI were rated by their parents as having more difficulties on the Organization of Materials subtest (i.e. misplace items; messy room). Additionally, children with CMI displayed more difficulties on a visual search task (CAS Receptive Attention subtest) compared to controls.

**Conclusions:** The present study found that children with CMI display intact intellect, yet subtle signs of executive dysfunction. While the true mechanism of CMI is unknown, CSF outflow obstruction at the 4th ventricle may be a contributing factor and may cause transient pulses of increased intraventricular pressure. Such pulsatile increases in pressure may transiently enlarge the lateral ventricles and subsequently cause periventricular white matter stretch yielding executive dysfunction. Future study of the specifics of the cognitive weaknesses in CMI patients should produce clues to further define the underlying anatomical abnormality.

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#### C.E. KRUEGER, H.J. ROSEN, B.L. MILLER & J.H. KRAMER. Know Thyself: Real World Behavioral Correlates of Self-Appraisal Accuracy.

**Objective:** Accurate appraisal of one's own abilities is important for choosing tasks in life, and for improving our performance on tasks at which we would like to excel. Previous studies indicated that people who

perform poorly on specific tasks tend to over-estimate themselves when rating their performance. In children, prior studies have indicated considerable variability in self-appraisal accuracy, but these studies have mostly been limited to memory functions, and the relationship between self-appraisal in a laboratory and behavior in the real world has not received much attention. The present study was designed to measure self-appraisal accuracy in children using tasks of executive function, and to investigate relations between self-appraisal and real world executive functioning behaviors.

**Participants and Methods:** Participants included 145 children (95 healthy children and 50 children with ADHD, very low birth weight, or sickle-cell anemia) ages 8-17. We examined accuracy of self-appraisal by assessing the discrepancy between children's estimates of their cognitive performance on fluency tasks and their actual performance on testing. Real world executive functioning was measured using the Behavior Rating Inventory of Executive Function.

**Results:** Consistent with previous research, low scoring children showed disproportionately reduced self-appraisal accuracy when compared to high scoring children. Furthermore, self-appraisal accuracy correlated with real world behaviors of executive functioning, including inhibition ( $r=.25$ ), shifting ( $r=.23$ ), and monitoring abilities ( $r=.23$ ), independent of actual performance.

**Conclusions:** Measures of self-appraisal accuracy should be included in clinical evaluations because this laboratory measure relates to real world behaviors.

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#### K. PENNER, L. JAKOBSON, S. LONGSTAFFE & A. HANLON-DEARMAN. Neurodevelopmental profiling in school-aged children referred for possible Alcohol Related Neurodevelopmental Disorder (ARND).

**Objective:** This cross-sectional study explored outcomes in children suspected of ARND across attention/executive function, language, sensorimotor, visuospatial, and memory/learning domains. Neurodevelopmental profiling was used to differentiate children with ARND from peers receiving other diagnoses (learning, attention, and/or behavior disorders). **Participants and Methods:** 122 non-dysmorphic, school-aged children with significant neurobehavioral and academic challenges, presumed prenatal alcohol exposure, and no prior diagnosis, completed the NEPSY as part of a multidisciplinary assessment. Scores in each domain were stratified by age, diagnosis, and gender.

**Results:** Diagnoses included ARND (52.5%), Fetal Alcohol Syndrome (FAS) or partial FAS (9.8%), Other (21.3%), Deferred (15.6%), and Normal (0.8%). Significant discrepancies between core domains (excluding attention and memory) were noted, which did not vary significantly by FASD subtype [ARND/(p)FAS] or gender. Children diagnosed with an FASD differed from those diagnosed "Other", performing significantly worse on tests of attention/executive function, language, and memory/learning, but comparably on tests of sensorimotor and visuospatial functioning. Significant correlations between age and the magnitude of visuospatial-language and sensorimotor-language domain discrepancy scores were noted in the FASD group. Tests of fixed effects yielded two decision trees, which contributed to FASD diagnosis using NEPSY scores.

**Conclusions:** 62.3% of children received an FASD diagnosis. This group demonstrated widening gaps between language and visuospatial or sensorimotor processing with age. Profile and trajectory differences between diagnostic groups enabled development of a decision tree, which may enhance patient care by facilitating timely identification of those at risk. Correspondence: Karen Penner, PhD (candidate), University of Manitoba, Department of Psychology, University of Manitoba, Winnipeg, MB R3T 2N2, Canada. E-mail: kpenner@cc.umanitoba.ca

#### P. POORZAND, S.N. GROSSMAN, M. GROWDON, J. JANG, B.L. MILLER & K.P. RANKIN. A Simple Rating Scale Identifies Distinct Patterns of Interpersonal Behavior in AD, SemD, and bvFTD.

**Objective:** Social behavior changes can be the first symptoms of neurodegenerative disease (NDG), but these signs can be missed by non-

specialist clinicians, who often assume NDG must involve cognitive deficits. We developed a novel screening tool that objectively rates spontaneous social behaviors, hypothesizing that divergent patterns of observed behavior will allow even non-experts to distinguish specific NDG groups from each other and from healthy older adults.

**Participants and Methods:** The Social Behavior Observer Checklist (SBOCL) is a 12-item rating scale completed by clinicians blind to the subject's diagnosis after a typical testing or interview session. Non-clinician psychometrists rated 111 subjects (26 Alzheimer's [AD]; 29 frontotemporal dementia [bvFTD]; 11 semantic dementia [SemD]; 12 Primary Progressive Aphasia; and 33 healthy older controls) after a 1.5 hour cognitive exam. Groups did not differ by age ( $63.9 \pm 11.6$  years). Groups were compared using SAS proc glm, controlling for differences in sex, education, and disease severity (MMSE).

**Results:** ADs were more self-conscious, made more self-deprecatory statements, and lost track of what they were doing more frequently than any other disease group ( $p < 0.05$ ). SemDs were more likely than any other group to resist examination parameters, interrupt the exam, ramble tangentially, and be preoccupied with time ( $p < 0.05$ ). bvFTDs were less self-conscious, more insensitive to others' privacy, disclosed inappropriate information, were stimulus-bound and preservative, and showed decreased initiation.

**Conclusions:** NDG diseases cause distinct patterns of spontaneous social behavior symptoms that can be objectively recognized even by non-experts. The SBOCL may help non-experts recognize and appropriately refer patients for dementia evaluation, even without cognitive symptoms.

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## Cancer

#### V. BORDES, A. KUNIN-BATSON, J. PERKINS & K. BAKER. Differentiating Psychosocial and Health-Related Quality of Life for Children Following Hematopoietic Cell Transplant for ALL or AML.

**Objective:** This study characterized the quality of life (QOL) of childhood leukemia survivors 1-16 years post-hematopoietic cell transplant (HCT). The differential impact of medical (age and time since transplant, ongoing medical problems), developmental/child (IQ, child-reported anxiety, adaptive functioning), and parent (distress and anxiety) factors on physical and psychosocial QOL was examined.

**Participants and Methods:** Survivors ( $N = 44$ ) ages 6-18 ( $M = 12.2$  years) in remission and 1+ years post-HCT ( $M = 8$  years) were randomly selected from our HCT database. Individuals with pre-existing neurological or genetic disorders were excluded. Participants underwent a neurocognitive assessment. Participants and parents completed the Child Health Questionnaire and related inventories.

**Results:** Participants had average FSIQ ( $M = 99.95$ ,  $SD = 16.20$ ). Parent ratings of Physical ( $M = 48.77$ ,  $SD = 7.92$ ) and Psychosocial ( $M = 51.01$ ,  $SD = 8.28$ ) QOL were consistent with population norms. In hierarchical linear regressions, medical variables accounted for significant variance in Physical QOL ( $R^2\Delta = 0.37$ ,  $F(3, 25) = 4.91$ ,  $p < .01$ ). Younger age and shorter time since transplant were associated with poorer Physical QOL. For Psychosocial QOL, child factors (IQ, anxiety, and adaptive functioning) accounted for 29% of the variance ( $F(3, 22) = 3.79$ ,  $p < .05$ ). Parent distress and anxiety added 20% to the variance ( $F(2, 20)$ ,  $p = .01$ ) beyond child factors.

**Conclusions:** Psychosocial and Physical QOL are distinct and equally important outcomes to consider in HCT survivors. This study highlights the importance of comprehensive, long-term care, including: medical follow-up, neurocognitive screening, and emotional support of children and their parents.

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**C.C. CARTER, S. CASTELLON, A. OPPENHEIM, L. KWAN & P. GANZ. Subjective and Objective Characteristics of Cognitive Functioning Following Breast Cancer Treatment.**

**Objective:** Cognitive complaints are common among women exposed to chemotherapy for breast cancer. It has been proposed that adjuvant endocrine therapy might also impact cognition, either independently or via an interaction with prior chemotherapy. We report preliminary findings from a prospective examination of women who recently completed primary treatment(s) (surgery, radiation, and/or chemotherapy) and then did, or did not, initiate endocrine therapy.

**Participants and Methods:** Participants completed a comprehensive neuropsychological battery and self-report measures of cognitive symptomatology [Patient Assessment of Own Functioning (PAOFI); Squire Memory Questionnaire (SMQ)]. Baseline comparisons (prior to endocrine therapy) were conducted between those who did (n=49), or did not (n=46), receive prior chemotherapy. Participants were then re-assessed six months later and comparisons were made across four cells based on treatment regimen: no treatment (n=7); chemotherapy only (n=5); endocrine only (n=18); chemotherapy & endocrine (n=21).

**Results:** Participants w/prior chemotherapy reported significantly higher subjective cognitive compromise at baseline (PAOFI,  $p < .01$ ; SMQ,  $p < .001$ ) and again at six-months (SMQ,  $p < .01$ ), regardless of endocrine status. However, between-group comparisons of neuropsychological variables (including change scores) did not reveal any significant differences at baseline or six-months.

**Conclusions:** Breast cancer patients who received chemotherapy endorsed greater rates of cognitive compromise relative to their peers who did not receive chemotherapy; however, these groups did not differ in their performance abilities on structured neuropsychological testing. Preliminary results did not show endocrine therapy to be an attenuating variable for either subjective or objective cognitive functioning. These findings will be re-assessed prior to INS-2010, at which time all baseline participants will have completed a six-month evaluation (N=95). Correspondence: *Christian C. Carter, Ph.D., Psychology, Greater Los Angeles VA Healthcare System, 11301 Wilshire Blvd., Bldg. 256 Room 243b, Los Angeles, CA 90073, United States. E-mail: cccarter11@yahoo.com*

**N. JAIN, M.M. HUDSON, B. MORRIS, K.K. NESS, K. SRIVASTAVA, L.L. ROBISON & K.R. KRULL. Neurobehavioral Functioning and Fatigue in Very Long-Term Survivors of Hodgkin's Lymphoma.**

**Objective:** Survival rates for Hodgkin's lymphoma (HL) are excellent (>90%) although significant physiological and psychological morbidity may occur secondary to cardiotoxic treatment. There is a paucity of published data on neuropsychological outcomes in these survivors. We report preliminary results of a study developed to evaluate neuropsychological functioning and fatigue in HL survivors.

**Participants and Methods:** Forty survivors (25F/15M, mean age 42.2 years, 18-35 years post diagnosis) underwent a series of comprehensive health evaluations to characterize cardiovascular and neuropsychological outcomes. Cardiac function was assessed by electrocardiography and echocardiography. Neurobehavioral outcomes were measured with the BRIEF, the Brief Symptom Inventory (BSI-18), and the FACIT-Fatigue scale. All survivors were treated with mediastinal radiation and 17 received anthracycline chemotherapy.

**Results:** When compared to normative values, HL survivors reported significantly more difficulty on the BRIEF Working Memory ( $p < .01$ ) and Task Monitor ( $p < .05$ ) scales. Significant correlations were observed between the FACIT-Fatigue scale and the BRIEF Emotional Control, Self Monitor, Initiate, Working Memory, and Task Monitor scales (all  $p$ 's < .01). Anxiety reported on the BSI-18 was significantly correlated with Emotional Control and Working Memory on the BRIEF ( $p < .01$ ). Although ejection fraction is not related to current neurobehavioral outcomes (all  $p$ 's > .05), detailed quantification of cardiac imaging is underway and these data will be evaluated in forthcoming analyses with a larger group of survivors.

**Conclusions:** These initial results suggest that HL survivors experience functional impairments, including anxiety, fatigue and executive dysfunction, which are likely to negatively affect daily living skills and general quality of life.

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**R. MARTIN, E.M. MAHONE, C. WELLS & A. HORSKA. Longitudinal Study of Twins Discordant for Brain Tumor and Radiation Therapy.**

**Objective:** Intracranial tumors are the most common neoplasms of childhood. Radiation therapy has contributed to increased survival of children with certain types of intracranial tumors; although associated neuropsychological impairment can occur, and can progress over time, perhaps as a result of continued white matter injury.

**Participants and Methods:** Neuropsychological data are presented for a set of twins, ages 5 years, 4 months at baseline, (a boy with twice resected right suprasellar pilocytic astrocytoma treated with chemotherapy (carboplatin, temozolomide) and 50.4 Gy of focal cranial radiation, and his healthy, typically developing twin sister). Data for both children are presented from four time points defined by the patient's radiation schedule: baseline (after resection but before radiation therapy), and 6, 15, and 27 months post completion of radiation therapy.

**Results:** At baseline, the patient's performance was lower than his sister's with the discrepancy increasing at the 6-month visit (most notably on Block Design—18 raw score points). At 15-month visit, the patient's scores remained stable or increased (visuospatial processing and verbal working memory); however, by 27-month visit, most of the patient's raw scores decreased again, with only working memory, phonological processing and motor speed stabilizing. In contrast, the healthy sister had steady raw score increases over the 27-month period.

**Conclusions:** Early surgical treatment for pilocytic astrocytoma, when accompanied by chemotherapy and cranial radiation, can be associated with initial loss of skills by six months post-treatment. By two years, some skills recover (verbal fluency) while others decline (visuoconstruction) or plateau (working memory), suggesting additional late effects of radiation treatment.

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**A. MELTON, H.M. CONKLIN, J. ASHFORD, S.E. SCHULENBERG, J. LI, T. MERCHANT, S. OGG, S. WU & X. XIONG. Influence of COMT Gene Variant on Working Memory in Survivors of Childhood Brain Tumors.**

**Objective:** CNS-directed treatments for childhood cancer have been demonstrated to disrupt developmental myelination in frontal brain regions, thus impairing cognitive processes that depend on these areas (e.g., working memory). Dopamine (DA) and the DA degrading enzyme Catechol-O-Methyltransferase (COMT) are integral to prefrontal cognition in typically developing children. The current study investigated the relationship between COMT genotype and working memory performance in a pediatric brain tumor population, a group susceptible to working memory deficits.

**Participants and Methods:** Working memory measures (computerized verbal and object self-ordered search tasks; Digit Span) were administered to 50 patients who had been treated with conformal radiation therapy for a primary central nervous system tumor (50% male; mean age =  $13.18 \pm 2.88$  years; mean age at irradiation =  $7.41 \pm 3.41$  years), as well as 40 healthy sibling control participants (50% male; mean age =  $12.91 \pm 2.62$  years). COMT genotype was determined using DNA ascertained by buccal swabs.

**Results:** Linear mixed models were used to investigate the relationship between COMT genotype and working memory performance. The statistical models did not reveal a significant relationship between COMT genotype and performance on the verbal or object self-ordered search tasks, nor on the Digit Span task, in either the patient or healthy sibling groups ( $F$ s < 1.0;  $p$ s > .05).

**Conclusions:** These negative results could be explained by the lack of a strong inhibition component among the self-ordered working memory tasks; however, the current study also failed to replicate earlier findings in healthy children using the Digit Span task. COMT genotype does not appear to be a resiliency factor that offers protection against working memory deficits in children treated for brain tumors. Implications for treatment and/or cognitive rehabilitation are offered.

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**K.L. NETSON, H.M. CONKLIN, J. ASHFORD, L.S. KAHALLEY, S. WU, X. XIONG & R.K. MULHERN. Parent and Teacher Ratings of Attention during a Year-Long Methylphenidate Trial in Children Treated for Childhood Cancer.**

**Objective:** Methylphenidate (MPH) ameliorates attention deficits associated with the cognitive late effects of childhood cancer treatment, as indicated by improved observer ratings and behavioral measures of attention. The ADHD literature reports discrepancies between parent and teacher ratings, and between observer ratings and behavioral measures of attention. Accordingly, this study examined parent and teacher ratings of attention and cognitive problems, and a behavioral measure of attention in childhood cancer survivors taking MPH. Inter-rater reliability and ecological validity were examined in this population.

**Participants and Methods:** Sixty-eight childhood cancer survivors with identified attention and academic problems participated in a twelve-month, open-label trial of MPH. The Conners' Rating Scales were administered to parents (CPRS) and teachers (CTRS) at pre-medication baseline, one, three, six, and twelve months. The Conners' Continuous Performance Test (CPT) was administered at baseline and twelve months.

**Results:** Improved attention was reported by parents and teachers after one month of MPH treatment ( $p < .05$ ) with relative stability of ratings between one and twelve months. Inter-rater reliability was moderate at best (e.g., Baseline ADHD Index; Shrout-Fleiss  $\rho = .45$ ,  $p < .001$ ). Parent ratings were significantly correlated with CPT Errors of Commission at baseline ( $p < .01$ ), but not at twelve months. Teacher ratings did not correlate with the CPT.

**Conclusions:** Improved attention over the twelve-month trial was almost exclusively accounted for by improvement during the first month of treatment with maintenance of benefits over time. Correspondence between parent and teacher ratings was moderate at best, and parent-reported symptoms correlated with behavioral measures of impulsivity. These results suggest that observer ratings do not fully capture symptom improvement in childhood cancer survivors treated with MPH and should be used in conjunction with other measures.

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**S.Y. PATWARDHAN, K.A. MYSZKA, R. COLLINS, C.J. ETZEL, C.A. MEYERS & J.S. WEFEL. Assessment of the Efficacy of Immediate Release Methylphenidate, Sustained Release Methylphenidate, and Modafinil for Patients with Primary Brain Tumor.**

**Objective:** Impaired neurocognitive functioning (NCF) among primary brain tumor (PBT) patients is ubiquitous. Research on immediate release methylphenidate (IRM) has demonstrated improvements in NCF and neurobehavioral function among PBT patients. This trial compared IRM with sustained release methylphenidate (SRM) and the novel vigilance promoting drug modafinil for the improvement of NCF of PBT patients. It was hypothesized that patients receiving methylphenidate would improve on memory, executive function and psychomotor processing speed measures, while patients receiving modafinil would improve on attention measures.

**Participants and Methods:** Twenty-four PBT patients (mean age=44.96±10.82, education=14.46±2.34, female=46%, left hemisphere tumor location=63%) participated and were randomized to IRM (Ri-

talim 10 mg), SRM (Concerta18 mg) or modafinil (Provigil 200 mg). Patients were tested before and after 4-5 weeks of psychostimulant therapy. NCF domains assessed included verbal memory, verbal fluency, attention, psychomotor processing speed, and executive functioning. Fatigue, symptom, and quality of life (QOL) measures were also administered.

**Results:** Longitudinal changes in NCF were analyzed with the likelihood ratio statistic after controlling for baseline performance. Standardized scores were used for all NCF tests and raw scores were used for fatigue, symptom and QOL measures. After adjusting for multiple comparisons, patients receiving methylphenidate (slope=2.017) demonstrated greater improvement than patients receiving modafinil (slope=0.975) on a measure of psychomotor processing speed (Trail Making Test Part A, chi-square statistic (df=1)=10.272,  $P=0.001$ ).

**Conclusions:** In this small pilot study, methylphenidate improved psychomotor processing speed but did not result in differential change on memory or executive function measures. Modafinil did not demonstrate differential effect on measures of attention.

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## Cognitive Neuroscience

**J.P. ALVAREZ-TOSTADO, O. INOZEMTSEVA & E. MATUTE. The Effect of Age and Gender in Sexually Dimorphic Tasks.**

**Objective:** The purpose of the present study is to characterize the changes related to age and gender in sexually dimorphic abilities. Sex cognitive dimorphisms have been long described in Neuroscience research. These differences are mainly attributed to steroid hormones.

**Participants and Methods:** 789 healthy children were assessed (350 males and 439 females) ages from 5 to 16 years old. Two group stratifications were done: 1. Children were divided in six groups distributing in two-age years ranged in order to know changes across age. 2. Two groups were conformed: prepubertal (5-9 years old) and postpubertal (12-16 years old) to check the possible hormone effect on the cognitive development. A total of twenty tasks from the Evaluación Neuropsicológica Infantil (ENI) were selected, based on their possible sex dimorphism. MANOVA analysis was used for both group stratifications.

**Results:** A significant age effect in all tasks was found. A sex effect was observed in: naming, discourse comprehension, different angled pictures, arithmetic problems solving, narrative coherence, mental calculation, and matrix, males presenting higher scores. Age effect continues when groups were divided in pre and postpubertals. When comparing prepubertal boys and girls, four tasks were found with significant sex effect, whereas in postpubertal group, this effect was found in seven.

**Conclusions:** The results suggest that sex differences are present in the child development and its manifestation is stronger in the adolescence, probably this effect could be boosted by the hormonal effect.

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**C. STAMOS & C.L. ARMSTRONG. Neuroanatomical Correlates of Auditory Selective Attention.**

**Objective:** The Auditory Selective Attention Test (ASAT; Armstrong, 1997) is an adaptation of previous auditory continuous performance tests, which limits the element of memory and includes perceptual and expectation contingencies, placing demands on perceptual processing and preparation for stimuli. The purpose of the study was to determine if the ASAT could discriminate patients grouped by brain region, and discern if ASAT error types were regionally associated. It was hypothesized that patients with anterior tumors would demonstrate more total omission errors than posterior tumor patients, left hemisphere lesions would be associated with worse performance, probability errors and errors of commission would be greater in anterior patients, and commission errors more common in right frontal patients.

**Participants and Methods:** Fifty-five patients (ages 21-66) with benign or low grade tumors located in one of the four neuroanatomical regions (anterior/posterior x left/right hemisphere), including a control subgroup of extra-axial tumor patients, and 55 demographically matched normal controls were given the ASAT. The ASAT includes total errors of omission, commission, errors after probability foil, and perceptual and sequencing errors.

**Results:** Expected differential anterior/posterior effects in error types (total errors and probability errors) were found, as well as significant left hemisphere impairment in all error categories, except commissions. Upon examining groups for all error types, significant differences between groups were found in total errors and commissions.

**Conclusions:** Results support the notion that the ASAT requires left hemisphere selective attention functions. These results also suggest that the ASAT's features are sensitive to impairment in the frontal lobe's postulated role in predicting the probability of a stimulus.

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**K.M. ARMSTRONG, J.E. CALAMARI, H.M. CHIK, N.K. PONTARELLI, B.L. DEJONG, J. SOCHA, A. MOLINO, S.V. SALSTROM, K.L. CASSIDAY & B.C. RIEMANN. Meta-Cognition in Obsessive-Compulsive Disorder: An Evaluation of Implicit Learning and Thought-Focused Attention.**

**Objective:** Meta-cognition plays an important role in the development and maintenance of Obsessive Compulsive Disorder (OCD). More specifically, we believe that thought focused attention (cognitive self-consciousness (CSC)) is a risk factor that is unique to OCD. Previous studies have found impaired procedural learning in OCD patients. Expanding on this research, the goal of this preliminary cross-sectional study was to determine if CSC was related to measures of implicit learning and to symptom severity in OCD patients and anxious controls.

**Participants and Methods:** The study examined a group of OCD patients (n=29) and anxious controls (n=11) as a preliminary evaluation of our hypotheses. Participants were examined with a battery of symptom severity measures and the Serial Reaction Time test, a measure of implicit learning and a marker for cortico-striatal-thalamic-cortical (CSTC) pathways. Repeated measures analyses were run to examine changes over trials for each group and interactions between groups.

**Results:** CSC was significantly related to OCD symptom severity measures and was significantly different between patient groups. CSC was found to be positively correlated with implicit learning in both the OCD and anxious control groups. Both groups showed significant implicit learning across both baseline and learning trials, with the OCD group showing slower reaction times across all baseline and learning trials.

**Conclusions:** Results provide initial support for the relationship between CSC, implicit learning, and OCD. Longitudinal data collection is still ongoing to evaluate changes in CSC and implicit learning following a course of cognitive-behavioral therapy.

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**P. BISACCHI, G. CONA, C. FLAIBAN, P. AMODIO & S. SCHIFF. Cognitive Alterations in Cirrhotic Patients with Minimal Hepatic Encephalopathy investigated with the Inhibitory Control Test.**

**Objective:** Minimal Hepatic Encephalopathy (MHE) is a sub-clinical condition detectable in acute and chronic liver diseases and it is characterized by a wide spectrum of neuropsychiatric symptoms.

The aim of this study was to evaluate the functioning of the executive control system with particular attention on contextual working memory updating and response inhibition in patients with MHE.

**Participants and Methods:** In the study 16 patients with cirrhosis (8 patients with MHE and 8 patients without MHE) and 8 healthy control subjects matched for age and instruction level underwent the Inhibitory

Control Test (ICT). The ICT is a computerized test in which a continuous series of letters are presented one after the other every 500 ms. The subject is asked to respond only if the letter X and Y (target letters) are alternated ("go trial"), and to inhibit the response if the X and Y are repeated ("lure trial"). So he/she is required to remember the preceding 'target-letter' interspersed among the irrelevant letters.

Participants underwent also a paper and pencil psychometric battery and electroencephalographic evaluation.

**Results:** Although performance in patients with cirrhosis was not significantly different to that of controls, the patients with MHE performed significantly worse than controls ( $p = 0.036$ ), providing less accurate responses (percentage of accuracy = MHE-patients: 76%; controls: 88%) regardless of the type of trial.

**Conclusions:** These data seem to suggest that cirrhotic patients with MHE may show some difficulties both in inhibition of prepotent responses (lure trials) and in updating of working memory (go trials).

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**B.H. CHAKRABORTY, G.J. SIEGLE, R. CONDRAY, A.L. CLARKE & S.R. STEINHAEUER. Influence of Parasympathetic and Sympathetic Activity on Pupillary Dilation Elicited During the Digit Span Task.**

**Objective:** Pupillary dilation during performance of the digit span task has been one of the most replicated findings over the past four decades, but the contributions of central pathways to the response have not been examined. Typically, dilation of the pupil increases as the number of digits is increased, and the pupil becomes smaller as digits are recalled.

**Participants and Methods:** To elucidate the relative sympathetic and parasympathetic dilation components, we recorded the pupil under dark and light conditions in each of eight healthy subjects. Pupil diameter was digitized as auditory computer-controlled sequences of 4, 7 or 10 digits were presented in random order.

**Results:** Subjects showed the expected increasing dilations as digit length increased, but did not exhibit pupillary overload in the 10-digit condition, which in some studies has been observed to produce decreased diameter for the longest digit lengths. Dilation was greater in amplitude under light than dark, suggesting a major contribution of central inhibition of the parasympathetic oculomotor nucleus from descending cortical pathways. In light, pupil diameter decreased following the last digit but before an instruction to respond, suggesting a momentary loss of central inhibition. In contrast, the smaller dilations in darkness were most characterized by a smooth transition from pupillary dilation (during encoding) to relaxation (during reporting), suggesting more gradual activation and subsequent relaxation of the sympathetic pathways.

**Conclusions:** Findings suggest that the major sources of pupillary dynamics during the digit span task are related to modulation of the central inhibitory influences impinging on the parasympathetic Edinger-Westphal complex of the oculomotor nucleus.

Supported by the Department of Veterans Affairs and NIMH Grants MH55762, MH082998; University of Pittsburgh Clinical and Translational Science Institute (CTSI; RR024153).

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**C.A. CLARK, K.A. ESPY, H. FANG, N. MINICH & H. TAYLOR. NEUROLOGICAL STRUCTURE AND ASSOCIATED TRAJECTORIES OF ACADEMIC ACHIEVEMENT AMONGST CHILDREN OF DIFFERING BIRTH WEIGHTS.**

**Objective:** Children born very preterm and at the low ends of the birth weight spectrum are at increased risk of low academic achievement. A predominant reliance on cross-sectional, risk-factor-based designs has provided little information regarding the neurological basis and longitudinal course of these difficulties.

**Participants and Methods:** In a prospective study spanning early school age through adolescence, Espy et al. (2009) used Growth Mixture Modeling to identify 2 latent clusters of children with distinct trajectories of achievement in arithmetic, mathematical problem solving and letter-word decoding. Relative to an average achieving cluster, decreasing birth weight was associated with increased probability of falling into a low achievement cluster, characterized by consistently low performance and a protracted period for the acquisition of academic skills. In the present study, 108 of the same children (37<750g, 35<1500g, 36>2500g, matched for age, SES and race) underwent MRI scanning during late adolescence (15-19 years).

**Results:** Analysis of MRI data in relation to latent achievement clusters revealed that each cm<sup>3</sup> increase in cerebral white matter, subcortical gray matter, amygdala, caudate, hippocampal, corpus callosum, total cerebellar and cerebellar white matter volume was associated with a 1-2 fold increase in the odds of being classified in the average achievement cluster. For caudate, corpus callosum and cerebellar white matter volumes, these associations were consistent after accounting for total cerebral volume.

**Conclusions:** Findings highlight the adverse implications of early disruptions in academic skill acquisition. Structural differences in subcortical systems and white matter tracts that mediate executive attention and motor control may constrain learning and help to explain heterogeneous academic trajectories amongst children born very preterm.

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**Y. MOLINA, R. CORREIA-PASSINHAS, G. NAVARRETE, A. NIETO & J. BARROSO. About the Interdependence between Clustering and Switching in Successful Semantic Verbal Fluency: a Non-linear Approach.**

**Objective:** Switching and clustering were originally proposed to be equally important for optimal performance in semantic verbal fluency (Troyer et al, 1997). However, the former equality has been disputed since some recent studies failed to show any contribution of the clustering component when characterizing the semantic verbal fluency performance pattern in clinical samples. We aimed to determine the weight of the variables underlying a good semantic verbal fluency performance.

**Participants and Methods:** 54 healthy adults aged from 30 to 79 participated in our study. Semantic verbal fluency performances were qualitatively analyzed following Troyer et al. (1997). A Feed-forward Neural Network applying the Backward Feature Selection (BFS) procedure was used to process the data. It has been showed before the usefulness of non-linear feature selection methods on neuropsychological issues (Navarrete et al. 2007, 2008).

**Results:** From an initial set of 20 variables, the BFS selected 2 (number of clusters, cluster mean size) reaching a 93.2% (+3%) accuracy (average of 5 10-fold cross-validation) on predicting a successful semantic fluency score (over 70th percentile in correct words generated).

**Conclusions:** Our results point that semantic verbal fluency performance is explained in a great extent by the number of clusters used, as a measure of the switching component, and the cluster mean size as a measure of the clustering one. So it seems that, at least in healthy populations, an efficient combination of both strategies is highly recommended for a successful animals fluency task performance.

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**A.M. DIAS, E. ODA & A. VAN DEUSEN. Modeling the Cognitive and Neurobiological Basis of the Process of Coping with Bargains in the Ultimatum Game.**

**Objective:** The Ultimatum Game (UG) is a zero-sum game that has become very important within neuropsychological studies due to its ad-

equacy to evoke decisions that neglect the maximization of expected utility, in order to preserve social values and punish unfairness. Recently, different studies have linked serotonin and serotonin-related responses to rejection rates, through the mediation of intolerance to unfairness, thus leading to the ‘serotonin hypothesis’ of the UG. However, there are evidences pointing to a much more complex neurobiological basis than originally assumed. **Objective:** We aim to introduce the ‘triple circuit hypothesis’, a new cognitive and neurobiological hypothesis of the process of coping with bargains in the UG.

**Participants and Methods:** Theoretical.

**Results:** Our hypothesis considers that, at the cognitive level, the minimum schemes to represent the response behavior are: pre-consciousness discrepancy; attributional schemes through valence production; and counterfactual tendency to restrain impulsive behaviors. In the neurobiological level, it proposes that, besides the serotonergic circuit, the minimum circuit relies on transient increases in phasic activity of neurons located in the dorsolateral portion of midbrain (error processing - dopaminergic); MPFC excitatory firings toward the limbic system (especially the amygdala, mainly through glutamatergic pathways; dopaminergic activity toward the MPFC, generating inhibitory activity, which disinhibit limbic activity).

**Conclusions:** These ideas are presented in association with a computerized simulation. Some of the evidences that support our hypothesis are: VMPFC lesions increase rejection rates; decreased right VMPFC size is correlated with diminished impulsivity control in young men; dopamine agonists increase impulsivity, DLPFC glutamatergic activity is associated with social cognitions (empathy).

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**K.L. EVANS & E. HAMPSON. Is There a Male Advantage on Tasks Recruiting the Ventral Prefrontal Cortex?**

**Objective:** Limited evidence suggests that the prefrontal cortex (PFC) is a brain region that is modulated by sex steroids. Ventral regions of the PFC are known to be involved in probabilistic reversal learning and in decision-making as assessed by the Iowa Gambling Task (IGT). Five studies have found that males tend to outperform females on the IGT by the later stages of the task, but there has been little attempt to examine sex differences in reversal learning. Therefore, the objective of the current study was to investigate whether a male advantage exists on both the IGT and probabilistic reversal learning.

**Participants and Methods:** Healthy young adults (Females: n = 43; Males: n = 29) completed the IGT, a probabilistic reversal learning task, and a vocabulary task used to estimate general intelligence. Participants were screened for medication use, history of head injury, and mental health conditions.

**Results:** As predicted, by the second half of the IGT males selected fewer cards from one of the disadvantageous decks than females. On the reversal learning task, there was no significant sex difference in acquisition of the reinforcement contingencies, but males made fewer errors than females during the reversal phase of the task. The groups did not differ in general intelligence.

**Conclusions:** The findings provide preliminary support for the hypothesis that a male advantage exists on cognitive tasks dependent on the ventral PFC.

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**C.D. GILBERT, K. KARLSCODT, R. POLDRACK, E. LONDON, N. FREIMER, R.M. BILDER & T. CANNON. Associations Between Schizotypy and Executive Function in a Large Healthy Sample [The UCLA LA2K Study].**

**Objective:** Recent evidence supports the notion that positive and negative dimensions of schizotypy differ according to distinct neuropsychological profiles (Dinn, et al., 2002). Although measures of cognitive

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impairment have been consistently correlated with negative symptomatology in adults with schizophrenia, such measures have been inconsistently correlated with both positive (Matheson & Langdon, 2008), and negative schizotypy (Szoke, et al., 2009). Individuals with increased negative schizotypal traits may be characterized by excessive cognitive stability and limited cognitive flexibility. Excessive cognitive stability may be well correlated with deficits in cognitive control represented by a spatial working memory capacity task (Bilder, et al., 2004).

**Participants and Methods:** 186 right-handed healthy adults completed the Chapman Scales for Perceptual Aberrations, Physical and Social Anhedonia and a spatial working memory capacity task (SCAP; Cannon, et al., 2002) as part of the Consortium for Neuropsychiatric Phenomics' large battery of behavioral and neurocognitive tests. All participants completed the measures within one month.

**Results:** Self-report scores on Chapman scales did not differ from normative values. Summary statistics show mean and standard deviation for working memory performance (RT at load 7, Mean=1242ms, SD=333ms). Pearson correlation coefficients were conducted in order to determine the relationship between the three schizotypy scales and the SCAP. Results demonstrated that Physical/Social Anhedonia were significantly associated with reaction time in the SCAP (load 7- PhyAnh  $r=0.241$ ,  $p<0.001$ ; SocAnh  $r=0.224$ ,  $p<0.002$ ; PerAb  $r=-0.01$ ,  $p<0.9$ ).

**Conclusions:** Preliminary analyses suggest negative schizotypy is associated with poorer performance on a test of spatial working memory (SCAP). These results may be due to excessive cognitive stability and related difficulties in updating working memory representations and shifting attention. Further analyses are currently underway.

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#### **K.M. GOEDERT, A. LEBLANC, S. TSAI & A.M. BARRETT. Prism Adaptation and Spatial Bias in Young and Aged Subjects: Adaptation Depends on Pre-Existing Bias Direction.**

**Objective:** A model of spatial neglect in the aged could prove valuable. This model may exist: In young controls, adaptation with left-shifting prisms induces asymmetric spatial errors: Right-shifting prisms do not (Colent, et al. 2000). A potential problem with this model is age differences in spatial biases: Young are more leftward biased (Jewell & McCourt, 2000). Here we compared the adaptation of young and aged to assess the importance of pre-existing biases.

**Participants and Methods:** Young ( $n = 12$ , 21-33 years) and aged ( $n = 12$ , 61-85) adapted to left- or right-shifting prisms. Pre- and post-adaptation we assessed line bisection error.

**Results:** Direction of bias, rather than age, better predicted asymmetric adaptation. Non-parametric Wilcoxon signed ranks tests revealed that for individuals with a consistent a priori leftward bias ( $n = 10$ ), training with left-shifting prisms produced a rightward aftereffect ( $p < 0.05$ ), but training with right-shifting prisms did not ( $p = 0.45$ ). Conversely, for individuals with an a priori rightward bisection bias ( $n = 5$ ), training with right-shifting prisms produced a leftward aftereffect ( $p < 0.05$ ), but training with left-shifting prisms did not ( $p = 0.69$ ).

**Conclusions:** These results suggest that 1) rightward bias induced by leftward prism adaptation may not be an accurate model of spatial neglect after right hemisphere stroke and 2) age-related changes in spatial bias may be important to understanding the mechanisms relevant to motor learning, successful rehabilitative interventions, and acquired pathologic spatial bias in the aged.

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#### **P. FORTIS, K.M. GOEDERT, L. FUREY & A.M. BARRETT. Spatial "Aiming" Motor Intentional Systems Adapt to Left-, But Not Right-Shifting Optical Prisms.**

**Objective:** Asking controls to make pointing movements while wearing prisms that shift the visual environment allows experimenters to study

motor learning, and potentially, the mechanisms of healthy and pathologic spatial bias (spatial neglect). In controls, training with left-shifting prisms results in post-adaptation rightward error, but training with right-shifting prisms does not result in concomitant leftward error (Colent et al., 2000). Spatial motor learning may involve changes in both "where" (perceptual attentional) awareness of target location and "aiming" (motor intentional) preparatory activity (Na et al., 1998). Here we assessed the effects of training with left- and right-shifting prisms on these two components.

**Participants and Methods:** Fifty-eight young controls adapted to either left- or right-shifting prisms by performing 60 line bisections. Pre- and post- prism training, participants bisected 15 lines on a computer monitor under natural- and reversed-viewing conditions.

**Results:** All participants, regardless of prism shift, reduced their bisection error during prism training (exhibited adaptation). All demonstrated after-effects in the direction opposite the prism shift as assessed by straight-ahead pointing. Dissociable effects were, however, observed on the fractionated "where" and "aiming" biases: Both left- and right-shifting prisms produced a rightward shift in "where" bias ( $p < 0.01$ ). However, the left-shifting prism produced a rightward shift in the "aiming" bias ( $p = 0.01$ ), while the right-shifting prism left "aiming" unchanged ( $p = 0.42$ ).

**Conclusions:** These results suggest that the generalizable post-adaptation effects previously observed when training with left-shifting prisms are the result of changes in motor intention, rather than changes in perceptual attention.

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#### **M.G. GONZÁLEZ-OSORNIO, F. OSTROSKY-SOLÍS, G. OROZCO & K. BORJA. A psychobiological approach to personality: examination between sexual orientation.**

**Objective:** To compare personality characteristics between homosexuals and lesbians, with heterosexual men and women.

**Participants and Methods:** 40 subjects were studied: 10 homosexuals, 10 lesbians and 20 heterosexuals (10 men, 10 women). Homosexuals and lesbians were selected using the Klein Sexual Orientation Scale. To examine Cloninger's psychobiological personality model, we used The Temperament and Character Inventory (Cloninger, 1987).

**Results:** The ANOVA between groups showed significant differences between the homosexual group and heterosexual female group in the Harm Avoidance (HA) subscale of the dimension of Temperament. The homosexual male group scored higher in Harm Avoidance than female heterosexual group. Among the heterosexuals there was a consistent tendency of the women to obtain higher scores.

**Conclusions:** Previous studies have reported that heterosexual women scored consistently higher in Harm Avoidance (HA) and in Reward Dependence (RD) (Miettunen et al., 2007) and that these traits reflect neurobiological tendencies to avoid damage and risk. The homosexual group showed a different temperament pattern. Results are discussed in relation to the psychobiological brain mechanisms among different sexual preferences

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#### **P. JIRIK-BABB & R.S. BABB. Cognitive Neuropsychology of Spatial Processing.**

**Objective:** The hypothesis that neuronal circuits subserving perception and conceptualization is based on neuropsychological results from patients. Both anatomical and functional imaging have identified specific circuits dealing with spatial problems.

**Participants and Methods:** Spatial information within semantic memory arises in the right parietal and temporal cortical areas. This spa-

tial information is directed to the prefrontal cortex, where spatial cognition occurs. The ventromedial prefrontal cortex simultaneously processes multiple executive functions, such as cognitive shifting. Projections back to the parietal cortex enable information to become available in a feedback loop, enabling the changing of cognitive structures underlying ideas.

**Results:** For example, although perceptually, objects in three-dimensional space separate from time do not contract when moving, they do contract based on relativity theory concepts. The issue becomes: Does the object only appear to contract or is it a real contraction? A solution to this puzzle can be found in Minkowski's spacetime. When an object is conceptualized as a four-dimensional, actual, spacetime object, it does not contract when moving. However, if one imagines that this object is "sliced" at different times, its three-dimensional "slices" would have different lengths when measured at different speeds in our common-sense world.

**Conclusions:** The ability for flexible thinking underlies processes such as solving logical problems in the perceptual and conceptual worlds. Such shifting of information could underly the abrupt change of a belief. A combination of neuropsychology and brain imaging could open new vistas in the investigation of neurocognitive functions underlying the process of spatial thinking.

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**W.D. KILLGORE, A. POST & D.A. YURCELUN-TODD. Sex Differences in Cortico-Limbic Responses to Images of High Calorie Food.**

**Objective:** Images of high-calorie foods have been associated with significantly greater activation within dorsolateral and medial prefrontal cortices relative to low-calorie food images, and these responses appear stronger in patients with eating disorders. Although eating disorders are significantly more common among women, there have been no studies examining sex differences in cortico-limbic responses to images of high versus low-calorie foods.

**Participants and Methods:** Sixteen healthy adults (8 male; 8 female) ranging from 40 to 57 years underwent fMRI (3-Tesla) while viewing color images of high-calorie foods (e.g., cheeseburgers, ice-cream), low-calorie foods (e.g., salads, fruits), and low-interest baseline pictures of leaves, flowers, and rocks. Each paradigm comprised 5 alternating 30-second periods of experimental and control stimuli, each consisting of ten images (2500 msec stimulus presentation; 500 msec inter-stimulus interval). Contrast images comparing high-calorie versus low-calorie conditions were created on SPM99 and compared between males and females in a second level analysis controlling for BMI.

**Results:** Women showed significantly greater whole brain responses within dorsal, medial, and lateral orbitofrontal cortex and posterior cingulate gyrus than men ( $p < .001$ ), whereas men showed no regions of greater activation than women. A priori regions of interest showed greater amygdala responses in men and greater insular responses in women ( $p < .05$ ).

**Conclusions:** Relative to men, women activated a network of cortical regions involved in self-reflective thought, behavioral control, and visceral responses when viewing high-calorie foods, whereas responses in men were greater in limbic structures. Findings may contribute to a neurobiological explanation for the higher prevalence of eating disorders among women.

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**E. KOTSOPoulos, A. KRITIKOS & A. PAVLIS. Visual Selective Attention: The Effect of Temporal Separation and Perceptual Load on Distractor Interference.**

**Objective:** The perceptual load theory of selective attention (Lavie, 1995) states that distractor processing is determined by the perceptual

load of the visual display. However, presenting distractor information prior to the presentation of relevant information also modulates distractor processing. The aim of this study was to examine the perceptual load theory in the context of temporal separation and distractor-target compatibility.

**Participants and Methods:** Twenty individuals performed a go/no-go visual attention task. Participants were required to respond to a target letter based on the feature (low perceptual load: LPL) or conjunction of features (high perceptual load: HPL) of a flanking item. Distractor items were presented either above or below the target. Distractors and targets were presented either simultaneously or separated by up to 200 milliseconds. Distractor interference was measured using reaction times (RTs) and accuracy. **Results:** A series of ANOVAs revealed no significant difference in RTs to the target letter between the preceding and simultaneous conditions. However, in both conditions, RTs were significantly faster in the HPL than in the LPL condition. Interestingly, accuracy was related to target-distractor congruence rather than perceptual load.

**Conclusions:** These results suggest that the perceptual load theory cannot account for distractor interference when stimulus onset asynchrony is manipulated. Instead, findings indicate that distractors may have been processed and discarded prior to response selection. Working memory processes are also implicated in visual attention such that the generation of an inhibitory template may have prevented distractor interference effects. The nature of working memory involvement in visual attention warrants further investigation.

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**E. KOTSOPoulos, A. KRITIKOS & A. PAVLIS. Visual Selective Attention: The Effect of Perceptual Load and Working Memory Demand on Distractor Interference.**

**Objective:** Many theories have implicated working memory involvement during visual search. Information held in working memory can bias attention in favor of activated internal representations. However, attention can still be directed towards irrelevant information depending on the availability of cognitive resources. The load theory of cognitive control and visual selective attention (Lavie et al., 2004) proposes that distractor interference is prevented in cases of high perceptual load (HPL) and low working memory load (LWML). This study aimed to directly contrast the effects of selective visual attention, perceptual load, and working memory load using a dual-task paradigm.

**Participants and Methods:** Twenty individuals simultaneously performed a visual attention task and a working memory task. The visual search task required participants to respond to a target presented amongst five nontargets (high perceptual load) or alone (low perceptual load); an irrelevant distractor appeared either above or below the target. The two working memory tasks varied in cognitive load. Distractor interference was measured using reaction times (RTs) and accuracy.

**Results:** ANOVAs revealed that perceptual load and working memory load were effectively manipulated. Crucially, distractor congruence interacted with working memory load but not with perceptual load. Under high working memory load, RTs were significantly faster to congruent and incongruent distractors versus neutral distractors and vice versa under LWML. Distractor congruence effects were eliminated across both perceptual and working memory load conditions.

**Conclusions:** Contrary to the cognitive load theory of visual selective attention, these results suggest that visual search processes and working memory storage may actually utilize the same limited capacity mechanism.

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**M.J. LARSON & W.M. PERLSTEIN. Cognitive Control, Performance Monitoring, and Neurocognitive Functioning: Is Bigger Really Better?**

**Objective:** The ability to monitor one's performance is essential for goal-directed behavior. The neural instantiations of performance monitor-

ing abilities can be measured using the error-related negativity (ERN) component of the scalp-recorded event-related potential (ERP). Current theories of the ERN suggest increased amplitudes are associated with better cognitive flexibility and cognitive control abilities; however, no studies directly examine the cognitive profile of individuals with differing levels of performance monitoring. Thus, the current study aimed to determine if larger ERN amplitude is associated with improved general cognitive functioning or whether this relationship is specific to certain domains of cognition.

**Participants and Methods:** High-density ERPs were acquired while 34 healthy participants performed a single-trial Stroop task. Response-locked ERPs were separately averaged for correct and error trials. Neuropsychological measures were given prior to ERP acquisition and consisted of measures of attention, processing speed, verbal fluency, memory, and executive functions.

**Results:** Multivariate profile analysis showed no differences in overall cognitive functioning between individuals with large- and small-ERN amplitudes; however, individuals with larger ERN amplitudes showed better performance in the specific domains of executive functioning and attention, but not processing speed, verbal fluency, or memory. ERN amplitude inversely correlated with incongruent-trial Stroop accuracy and measures of executive functioning.

**Conclusions:** Findings indicate larger ERP reflections of performance monitoring are associated with improved performance in the specific cognitive domains of attention and executive functioning, but not overall cognitive performance across all domains. Findings are consistent with recent work indicating performance monitoring requires consistent vigilance to task performance, cognitive flexibility, and the ability to rapidly adjust performance as necessary for goal-directed behaviors.

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**A. LOPEZ-FRANCO, F.R. GÓMEZ-VELÁZQUEZ, A.A. GONZÁLEZ-GARRIDO, D. ZARABOZO-HURTADO & E. RODRÍGUEZ-SANTILLÁN. Visual Word Recognition In Children And Adults.**

**Objective:** Reading accuracy depends upon fast on-line adjustments in linkage between the content of the text and background knowledge. This is probably why top-down mechanisms let the reader to generate context-guide predictions which might be affected by the frequency in which read words used to appear in daily language. The objective was to explore different stages of reading skillfulness in visual word recognition in Spanish using ERPs.

**Participants and Methods:** Two groups of fourteen (A: eight year-old children; B: young university students) healthy, normal IQ, right-handed subjects were voluntarily evaluated. They performed a task in which two successive stimuli were presented in a screen monitor: an easy-naming draw and a subsequent word that matched the draw (A: control condition) or not (B: orthographic violation, C: semantic violation). Subjects had to judge if the stimuli pair matched or not, while ERP were simultaneously recorded.

**Results:** As expected, behavioral results showed significant differences between the groups for the amount of correct responses and reaction times. In general, ERP showed higher amplitudes in children, while significant differences in N170 component (lateralized to the left in adults) were exposed. ERP differences across conditions were earlier in adults, which also exhibited higher differences in P600-like component. A positive waveform peaking around 450 ms was exclusively seen in children, and it reached higher amplitude for orthographic violations.

**Conclusions:** Present results seem to emphasize that skillful reading could depend upon the visual expertise and the efficiency of top-down processes influencing the word recognition process.

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**S.M. MCCLINTOCK, N.K. DEWIND, H. TERRACE, M.M. HUSAIN, S.B. ROWNY, T.J. SPELLMAN & S.H. LISANBY. Differential Effects of Magnetic and Electric Seizure Therapy on Strategies for Spatial Working Memory.**

**Objective:** Free-range spatial working memory measures provide unique information regarding underlying cognitive strategies, such as stereotypy. This strategy involves repetitive sequential selection of a spatial pattern once a correct sequence has been identified. We previously found that electric (EST) but not magnetic seizure therapy (MST) impaired performance on a spatial working memory task, thus we tested the hypothesis that EST disrupted stereotyped patterns in the selection of spatial stimuli.

**Participants and Methods:** The subjects were three pathogen-free male rhesus macaca mulatta with a mean age of  $83 \pm 26$  months (approximate human age equivalent:  $20.8 \pm 6.5$  yrs). Subjects completed the Columbia University Primate Cognitive Battery computerized, touch-screen, free-range spatial working memory task. The within-subject study design allowed subjects to receive each treatment condition (EST, MST, sham) and serve as their own control. Kendall tau correlations were computed between actual and predicted touch of the spatial stimuli.

**Results:** All correlations were significant (all p-values  $< 0.0001$ ), and were lower in the EST relative to the MST or sham conditions. As reflected in the touch pattern, the preferential starting point and stereotypic movement were maintained in the sham and MST conditions, but not the EST condition for two subjects.

**Conclusions:** This is the first study to contrast the effects of EST and MST on spatial working memory strategies. Each subject showed a preferential starting point and predictable touch pattern, and our findings suggested that EST, but not MST impacted stereotypy. Further research is needed to replicate these findings that may have significant implications for understanding cognitive component processes of memory function and impairment.

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**K. MURPHY, W.B. BARR, R. KUZNIECKY, J. DUBOIS, C. CARLSON, B.T. QUINN, M. BLUMBERG, M. MIKHLY, O. DEVINSKY, C.R. MACDONALD, A. DALE, E. HALGREN & T. THESEN. Phonetically Irregular Word Pronunciation and Cortical Thickness in the Adult Brain.**

**Objective:** The maturation of fluent oral reading skills relies on extracting statistical regularities between orthographic and phonetic features. However, typical rules do not apply when a reader is confronted with phonetically irregular words. For such words, accurate pronunciation requires prior exposure to unique relationships between visual and auditory features. The objective of the current study was to determine whether such word knowledge acquisition is accompanied by structural changes in areas associated with orthographic to phonetic transformations.

**Participants and Methods:** We used high resolution MRI to determine whether performance on a visual word-reading test composed of phonetically irregular words, the Wechsler Test of Adult Reading (WTAR), is associated with changes in brain structure. A sample of 64 right-handed, neurologically intact individuals (age range: 18-66) were administered the WTAR and underwent scanning at 3T using a T1-weighted sequence optimized for grey-white matter contrast. Using quantitative morphometric post-processing procedures, cortical thickness was estimated at each vertex on the cortical mantle and correlated with WTAR scores while controlling for age.

**Results:** Higher scores on the WTAR were associated with thicker cortex in the anterior superior temporal gyrus, the angular gyrus, and the intraparietal sulcus of the left hemisphere, as well as the homologous areas of the right hemisphere.

**Conclusions:** These results demonstrate that skilled pronunciation of phonetically irregular words is accompanied by structural changes in adult language networks responsible for orthographic to phonetic transformation.

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**G. NAVARRETE, R. CORREIA-PASSINHAS, Y. MOLINA, A. NIETO & J. BARROSO. Neural Networks on Phonetic Verbal Fluency: Discovering Language-Specific Variables.**

**Objective:** Although verbal fluency has been largely studied in Spanish speaking population, the qualitative aspects have been frequently ignored. Our purpose is to deeply analyze phonetic verbal fluency using a Neural Network (NN) to identify the more relevant components for a satisfactory execution. Non-linear feature selection methods can be useful to reduce complexity on neuropsychological databases (Navarrete, et al. 2007, 2008).

**Participants and Methods:** A phonetic verbal fluency test (FAS) was administered to 54 healthy adults (age  $x(sd)=55.31(14.17)$ ). Qualitative components were defined according to Troyer et al. 1997, but new kinds of phonetic cluster as “beginning by the same first syllable” and “same syllable ending” were added. A NN was used, applying the Backward Feature Selection procedure (BFS), to analyze the data.

**Results:** From a set of 60 variables, the BFS selected 3 (number of switchings, mean cluster size for “beginning by the same first syllable” and number of “same syllable ending” clusters) reaching a 95.6% (+3.5%) accuracy (average of 5 10-fold cv) on predicting a successful phonetic verbal fluency score (over 70th percentile in correct total words generated -FAS-).

**Conclusions:** Results highlight the relevance of switching in phonetic verbal fluency and confirm that this frontal-lobe related strategy is the core domain beyond this task. Our results also show that in Spanish, both switching and clustering referred to syllables help to explain the variance in performance. Although further analysis are needed, when studying verbal fluency performance, not only universal cognitive, but also language-specific variables are required in order to fully understand this phenomenon.

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**N. PAQUETTE, B.G. FRANKENBERGER, O. FLOREA, J. TREMBLAY, P. VANNASING, R. BELAND, F. LEPORE & M. LASSONDE. Using Near-Infrared Spectroscopy to Assess Receptive Language in Healthy Adults.**

**Objective:** In recent decades, functional magnetic resonance imaging (fMRI), a non-invasive technique, has proven to be more effective than the Wada test in the evaluation of language lateralization in special populations such as persons with epilepsy and children. However, fMRI requires that subjects remain motionless during data acquisition, making the assessment of expressive language difficult particularly in young children. Near-Infrared spectroscopy (NIRS) is a non-invasive technique that has been shown to be more tolerant to motion artifacts. Given this advantage, NIRS has been used in recent years to study expressive language in special populations. However, NIRS has been used sparingly in the study of other language functions such as receptive language. The aim of the present study is to expand the use of NIRS studying the localization of cerebral areas involved in language comprehension.

**Participants and Methods:** Four native French speakers, with no knowledge of the Arabic language, listened to a story read aloud by a bilingual speaker both in French and in Arabic.

**Results:** Results revealed that activation, mainly localized in the left temporal area, was significantly higher when participants were listening to the French than to the Arabic story.

**Conclusions:** These preliminary results suggest that NIRS may be a useful technique to assess receptive language in adults. This information will be the basis for further studies related to receptive language development in children.

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**F.W. SABB, J. ERICKSON, D. LAU, X.E. CAGIGAS, R.A. POLDRACK, T.D. CANNON, E.D. LONDON, N.B. FREIMER & R.M. BILDER. Covariation between measures of executive function: Experimental correlates for Task-Switching in a healthy community sample [The UCLA LA2k Study].**

**Objective:** Cognitive control is a latent construct with multiple component functions including working memory (WM), response inhibition, and task/set switching (TS). Classic neuropsychological TS tasks including WCST and TRAILS are reliable, but confound switching with other components that are difficult to measure separately. Using a switching task from the cognitive neuroscience literature, we examined potential sources of variance for switching in comparison to a neuropsychological switching task (Color-Trails test [CTT]).

**Participants and Methods:** 186 right-handed participants completed a large test battery for the Consortium for Neuropsychiatric Phenomics, including a Color-Shape TS task (CST, Miyake&Friedman, 2004), a WM capacity task (Cannon et al, 2002), a computer-based Stroop (Holmes&Pizzagalli, 2008), as well as neuropsychological assessments involving switching (Color Trails; CTT) and general ability (Vocabulary&MatrixReasoning).

**Results:** The CST task showed significant switching costs (switch minus repeat trial RT, 258ms,  $t[1,185]=23.0$ ) and interference (incongruent minus congruent response mapping, 49ms,  $t[1,185]=6.5$ ). Stroop showed significant interference (incongruent minus congruent color-word, 134ms,  $t[1,185]=25.7$ ). CTT Interference was 1.14/0.57 (mean/sd).

Pearson's correlations between CTT Interference and CST interference was 0.15( $p=0.04$ ), and cost 0.02( $p=0.83$ ). Correlations between CTT and Stroop Interference was -0.01( $p=0.89$ ) and CTT Time-2 and Stroop was 0.19( $p=0.01$ ). Correlations between measures of interference in Stroop and Color/Shape Task was 0.24( $p=0.001$ ). Correlations between CST cost and Stroop was 0.17( $p=0.02$ ) and Cost and WM accuracy was 0.07( $p<0.4$ ).

**Conclusions:** We found that the CST is correlated with other measures of switching, including Stroop and Color-Trails. There was no relationship between switching and WM, both components of cognitive control. Further analyses are underway.

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**M.T. SCHMID, G. ÅRDAL, M. STRAND, A. LUND & J. HAMMAR. Executive functioning in patients with First episode Major Depression and in patients with Recurrent Major Depression- Preliminary results.**

**Objective:** Impairment in Executive Functioning (EF) in the acute phase of recurrent MDD is well documented. However, few studies have investigated EF in MDD patients that experience their first depressive episode, and findings in this field are inconclusive. Further, previous studies suggest that cognitive impairment worsens for every episode of depression.

The aim of the ongoing study is to assess the role of diagnostic subtype on performance in EF in patients with first episode MDD (FE) and patients with recurrent MDD (RC).

We expected that the RC group would show impairment on EF compared to the control group. Further, we expected that the FE group would perform equal to the control group.

**Participants and Methods:** EF was investigated groups of 10 FE and 10 RC patients (age 18-45) with a DSM-IV diagnosis of MDD, in the acute phase of illness, using four tests (Verbal fluency, Color- Word Interference, Trail making, Tower) from the Delis Kaplan Executive Function System (D-KEFS). Inclusion criteria was a Hamilton Depression Rating Scale (HDRS) score of >18. The patients were compared with a group of 10 healthy matched control subjects.

**Results:** Preliminary results show that the RC and the FE group performed significantly poorer on EF measures of Inhibition and Category (verbal) Fluency compared to the control group. Importantly, all other measures of EF were preserved in the two patient groups.

**Conclusions:** In conclusion, preliminary analysis show that patients with MDD, independent of diagnostic subtype, show impairment in specific aspects of EF, namely Inhibition and Category (verbal) fluency. Correspondence: *Marit T. Schmid, PhD student, cand.psychol, Department of biological and medical psychology, Institute of clinical neuropsychology, Jonas Liesvei 91, Bergen 5009, Norway. E-mail: marit.schmid@psybp.uib.no*

#### M. SITSKOORN. Neural Correlates of the Seven Sins.

**Objective:** Greed, lust, gluttony, sloth, envy, pride and wrath. The seven sins are strong motivators for our behaviour in daily life and when they get out of hand they become central to several clinical syndromes. Knowledge of their neural correlates is therefore of both clinical and general importance. The present study is a literature search in an attempt to underpin these neural correlates.

**Participants and Methods:** An extensive literature search was conducted in the field of cognitive/emotional/social neuroscience on topics related to the seven sins.

**Results:** Based on the reviewed literature it is concluded that each of the seven sins and the ability to resist their temptations rely on a neural network in which elements from the reward system, the pain network and other specific parts of the frontal lobe play an important role. The different sins have specific and overlapping neural correlates.

**Conclusions:** The possible neural correlates of each separate sin and the ability to have control over them will be covered. In addition, the possible implications of this knowledge for several clinical syndromes and prosocial and anti-social behaviour in the general population will be discussed. Correspondence: *Margriet Sitskoorn, Ph.D., Faculty of Social and Behavioural sciences, University of Tilburg, PO Box 90135, Tilburg 5000 LE, Netherlands. E-mail: m.m.sitskoorn@uvt.nl*

#### N.A. THOMAS & L.J. ELIAS. Do Perceptual Asymmetries Differ in Peripersonal and Extrapersonal Space?

**Objective:** A space-based dissociation has been observed in clinical hemineglect wherein neglect can be specific to either peripersonal or extrapersonal space. This same dissociation might occur in pseudoneglect, where both space-based and visual field differences have been observed. The greyscales task has been used with both clinical and non-clinical populations to measure hemispatial neglect and perceptual asymmetries.

**Participants and Methods:** Upper and bottom visual field differences were examined within-subjects (N=39 right-handers), by presenting the greyscales task in both peripersonal and extrapersonal space. Greyscales were either equiluminant or had slight luminance differences.

**Results:** Accuracy and bias scores were calculated. The typical leftward bias was observed to be strongest in the bottom visual field; however no space-based differences were observed. Participants were more accuracy in the upper visual field in extrapersonal space.

**Conclusions:** There is some support for the suggestion that there is an upper visual field advantage for processing extrapersonal space. It appears that perceptual biases differ between the upper and bottom visual fields, but this is not related to space-based perceptual biases.

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#### J.A. VALLUZZI, P. ST. CLAIR, X.E. CAGIGAS, F.W. SABB, C.E. BEARDEN, E.D. LONDON, T.D. CANNON, N.B. FREIMER & R.M. BILDER. Chronotype and Neuropsychological Measures of Cognitive Ability in a Large Community Sample [The UCLA LA2k Study].

**Objective:** Chronotype, or circadian typology (morningness/eveningness), reflects one's preference to be alert and active early or late in the day. Previous research has shown a relationship between chronotype and

cognition such that evening types are more likely to have higher IQ estimates regardless of the time of day in which testing occurs. Chronotype has also been proposed as an endophenotype for both ADHD and Bipolar Disorder and thus, the effect of chronotype on cognitive performance in healthy individuals is an important factor in the study of these psychiatric populations. Here we examine the effect of chronotype on cognitive performance in a large community sample.

**Participants and Methods:** As part of the Consortium for Neuropsychiatric Phenomics, a sample of 182 right-handed adult participants completed the Munich Chronotype Questionnaire (MCTQ) to assess morningness/eveningness, the Color Trails Test (CTT) to assess processing speed, and subtests from the Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV) as measures of verbal comprehension, perceptual reasoning, and working memory. Chronotype and cognitive measures were adjusted by age or education, when such adjustments were indicated.

**Results:** Bivariate correlations demonstrated that a person's midpoint of sleep on free days (a derived predictor of chronotype) and onset of sleep were positively associated with perceptual reasoning and verbal comprehension. Sleep duration was positively correlated with processing speed. Extremely early chronotypes were negatively correlated with perceptual reasoning, while late chronotypes were positively correlated with verbal comprehension.

**Conclusions:** These results provide preliminary evidence for the relationship between cognitive ability and circadian typology. Further analyses are currently underway.

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#### S. YAMIN, I. WALTERS & E. KOTSOPoulos. The Role of Task Difficulty on Processing and Storage in Working Memory: Evidence for Single Capacity Models.

**Objective:** Research suggests that cognitive resources are a single flexible facility of limited capacity that can accomplish both processing and temporary storage of information; when processing or storage demand exceeds a predetermined limit, performance deteriorates. This suggests a trade-off between processing and storage in working memory. The study aimed to examine the relationship between processing and storage using a modified version of the task-span procedure designed by Logan (2004).

**Participants and Methods:** 16 individuals performed a working memory task consisting of two types of conditions: a perform condition whereby individuals were given lists of task names followed by lists of stimuli on which to perform the tasks on; and a recall condition where individuals were given lists of task names and then cues to recall the names of the task. Tasks were also grouped based on the difficulty within sequences. The list-length of tasks to be recalled was 4, 6 and 8.

**Results:** A series of ANOVAs revealed greater accuracy in the recall condition compared with the perform condition ( $p < .01$ ). Faster reaction times and greater accuracy was found in the easy versus hard condition ( $p < .05$ ). As expected there was a significant difference in accuracy between list-lengths 4, 6 and 8 ( $p < .05$ ).

**Conclusions:** The results suggest that additional processing requirements impaired recall particularly when dual tasking and when processing requirements increased. Contrary to Logan (2004), there was a dual task decrement when storage and processing tasks were combined. These findings implicate a central processing limit in working memory which must accommodate both processing and storage.

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#### S. YAMIN, I. WALTERS & E. KOTSOPoulos. Understanding the Relationship between Task Switching and Working Memory: Using a Modified Task-Span Procedure.

**Objective:** The task-span procedure (Logan, 2004) is used to examine the relationship between task switching and working memory. The current study modified the procedure to account for prepara-

tory factors that may occur in the interstimulus interval between tasks. The aim of the current experiment was twofold: to examine the effect of working memory load on task switching and to develop an improved measure of reaction time cost associated with this process.

**Participants and Methods:** 16 individuals performed a working memory task comprising two types of conditions: a perform condition where individuals were given lists of task names followed by lists of stimuli to perform the tasks on; and a recall condition where individuals were given lists of task names and then cues to recall the names of the tasks. The modified task-span procedure required participants to learn associations between shapes and task-names in the study phase.

**Results:** A series of ANOVAs were conducted on accuracy and reaction time data. Accuracy remained stable as the number of switches within a trial increased (list length). However accuracy decreased as the number of tasks required to be performed within a sequence increased. Reaction time data was variable and did not point to significant switch costs across conditions.

**Conclusions:** Contrary to Logan's (2004) formulations, the results demonstrated that switch costs do not occur between tasks. Instead switch costs are seen in the alternation between storage and processing and that this trade-off represents true switch costs. The findings suggest that switch costs are best measured within tasks rather than between tasks. Correspondence: Sami Yamin, *DPsych (Clinical Neuropsychology)*, Victoria University, 393 Centre Road, Berwick, Melbourne, VIC 3506, Australia. E-mail: syamin@three.com.au

**K. ZUCKERMAN, A. MARGOLIS & G. KURIAKOSE. Comparing Three Childrens Draw-a-Clock Test Systems; Quantifying Qualitative Errors.**

**Objective:** The Clock Drawing Task (CDT) was originally used to detect cognitive changes in elderly patients with Alzheimer's or dementia. In recent years the CDT has been used with children as a means to gain insight into the development of executive functioning. Past studies using the Children's Draw A Clock Test (CDCT) have found that children with ADHD and/or reading disorders tend to demonstrate greater deficits in executive functions than do typically developing children. This study will compare three scoring systems for the CDCT that have been developed over the last twenty years in order to highlight strengths and weaknesses in each.

**Participants and Methods:** This study focuses on the importance of quantitative error analysis for understanding how groups of children perform the task. The most recent scoring system, introduced in NEPSY II, yields an overall score rather than individual scores for the various types of errors. Likewise, Cohen's clock scoring system also qualitatively lists the errors made by children. Rather than giving a specific score for each error present, it simply states what qualitative error is present. The scoring system used in the present study (Kirk, Margolis, Cardegna, McCarthy & McCauliffe, 2000) quantifies children's qualitative errors by giving individual and specific scores for each error present, providing the examiner with greater insight into the child's strengths and weaknesses. We examined eighty clocks drawn by typically developing children between the ages of 5 and 17.

**Results:** Quantifying the qualitative errors reveals developmental trends in spatial planning and conceptual knowledge, as well as spatial planning errors and conceptual knowledge errors.

**Conclusions:** Because research and interest in the CDCT have grown in recent decades, it is important to analyze and compare the various scoring systems in order to unearth what scores are most relevant and important. Correspondence: Karli Zuckerman, *University of Georgia, 173 Magnolia Bluff dr., Athens, GA 30601, United States. E-mail: klz531@uga.edu*

**G. ÅRDAL, M. SCHMID & . HAMMAR. Impaired cognitive inhibition - a trait marker for recurrent depression? Results from a ten year follow up study.**

**Objective:** Cognitive impairment in the acute phase of depression is well documented. However, less is known about how this impairment evolves in relation to symptom reduction and remission in a long - term perspective. The aim of this study was to examine cognitive functioning with the Stroop-paradigm in short and long -term follow up in patients with unipolar recurrent major depressive disorder (MDD).

**Participants and Methods:** 19 patients diagnosed with recurrent MDD and 19 individually matched controls were tested using the Stroop color word interference task at three occasions; in acute phase, after six months, and after ten years. Mean symptom score as measured by the Hamilton Depression Rating Scale (HDRS) were 22 in the acute phase of illness, 8.6 in the six months follow up and 5.5 in the 10 year follow up, indicating that the patient group were in symptom reduction in the short term follow up and in remission in the long-term follow up.

**Results:** The results show that the two groups performed equal on the Color and Word cards in both the acute phase of illness, short (6 months) and long -term (10 year) follow up. However, the patients were impaired compared to the control group on the inhibition condition in all test occasions.

**Conclusions:** In conclusion, the results show a long lasting cognitive impairment in inhibition which is present 10 year after acute phase despite significant improvement in depression symptoms. This indicates that the cognitive impairment associated with acute phase of MDD is long lasting despite symptom reduction and recovery.

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## Electrophysiology/EEG/ERP

**D.A. GOOD, J. FAIR & M.J. LARSON. Empathy and Error Processing.**

**Objective:** Recent research suggests a relationship between the evaluative control function of performance monitoring and empathy. Performance monitoring can be measured using post-error reaction time slowing, the error-related negativity (ERN), and the post-error positivity (Pe) components of the scalp-recorded event-related potential (ERP). We hypothesized that increased empathy would be associated with increased reflections of performance monitoring (i.e., the ERN) and that specific aspects of empathy (i.e. empathic concern) would account for the majority of this relationship.

**Participants and Methods:** Thirty healthy participants completed two measures of empathy, the Interpersonal Reactivity Index (IRI) and the Empathy Quotient (EQ), and a modified Stroop task while high-density ERPs were recorded. Pearson's correlation analyses and partial correlations were used to control for the effect of negative affect and test the relationship between performance-monitoring indices and measures of empathy.

**Results:** Post-error slowing was associated with increased Empathic Personal Distress on the IRI. ERN amplitude was related to overall Empathy score on the EQ and the Fantasy Subscale of the IRI. The Pe was not related to measures of empathy. Results remained consistent after controlling for negative affect. Results of the partial correlation also produced an additional relationship between ERN amplitude and Empathic Concern on the IRI. This relationship was significant only when controlling for negative affect.

**Conclusions:** Findings support a connection between empathy and neural reflections of performance monitoring. Findings also suggest that negative affect can obscure the relationship between ERN amplitude and Empathic Concern. Vigilance is proposed as a possible explanation for the connection between ERN amplitude and empathy.

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**W.D. KILGORE, K.L. SMITH, R.M. REICHARDT, D.B. KILGORE & T.J. BALKIN. Intellectual Capacity is Related to REM Sleep Following Sleep Deprivation.**

**Objective:** Some evidence suggests that rapid Eye Movement (REM) sleep increases following acquisition of new learning, and the magnitude of the REM increases is correlated with intelligence. The relation-

ship between intellectual ability and the subsequent architecture of recovery sleep following a cognitively demanding period of sleep deprivation has not been studied. Therefore, we examined the relationship between intelligence and polysomnographically scored sleep following two nights of continuous wakefulness.

**Participants and Methods:** Thirty-four (18 men) healthy participants completed the Wechsler Abbreviated Scale of Intelligence (WASI) as an estimate of Full Scale (FSIQ). After a baseline night of sleep (8 hours in bed), participants were deprived of sleep for 61 hours, followed by 12 hours of recovery sleep monitored with polysomnography. Polysomnographically measured sleep stage data were correlated with FSIQ.

**Results:** Measured intelligence (FSIQ) was significantly ( $p < .05$ ) correlated with several measures of sleep duration and quality, including total sleep time, sleep efficiency, percent of total sleep that was REM, and actual time spent in REM sleep. In contrast, FSIQ was unrelated to latency to REM, number of awakenings, or any quality or duration indices related to Stage 1, Stage 2, or slow wave sleep.

**Conclusions:** Higher intelligence was positively related to the quality and duration of recovery sleep following a cognitively demanding period of continuous wakefulness, especially for measures of REM sleep. Findings suggest that individuals with higher intelligence spent more of their recovery sleep time in REM sleep than those with lower intelligence. Additional research will be necessary to clarify the directional nature of this relationship.

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#### C. LUKIE & C.B. HOLROYD. Neural Mechanisms of Individual Differences in Personality Traits.

**Objective:** Individual differences may influence the manner in which an individual learns from their environment and monitors their behaviour. We investigated the impact of individual differences in personality traits related to impulsivity on the feedback error related negativity (fERN).

**Participants and Methods:** Participants included 39 undergraduate students at the University of Victoria. An ongoing EEG was recorded using BrainVision Recorder from 41 electrodes mounted in a fitted nylon cap with a standard 10-20 layout. Participants engaged in a computerized T-maze task in which they navigated their way through a maze in search of rewarding stimuli. The fERN was determined for each participant by subtracting the average ERP elicited by the reward feedback from the average ERP elicited from the no-reward feedback. Lastly, all participants completed a computerized version of the Impulsiveness Questionnaire (17).

**Results:** Based on their 17 Empathy subscale scores, participants were grouped into top and bottom quartiles of high ( $n = 10$ ,  $M = 17.1$ ) and low ( $n = 16$ ,  $M = 9.56$ ) groups. The difference in fERN amplitude between the high ( $M = -3.66\mu V$ ,  $SD = 2.90\mu V$ ) and low ( $M = -5.08\mu V$ ,  $SD = 2.32\mu V$ ) empathy groups was significant ( $t(24) = 3.45$ ,  $p < 0.05$ , corrected for multiple comparisons).

**Conclusions:** Individuals with high empathy scores had a larger fERN in comparison to those with low scores. These results suggest that individuals high on traits of empathy may be more perceptive of their environment and more sensitive to feedback; alternatively, they may be more motivated to please the experimenter and have a stronger sense of personal involvement in the task.

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#### P. MOLFESE. Neural Correlates of Response to Intervention in Children.

**Objective:** The objective of this study was to explore the use of Event-Related Potentials (ERPs) to identify neural correlates of instructional

response. It was hypothesized that, as in previous studies using Magnetoencephalography (MEG) and functional Magnetic Resonance Imaging (fMRI), an ERP study would find significant differences between three groups of children: typically developing children, children responding to a reading intervention, and children who were inadequately responding to intervention.

**Participants and Methods:** To evaluate these hypotheses, 23 children participating in an ongoing reading intervention project were recruited. ERPs were recorded using 128 electrodes in both a word/non-word discrimination task and a rhyming task. These ERPs were quantified both using traditional peak amplitude measures, as well as minimum-norm source data.

**Results:** Results identified that ERPs discriminated among typically developing children, those responding adequately to a reading intervention, and those responding inadequately. These effects occurred as main effects and interactions with other variables: stimuli, hemisphere, and region. Source analysis identified similar results, replicating some findings from previous MEG and fMRI studies.

**Conclusions:** Similarities between adequate responders and typically developing children were attributed to normalization in brain activation discussed at length in previous reports. While continuing differences between the typically developing and responding groups suggest that, while these previously at-risk readers now read at average levels, the process that their brains use to read is different. This implies the presence of a compensatory mechanism in the processing of the stimuli.

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#### R. SOLIS, J. RICARDO-GARCELL, Y. RODRÍGUEZ-AGUDELO, U. RODRÍGUEZ & M. RODRÍGUEZ. Involuntary attention in Parkinson's disease: an event related potential study.

**Objective:** Involuntary attention is an automatic selection capacity for potentially relevant but initially not processed stimuli. It has been studied using the Event Related Potential (ERP) technique with auditory distraction tasks. The obtained distraction potential consists of three components: the mismatch negativity (MMN), related to automatic irregularity detection; P3a, the electrophysiological index of attentional capture; and reorientation negativity (RON), an indicator of cognitive return to the relevant task. Dopamine has been associated to the generation of this potential. In turn, Parkinson's disease (PD) results from striatal dopaminergic depletion, producing neuropsychological impairment.

The objective of this work was to study the electrophysiological characteristics of involuntary attention and its association with neuropsychological impairment in PD.

**Participants and Methods:** Fifteen patients with PD and 15 controls responded to an auditory distraction paradigm while an EEG was obtained. They were administered a neuropsychological battery for executive functions as well. The distraction potential resulted from the subtraction of the electrophysiological response to standard stimuli from the response to distracting stimuli.

**Results:** The PD group showed lower MMN and P3a amplitudes, as well as poorer performance in cognitive flexibility and working memory, compared to controls ( $p < 0.05$ ). MMN and P3a were inversely associated to perseverations and number of errors ( $p < 0.05$ ). There were no significant differences in RON amplitudes.

**Conclusions:** We found impairment in the auditory irregularity automatic detection and involuntary attentional capture in the PD group, but not in their reorientation to the primary task. These alterations could be related to other cognitive alterations previously reported in neuropsychological studies.

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## Epilepsy/Seizures

### K. BLACKSTONE, S. CAYLESS, J. KREIDER, J. MAYO, W.D. GAILLARD & M.M. BERL. Executive Functioning Profile in Pediatric Epilepsy.

**Objective:** Executive functioning (EF) skills have been found to be impaired in children with epilepsy (CWE); however, previous studies included largely lower functioning and generalized epilepsy. We aimed to delineate EF profiles of children that are higher functioning and have localization-related epilepsy.

**Participants and Methods:** CWE were included in the study if they underwent a neuropsychological evaluation including the Behavior Rating Index of Executive Functioning (BRIEF), a parent-rating measure of daily EF in children. 122 CWE were included (66 M; ages: 3-19, mean: 9.7; FSIQ mean: 93). 107 (88%) had localization-related epilepsy (39 secondarily generalized) and 15 (12%) were primarily generalized (age of onset mean: 5.7 years, range 0.5 to 16.0; antiepileptic drugs (AED) mean: 1.7, range: 0-3).

**Results:** 62% of the sample displayed clinically elevated scores on one or more scales and 33% on four or more. Children met clinical significance ( $T > 65$ ) more frequently on subscales from the Metacognitive Index (ranging from 31-45% of the sample) compared to the Behavior Regulation Index (ranging from 18-27%). EF problems were negatively correlated with IQ ( $p < .01$ ) except for Organization of Materials ( $p = .66$ ). Greater duration of epilepsy, earlier age of onset, and abnormal MRI findings were associated with increased executive dysfunction ( $p < .05$ ). Age, gender, epilepsy type, seizure focus and number of AEDs were not significantly related to BRIEF scores.

**Conclusions:** CWE demonstrated a distinct profile of metacognitive difficulties on the BRIEF, with nearly half of the sample having clinically elevated scores for Working Memory and Plan/Organization. This is consistent with the observation that the Inattentive subtype of ADHD is more common in CWE. Seizure characteristics are not uniformly indicative of executive dysfunction. Even in a referred population, one-third of the sample did not reach clinical significance on any aspect of EF, demonstrating that a subset of CWE have good executive control. Correspondence: *Kaitlin Blackstone, B.A., Neuropsychology, Children's National Medical Center, 1348 Independence Ave SE, Washington, DC 20003, United States. E-mail: kblackst@cnmc.org*

### M. BLACKWELL, J.H. SANZ, E. DEMATT, A.L. HARTMAN & C.F. SALORIO. Behavioral Difficulties after Left and Right Hemispherectomy.

**Objective:** Parents of children who undergo hemispherectomy for intractable seizures report behavior problems as a primary concern after surgery, yet research is limited in this area. We sought to (1) investigate patterns of symptoms in children after left or right hemispherectomy surgery and (2) validate a novel list of behavior descriptors in this population.

**Participants and Methods:** Parents of 17 children [9 right hemispherectomy (RH); 8 left hemispherectomy (LH)] completed the BASC and BRIEF. Parents also selected their children's behaviors from a list of frequently-reported descriptors. Mean age (9.2 years) and time since surgery (4.2 years) did not differ between groups ( $p > 0.1$ ).

**Results:** Parents endorsed multiple concerns on the BASC and BRIEF. Distinct differences in cognitive profiles were found between RH and LH. Scale elevations on BRIEF GEC, Working Memory, Behavior Regulation, and Self Monitoring, and on BASC Hyperactivity, were more frequently seen in LH. In contrast, RH displayed greater scale elevations on BASC ADL and Withdrawal, and on BRIEF Initiation scales. LH were more likely to be described as "energetic" and "silly," whereas RH were "irritable," "moody," and "sad." Endorsements of simple descriptive terms mapped onto BASC and BRIEF scales that describe similar problems (e.g., parents who endorsed "silly" also rated their child significantly higher ( $p < 0.05$ ) on several scales, including BASC Hyperactivity, and BRIEF Inhibit).

**Conclusions:** Behavior patterns differ depending on side of hemispherectomy surgery. Also, symptom descriptors commonly used by parents can be related to standardized measures. Accurately identifying behavior patterns after surgery is critical for targeted psychosocial interventions.

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### B.A. BOATWRIGHT, R.J. HEINRICH, D.K. SOETAERT & L.E. BAADE. MCMI-III Dependent Scale and Differentiation of Epileptic and Non-Epileptic Seizure Patients.

**Objective:** Differentiation between patients with epileptic seizures (ES) and non-epileptic seizures (NES) is often aided by the use of personality testing. Elevations on the Minnesota Multiphasic Personality Inventory-2 (MMPI-2) scales 1 (Hypochondriasis) and 3 (Hysteria) are often present in NES patients. On a video EEG unit, it has been noted that NES patients often have elevations of the Millon Clinical Multiaxial Inventory-III (MCMI-III) Dependent scale. The current study examines the Dependent scale to determine its diagnostic utility in differentiating ES and NES patients.

**Participants and Methods:** This study included 77 inpatients on a video-EEG unit of a comprehensive epilepsy center. The MMPI-2 and MCMI-III were administered, and diagnosis by an Epileptologist was based on Video EEG-data (27 patients ES; 50 patients NES). Scale 3 (Dependent) on the MCMI-III was used as a dependent measure in a series of regression analyses.

**Results:** NES patients with an elevated MMPI-2 Scale 1 were likely to have an elevated Dependent scale on the MCMI-III ( $R^2 = .13$ ,  $F(2, 47) = 3.58$ ,  $p < .01$ ). However, ES patients with elevated MMPI-2 scales 1 and/or 3 did not show elevations on the MCMI-III Dependent Scale.

**Conclusions:** Patients with elevations on MMPI-2 Scale 1 and MCMI-III Dependent scale are more likely to be diagnosed as NES. ES patients do not show elevations on the Dependent scale, even when MMPI-2 Scales 1 and 3 are high. The Dependent scale is shown to have utility in differentiation between ES and NES patients. Further research into this scale and NES patients should follow.

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### N.M. BOGOD, M. SINDEN & S. YEUNG. Very rapid forgetting and autobiographical memory loss in new onset ideopathic adult epilepsy.

**Objective:** Investigations of the rare phenomenon of very rapid forgetting and autobiographical memory loss in ideopathic adult epilepsy.

**Participants and Methods:** 41 y.o. Caucasian male with new onset epilepsy of one year duration seen in collaboration with behavioral neurology. Investigated by neuropsychology, behavioral neurology, and subsequently by an epileptologist with follow up pending.

**Results:** Observed nocturnal seizures suggestive of partial-complex epilepsy. EEG confirmed non-dominant temporal lobe epilepsy (TLE). Structural brain imaging normal. Treated with anti-epileptic medication with zero witnessed seizures over preceding two weeks. Overall performance on a comprehensive neuropsychological test battery normal in all respects. Psychological functioning normal. Autobiographical Memory Inventory revealed significant loss of remote memory with a temporal gradient (episodic loss > semantic). One-week follow-up revealed substantial loss of ability to recall almost all details of the recent testing experience. Referral to an epileptologist to investigate whether subthreshold/unwitnessed seizures contributing/maintaining abnormal forgetting and impaired remote memory. Long term neuropsychological follow-up post-treatment and further investigation by the epileptologist is pending.

**Conclusions:** Patient with EEG confirmed adult onset ideopathic TLE who appears neuropsychologically normal on standard tests including

memory, but who has experienced forgetting of most new information, episodic > semantic, within 7 days of exposure, and autobiographical memory loss with a temporal gradient (again episodic > semantic). This is consistent with a very small literature reporting this rare condition in TLE. We proposed the possibility that his forgetting was maintained by unwitnessed/subthreshold seizure activity, and follow-up is pending after aggressive treatment by an epileptologist.

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**S.R. BONGIOLATTI, E.B. FENNEL & P.R. CARNEY. Attention in Children with Epilepsy and Co-Morbid Sleep Disturbance.**

**Objective:** Recent research has suggested that children with epilepsy may be more susceptible to sleep disturbance. Although sleep disturbance has been associated with attention impairments in other pediatric populations, few studies have examined this relationship in children with epilepsy. We hypothesized that children with epilepsy with a higher frequency of sleep disturbance would perform more poorly on measures of attention than children with a lower frequency of sleep disturbance.

**Participants and Methods:** Nineteen children with epilepsy ages 6 to 12 years were recruited from a university-affiliated pediatric neurology clinic. Participants were administered subtests of the Test of Everyday Attention in Children (TEA-Ch). Parents completed a sleep questionnaire to assess frequency of sleep disturbance symptoms.

**Results:** Children were assigned to two sleep groups using a median split of sleep questionnaire scores. Independent samples t-tests were employed to test whether children with epilepsy and a higher frequency of sleep problems performed more poorly on the TEA-Ch than those with a lower frequency of sleep problems. Results indicated that the High Frequency group performed worse on a measure of sustained auditory attention. There were no group differences on tests of selective attention or attentional control/switching.

**Conclusions:** Among children with epilepsy, those whose parents endorse a higher frequency of sleep problems were found to have greater difficulty sustaining attention to auditory information than those who were reported to have fewer sleep problems. Additional research to examine the contribution of sleep disturbance to inattention and to determine whether treating sleep disturbance might improve attention in children with epilepsy is merited.

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**R.M. BUSCH, D. FLODEN, T.T. LINEWEAVER, J.S. CHAPIN, K. UNWONGSE, T. WEHNER, R. DIAZ-ARRASTIA & I.M. NAJM. APOE  $\epsilon 4$  is Not Related to Hippocampal or Brain Volume in Patients with Medically Intractable Temporal Lobe Epilepsy.**

**Objective:** The apolipoprotein (ApoE)  $\epsilon 4$  allele has been associated with memory loss in patients with multiple neurological disorders (e.g., TBI, multiple sclerosis, Alzheimer disease) and with reduced hippocampal volumes in demented and nondemented elders, although these findings have not been universal. Our recent research suggests that APOE  $\epsilon 4$  is associated with reduced memory performance in patients with longstanding temporal lobe epilepsy (TLE). The current study sought to determine if  $\epsilon 4$  is also related to reduced hippocampal and brain volume in patients with TLE.

**Participants and Methods:** MRI-based volumetric analyses of the hippocampus and whole brain were conducted in 59 patients with medically intractable mesial temporal lobe epilepsy due to hippocampal sclerosis (left TLE=31; right TLE=28). The distribution of ApoE genotypes ( $\epsilon 4$ =13; non- $\epsilon 4$ =46) was consistent with that typically observed in the general population, and there were no significant differences between the genotype groups on any demographic or seizure variables. Independent samples t-tests were used to compare volumetric differences between patients with and without at least one  $\epsilon 4$  allele.

**Results:** There were no significant differences in raw hippocampal or whole brain volumes as a function of  $\epsilon 4$  status. There were also no differences between the study groups in hippocampal volumes after correcting for total brain volumes. Patients with an  $\epsilon 4$  allele showed a trend toward having a smaller discrepancy between ipsilateral and contralateral hippocampal volumes as compared to patients without this allele ( $p=.06$ ).

**Conclusions:** The APOE  $\epsilon 4$  allele is not associated with significant hippocampal or whole brain atrophy in patients with medically intractable TLE. This research was funded by the Epilepsy Foundation, Postdoctoral Fellowship Program, with additional support from NIH (RO1 HD4817 and UO1 HD42652) and the US Department of Education (H133A02052601).

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**J.S. CHAPIN, D. FLODEN, R. BUSCH, P. KLAAS, R. NAUGLE & I. NAJM. Development of an equation to predict risk of verbal memory decline after left temporal lobectomy.**

**Objective:** A subset of patients experience verbal memory decline after left temporal lobectomy to treat epilepsy. Established predictors of decline include better preoperative memory, mesial temporal sclerosis (MTS), later age of epilepsy onset, and asymmetry on Wada testing. Using preoperative data routinely available, we developed an equation to predict risk of memory decline after left temporal lobectomy at the individual patient level.

**Participants and Methods:** Adults who underwent left temporal lobectomy and completed the WMS-III before and after surgery were included ( $n=101$ ). MTS was visualized on 3T MRI in 64 patients (63.4%), and mean age of seizure onset was 14.2 (11.0). 97 of the 101 patients were right-handed. Verbal memory was measured with the Auditory Delayed Memory Index (ADM), and decline was based on reliable change indices. Preoperative ADM, presence or absence of MTS, and age of onset were entered as potential predictors of presence or absence of memory decline using logistic regression. Because Wada testing is not routinely conducted at an increasing number of centers, these data were not included. An equation was created to predict the likelihood of ADM decline for an individual patient.

**Results:** Mean ADM decreased from 85.0 (15.1) to 81.0 (15.1), with 20 (19.8%) patients demonstrating decline. Age of onset was not a significant predictor of decreased memory and was eliminated from further analysis. Higher preoperative ADM score ( $p=.007$ ) and presence of MTS ( $p=.024$ ) predicted ADM decline ( $p<.001$ ).

**Conclusions:** Pending validation in an independent sample, use of this regression equation will allow for more precise prediction of memory decline on an individual patient level, using data routinely collected during preoperative evaluations.

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**S.J. HUNTER, C. SINIACO, C. CASNAR, P. OGDEN & M. KOHRMAN. Neurocognitive and Behavioral Outcomes of Pediatric Epilepsy Surgery.**

**Objective:** Intractable epilepsy is associated with cognitive and regulatory dysfunction. Children with chronic epilepsy show impairments with learning, memory, attention, and executive skill development. With seizure control, deficits can reduce or ameliorate. The objective of this study was to assess functional and adaptive improvements in children with intractable seizures who underwent resection surgery. We sought to determine whether improvement in seizure control led to improved neurocognitive and behavioral status.

**Participants and Methods:** 20 pediatric patients underwent comprehensive clinical pre and post surgery neuropsychological evaluations. Measures included verbal, nonverbal, and full scale IQ performance;

working memory, attention, and executive functioning; and parent behavioral report (BASC-II). Analysis of medical variables included age of seizure onset, duration of epilepsy, age at time of surgery, laterality of seizure focus, pathology of tissue removed, and number of antiseizure medications.

**Results:** Results showed improvements in verbal abilities and executive functioning. An increase in emotional and behavioral difficulties was also observed, specifically internalizing symptoms. Regression analyses indicated a relationship between reduction in seizure frequency and duration of illness, gender, and length of time between surgery and evaluation.

**Conclusions:** Overall, increased functioning in areas pertinent to adaptive functioning was seen, although mood and behavioral control remained variable. Results are discussed with regard to the need for ongoing supports and potential areas of specific intervention

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#### **S. KARANTZOULIS, A.K. TROYER, C. CARLSON & W.B. BARR. Associative Memory Following Anterior Temporal Lobectomy.**

**Objective:** There has been growing interest in the differential role of mesial temporal lobe structures in memory. We sought to identify how resection of hippocampus (considered essential for the integration of information across modalities) and associated neocortical structures (e.g., perirhinal cortex; essential for memory for single items) interferes with associative learning using three novel recognition memory tasks.

**Participants and Methods:** Twenty-one individuals that underwent unilateral anterior temporal lobectomy (ATL; M age = 42; M Education = 15) were compared with 16 matched healthy controls (M age = 38; M Education = 16). Three computerized tasks involving word-word, object-location, and face-name pairs were administered, together with a set of neuropsychological measures.

**Results:** As expected, the ATL participants scored significantly below the controls on all three associative memory tests. Also as expected, there was a greater association- than item-recognition deficit in the ATL group relative to controls. Contrary to expectations, there was no greater recognition deficit for the associations between different (i.e., face-name pairs) than between same (i.e., word-word pairs) types of items in the ATL group relative to controls.

**Conclusions:** While the expected dissociation between across- vs. within-modality associative memory did not emerge, the dissociation between associative and item memory following ATL was observed. These preliminary data suggest that the hippocampus may not contribute predominantly to the associative learning and recall of information across modalities.

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#### **B.M. KORMAN, M. DUCHOWNY, P. JAYAKAR, T. RESNICK & G.J. REY. Memory in Pediatric Epilepsy: Effects of Histopathology and Lesion Location on Word List Retrieval.**

**Objective:** It is well-accepted that the adult hippocampal formation and neocortex contribute to the storage and retrieval of information and acquired lesions can disrupt these functions. The contribution of these structures to memory in the child is less well understood. This study evaluated the relationship between verbal memory performance and lesion characteristics and location in children with intractable epilepsy. We were particularly interested in determining whether additional involvement of mesial temporal lobe structures resulted in greater memory impairment compared to lateral temporal involvement alone.

**Participants and Methods:** We assessed memory in 57 children (mean age=12.69) undergoing surgery for intractable epilepsy due to histopathologically confirmed focal cortical dysplasia. 42 subjects had neocortical lesions alone (17 temporal; 25 extratemporal) and 15 subjects had hippocampal sclerosis (HS) in addition to temporal neocortical lesions. Verbal memory was measured by delayed word list recall.

**Results:** Verbal memory was mildly impaired ( $z = -1$ ) or worse in 56% of the sample, with significant impairment ( $z = -2$ ) in 25%. The presence of HS did not contribute to additional memory morbidity beyond that of temporal or neocortical lesions with either bilateral ( $p = .660$ ) or unilateral pathology ( $p = .844$ ). Memory was not significantly different for patients with temporal vs. extratemporal lesions ( $p = .383$ ).

**Conclusions:** Subjects with pathology in the hippocampus and neocortex showed no greater memory deficit than subjects with neocortical lesions alone. Temporal and extratemporal cortical pathology disrupted memory performance equally, suggesting that neural networks subserving declarative memory in children with epilepsy are vulnerable to disruption at multiple points with equivalent effect upon memory morbidity.

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#### **M. KRISHNAN, D. LORING, K. MEADOR, E. ANDRESEN, L. WAXENBERG & R. BAUER. The Roles of Depression, Healthcare Attitudes, and Beliefs in Predicting Anti-Epileptic Drug Adherence.**

**Objective:** Depression has been shown to be a substantial contributor to reduced adherence to medication in numerous chronic illnesses, but little research has investigated depression's effect on adherence in epilepsy. The present study attempts to determine the effect of depression on rates of anti-epileptic drug adherence as well as to explore the roles of healthcare beliefs and attitudes in predicting adherence.

**Participants and Methods:** Patients (56) were recruited during outpatient epilepsy clinics. They completed questionnaires to assess their healthcare attitudes and beliefs as well as a structured clinical interview for psychiatric disorders (MINI) and brief cognitive screening. Adherence was measured using two self-report techniques, the Morisky questionnaire and an additional retrospective self-report measure.

**Results:** No relationship between depression and reported rates of adherence was found using either measure of adherence. The two measures of adherence were found to be predicted by different variables, with the Morisky measurement predicted by performance on memory testing, and health locus of control predicted retrospective report of adherence. There was also weak association between measures of adherence.

**Conclusions:** The present study did not find a relationship between depression and anti-epileptic drug adherence. Rather, a complex pattern related healthcare knowledge and attitudes, cognition, and adherence. This study highlights the need for additional investigation into anti-epileptic drug adherence.

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#### **J. LEE. General Cognitive Functioning Following Hemispherectomy in Children with Intractable Seizures.**

**Objective:** While hemispherectomy is a viable option for intractable seizures in children, cognitive outcome data following hemispherectomy remains sparse, particularly in regards to studies of verbal and performance IQ. This current research explored intellectual functioning 5 to 30 years following hemispherectomy. It was hypothesized that VIQ would be higher than PIQ; specifically, that early left resection lead to lower VIQ and that the opposite would be found following early right resection.

**Participants and Methods:** Participants included 35 children and adults (ages 4 to 29) for whom left ( $n = 25$ ) or right ( $n = 10$ ) hemispherectomy was performed early in life. Wechsler IQ and selected subtest (i.e., Block Design and Vocabulary) scores were compared between children with left and right hemispherectomies using ANOVAs.

**Results:** No differences were found by side of resection on Full Scale IQ, Verbal IQ, Performance IQ, or the Vocabulary and Block Design subtests. However, those who received left hemispherectomies exhibited higher VIQ scores than PIQ scores compared those who received a right resection or hemispherectomy.

**Conclusions:** Utilizing cognitive outcome data following hemispherectomy from the UCLA Pediatric Surgery Program, we did not find differences in overall IQ based on side of hemispherectomy. Verbal skills predominated in individuals whose right hemisphere remained intact, which may reflect the brain's ability to compensate for the resected verbal hemisphere. Alternatively, it could be argued that language had shifted prior to surgery in order to compensate for the resected left hemisphere.

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**S. LUNDY KRIGBAUM, D. SARCO, M. GREGAS, M. TAKEOKA & K.M. BOYER. Emotional, Behavioral and Executive Dysfunction is Associated with a Greater Degree of Epileptiform Discharges in Children with Benign Rolandic Epilepsy with Centro-Temporal Spikes (BRECTS).**

**Objective:** Increasing evidence links BRECTS with mild cognitive problems. Not clear, is how epileptic discharges affect the severity of neuropsychological dysfunction. Frequent epileptiform discharges are thought to impair cognition. However, the relationship between spike discharges and neuropsychological function is not well understood.

Our exploratory investigation aimed to survey attention, executive functions, emotional and behavioral adjustment of children with BRECTS and correlate these data with spike frequency.

**Participants and Methods:** Twenty-four children, aged 6-12 years with EEG and neurological evaluation consistent with BRECTS were selected from consecutive routine EEG studies over 1 years time. Parents completed the Behavior Assessment System for Children- Second Edition and the Behavior Rating Inventory of Executive Function within 6 months of clinical EEG.

EEG spike wave indices (SWI: absolute number of spike discharges divided by total minutes of recording) were measured for the awake, sleep, and total recording times of routine outpatient partially sleep-deprived EEGs. The strength of association between the SWI and neuropsychological variables was measured using Pearson correlation coefficients.

**Results:** Symptoms of depression, aggression, and conduct problems were strongly correlated with SWI during awake and sleep states. Executive dysfunction was significantly correlated with SWI during sleep. Greater disturbance was associated with higher SWI. Symptoms of anxiety, hyperactivity and attention problems were not significantly correlated with the SWI.

**Conclusions:** Our results suggest that the greater the epileptiform activity in children with BRECTS, the higher the likelihood of depression, psychological disturbance and executive dysfunction. More research is needed to predict and prevent neuropsychological problems associated with childhood epilepsies with frequent epileptiform activity.

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**J. NASLUND & D. WITTENBERG. Comparison of language and semantic memory abilities in left and right mesial temporal sclerosis.**

**Objective:** Hippocampal sclerosis in temporal lobe epilepsy is associated with cognitive deficits. Language and semantic memory function, however, is reported less frequently, as are the relative deficits between left mesial temporal sclerosis (LMTS) and right mesial temporal sclerosis (RMTS). We hypothesized that LMTS have greater language and semantic memory dysfunction as compared to RMTS.

**Participants and Methods:** Participants were 44 patients (53% female) with LMTS and 39 patients (54% female) with RMTS who underwent comprehensive neuropsychological assessment as part of their pre-operative evaluation. Both groups were matched on demographic variables including age (LMTS = 40.1±9.9; RMTS = 42.1±12.1) and education (LMTS = 11.4±3.1; RMTS = 12.4±3.1). Aspects of language and semantic memory such as naming, word definition, and word list

generation, were assessed using the vocabulary, similarity, and information subtests of the WAIS-III in addition to the VIQ composite score, Controlled Oral Word Association (COWA), and the Boston Naming Test (BNT). Performance differences were determined using independent samples t-test.

**Results:** Examination of performance on the BNT, WAIS-III subtests, and VIQ scores revealed significant differences between the groups ( $p < 0.05$ ) with LMTS demonstrating greater dysfunction. Semantic fluency revealed significant differences between the groups as well (RMTS > LMTS) while phonemic fluency was non-significant. All scores were within normal limits for RMTS, while the LMTS group consistently fell below expectation.

**Conclusions:** LMTS patients displayed significantly poorer performance than RMTS patients on tests of language and semantic memory. In fact, RMTS patient performance generally fell within normal limits. These findings provide insight regarding the language and semantic memory deficits specifically associated with LMTS.

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**S.M. PATEL, A.E. KANE, E.L. COADY, L. SEPETA, J.L. HORSFALL & S.Y. BOOKHEIMER. The Relationship Between Language and Verbal Memory in Mesial Temporal Lobe Epilepsy Patients with Right Hemisphere Speech.**

**Objective:** Cognitive networks associated with language can be atypically organized in mesial temporal lobe epilepsy patients (MTLE). It is widely accepted that in most patients the left hemisphere houses language and verbal memory; the relationship between language and memory in patients with right hemisphere speech is unknown. We examined the relationship between language and verbal memory in MTLE patients.

**Participants and Methods:** We compared demographically matched MTLE patients with language dominance in the right hemisphere ( $n=8$ ) and left hemisphere ( $n=20$ ) on a measure of verbal memory (WMS-III Verbal Paired Associates). Language dominance was determined using the intracarotid amobarbital procedure. Four groups were defined based on hemisphere of language dominance and seizure focus (RSp/RF,  $n=3$ ; RSp/LF,  $n=5$ ; LSp/LF,  $n=10$ ; LSp/RF,  $n=10$ ). We examined differences between immediate and delayed performance and calculated retention rates in these groups.

**Results:** ANOVA results: (1) No significant difference between RSp/RF and RSp/LF groups was found; RSp/RF patients retained 95% and RSp/LF patients retained 76% of information. (2) Ipsilateral language and seizure focus revealed no differences (RSp/RF=95%, LSp/LF=71%). (3) Contralateral language and seizure focus revealed no differences (RSp/LF = 76%, LSp/RF = 87%). (4) Controlling for seizure focus, no differences were found (RSp/RF=95% versus LSp/RF=87%; LSp/LF=71% versus RSp/LF=76%).

**Conclusions:** These findings suggest right hemisphere language dominant patients have left hemisphere dominant verbal memory regardless of seizure focus. A pattern emerged suggesting verbal memory does not follow language dominance in patients with atypical brain organization, a finding which has important implications for understanding cerebral organization as well as improving neurosurgical intervention in epilepsy patients.

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**K.D. PHILLIPS, J. KOOP, L. BLACKBURN & K. BROWN. Cognitive and Behavioral Outcomes in Pediatric Epilepsy Surgery: The Significance of Attention.**

**Objective:** Surgery has been increasingly employed as an intervention for pediatric epilepsy. In addition to improved seizure control, medical professionals and parents are concerned with the impact of surgery on

cognitive and behavioral functioning. Research to date has emphasized adults, with relatively few studies examining children or considering the ongoing developmental processes. Moreover, research on child outcomes has typically included small samples or focused on a particular type of surgical resection. This study examined global cognitive and behavioral outcomes in children who underwent surgical resection for intractable epilepsy.

**Participants and Methods:** Participants included 37 children (16 females) aged 4–18 at the time of surgery ( $M=11.80$ ,  $SD=4.05$ ). All participants had pre- and post-surgical neuropsychological evaluations, including measures of IQ and parent-report of behavioral/emotional functioning. The average time from surgery to the post-neuropsychological evaluation was 11.41 months ( $SD=7.67$ ). Analyses were conducted at the group level and by resection type.

**Results:** Approximately 78% of the sample was seizure-free after surgery, with no differences among subgroups. Overall IQ did not change following surgery. Attention problems improved for the sample,  $F(1,27)=4.11$ ,  $p=0.05$ , but anxiety and mood did not.

**Conclusions:** These findings confirm previous data about stability of global cognitive functioning approximately one year post-surgery. The improvement in parent-report of attention skills has not been documented previously and indicates attention skills should be assessed in surgical patients. These findings have implications for the role of neuropsychologists in informing medical professionals and parents about the potential risks and benefits of surgery. Future research should examine differences among more specific cognitive skills, particularly attention.

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**P.A. PHILLIPS, S. LACEY, S. ALI, A.Y. STRINGER, K. SATHIAN & B.M. HAMPSTEAD. Memory of Complex, Three-Dimensional Objects Appears Sensitive to Visuospatial Memory Deficits in Patients After Unilateral Amygdalohippocampectomy.**

**Objective:** It is generally accepted that lesions to the left or right medial temporal lobe (MTL) result in verbal or visuospatial deficits, respectively. Because visuospatial memory tests show a tenuous relationship with right MTL dysfunction, we developed a novel test using complex 3-dimensional stimuli (Block Memory Test – BMT). To control the encoding strategy, half the stimuli were multicolored (Color towers) and half were uniform gray (Gray towers). Instructions were given to recite the colors (verbal processing) or take a mental picture of the Gray towers (visuospatial processing).

**Participants and Methods:** Twelve patients received unilateral amygdalohippocampectomies (AHP: 6 right) for treatment of intractable epilepsy. They were matched for demographic and disease-related variables and performed similarly on standardized measures of verbal (California Verbal Learning Test-II) and visuospatial memory (Taylor Complex Figure). During the BMT, participants were given 4 exposure trials to learn and remember 12 target stimuli (6 Gray towers). Long-term retention was assessed after a 20-minute delay. Accuracy was measured using  $d'$ .

**Results:** Although there were no significant differences between groups during the learning trials ( $p>.05$ ), the right AHP group became significantly less accurate with the Gray towers after the delay (delay vs. trial 4) while left AHP accuracy remained stable. A  $d'$  loss  $>1$  yielded sensitivity of 67%, specificity and positive predictive power of 100%, and negative predictive power of 75% for right AHP.

**Conclusions:** These initial findings support the role of the right MTL in visuospatial memory and suggest stimulus type and test instructions may be important variables to consider in future research.

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**D.T. PULSIPHER, E. HUTCHINSON, K. DABBS, E. MEYERAND, R. SHETH, B. HERMANN & M. SEIDENBERG. Developmental Changes in Frontal-Subcortical Circuitry in Pediatric Idiopathic Generalized Epilepsy: A Voxel-Based Morphometry Study.**

**Objective:** Frontal-subcortical circuitry is believed to be pathophysiological in idiopathic generalized epilepsy (IGE). Because frontal-subcortical circuitry underlies executive functioning, abnormalities of this circuit may underlie the commonly observed executive dysfunction in IGE. The purpose of the study was to examine the two-year developmental trajectory of frontal-subcortical structure and executive functions in children with recent-onset IGE.

**Participants and Methods:** 22 children with recent-onset epilepsy and 36 healthy controls completed select D-KEFS subtests and underwent whole-brain MRI. Voxel-based morphometry (VBM) was used to examine between-group and within-subject differences, as well as correlations with D-KEFS measures. All IGE participants were assessed within one year of epilepsy onset. The same MRI and testing protocol was repeated two years after baseline for both groups.

**Results:** Small frontal white matter group differences were observed at baseline (IGE < control), but no group differences were observed at follow-up. However, significant orbitofrontal grey matter loss over time was observed in the IGE group. No longitudinal changes were seen in the control group. D-KEFS scores were significantly correlated with thalamic, frontal, and parietal volumes in the control group. In contrast, the caudate nuclei and cerebellum were significantly correlated with the D-KEFS in the IGE group.

**Conclusions:** Children with recent-onset IGE show significant abnormal development changes in orbitofrontal cortex. While the control group's D-KEFS scores were correlated with thalamofrontal circuitry, a different set of structures in the frontal-subcortical-cerebellar network was correlated with executive functions in the IGE group. It is possible that these structures compensate for thalamofrontal abnormalities in IGE.

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**J.H. SANZ, M. BLACKWELL, E. DEMATT, A.L. HARTMAN & C.F. SALORIO. Behavioral Predictors of Quality of Life Following Hemispherectomy Surgery.**

**Objective:** By parent report, children who undergo hemispherectomy surgery to treat intractable epilepsy often experience significant behavioral and mood problems post-surgically. The nature of these difficulties and how they contribute to quality of life has not been examined. This study explores how behavioral concerns following hemispherectomy contribute to quality of life.

**Participants and Methods:** Parents of 17 children (9 post-right hemispherectomy (RH), 8 post-left hemispherectomy (LH)) completed the BASC-2, BRIEF, and the PedsQL. Demographic variables, such as age at surgery, current age, seizure outcome, and etiology of seizures were also collected. Relationships between demographic variables, behavioral scales, and quality of life were examined.

**Results:** Parent report of behavioral symptoms, internalizing symptoms, externalizing symptoms and executive dysfunction were associated with decreased parent reported quality of life. Observed correlations were generally robust, with corrected  $p<.05$ . Specific domains of quality of life (i.e., social, emotional, school) had unique patterns of association with specific behavioral scales. In contrast, demographic variables, including side of surgery, were not related to quality of life variables in this small sample.

**Conclusions:** Behavioral problems, including executive dysregulation, are a potential sequela of hemispherectomy surgery and are potentially key components in disrupting quality of life. Additional research, including longitudinal work in larger samples, is necessary to further characterize behavioral outcomes and their effects on quality of life across the lifespan. Self-report of behavioral and emotional status should also be evaluated for older children/adolescents. Understanding these relationships is critical to the development of targeted behavioral interventions to improve functioning and quality of life after surgery.

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**M.M. SMITH, L. BAUER, M. ALOSCO, G. TREMONT, J. DAVIS, A. BLUM & W.C. LAFRANCE. Personality Characteristics in Patients with Epileptic Vs. Nonepileptic Seizures.**

**Objective:** Patients with nonepileptic seizures (NES) and patients with temporal lobe epilepsy (TLE) have high rates of comorbid psychopathology and are difficult to distinguish based on neuropsychological testing. While there is an extensive, though mixed literature on personality characteristics in TLE, less is known regarding personality in NES. Understanding personality in NES may help to refine diagnosis and intervention approaches.

**Participants and Methods:** 21 EEG-confirmed patients with NES and 38 video EEG-confirmed patients with TLE completed the Bear-Fedio Inventory (BFI), a 100-item self-report inventory of 18 personality characteristics associated with TLE. It has been demonstrated in previous literature to distinguish TLE patients from normal and neurological controls.

**Results:** The groups were not significantly different based on sex, age, or years of education. On average, patients with TLE endorsed 35 items and patients with NES endorsed 41 items. T-tests revealed that the NES group reported significantly higher levels of sadness ( $p < .05$ ) and religiosity ( $p < .01$ ) than the TLE group.

**Conclusions:** Results suggest that patients with NES and TLE endorse TLE-associated personality characteristics similarly, though patients with NES may in fact experience higher rates of sadness and religiosity. These findings are similar to those in the cognitive testing literature, suggesting that patients with TLE or NES are difficult to distinguish based on personality inventories such as the BFI and neuropsychological testing.

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**A.C. SOPER, M. WAGNER, K. TOPPING & P. PRITCHARD. A Neurosurgical Case Report of Transient Epileptic Amnesia.**

**Objective:** One memory disorder that is potentially treatable with antiepileptic drugs (AED's) is transient epileptic amnesia (TEA) (Kapur, 1993). According to Zeman et al. (1998), working diagnostic consensus criteria include transient, episodic memory dysfunction with preserved sensorium in which at least two of the following were present: (1) initial positive response to AED's; (2) abnormal EEG; and (3) spell recurrence. We present the first reported case of a neurosurgical intervention for refractory TEA. VEEG, 3T MRI, and neurologic as well as neuropsychological findings are presented with post-surgical clinical outcome.

**Participants and Methods:** An archival chart review identified a 47-year old female who presented to our outpatient neurology service and was diagnosed with TEA.

**Results:** Recurrent TEA episodes occurred until neurosurgical intervention was performed. Inpatient VEEG monitoring captured epileptiform right temporal lobe spike discharges. 3T MRI showed a flattened right hippocampal head. Pre-surgical neuropsychological testing showed a significant discrepancy between verbal and visual memory. Pre-surgically, spells increased to a daily frequency despite maintenance on AED's. The patient underwent right anterior amygdalohippocampectomy for refractory TEA at our epilepsy surgical center. At 10-month follow-up, she was free of TEA spells, and cognitive complaints remitted. Neuropsychological testing post-surgically showed no verbal-visual memory asymmetry, with performance otherwise unchanged.

**Conclusions:** This is the first known post-surgical case of TEA. The studies performed do not provide evidence that would elucidate the exact mechanism for the unique TEA phenotype. This case report illustrates one memory disorder, transient epileptic amnesia (TEA), that is potentially treatable with AED's or surgery.

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**L. STROBER, R. BUSCH, C. JESSICA, G. TESAR, A. VIGUERA & I. NAJM. Psychometric properties of the Beck Depression Inventory-II (BDI-II), Beck Depression Inventory-Fast Screen (BDI-FS) and Center for Epidemiological Studies-Depression (CES-D) in an epilepsy sample: Are our present measures sufficient?**

**Objective:** Symptoms of depression and epilepsy, and antiepileptic side effects frequently overlap (e.g., fatigue, sleep difficulties). As a result, common self-report depression measures may not accurately assess depression in patients with epilepsy (PWE). The present investigation sought to determine whether common screening measures are adequate tools in epilepsy and whether a measure designed specifically for the medically-ill performs better.

**Participants and Methods:** Fifty-three depressed and 23 non-depressed PWE underwent a structured clinical interview (Mini International Neuropsychiatric Interview [M.I.N.I]) to assess depression (i.e., MDD, dysthymia, adjustment disorder). Patients also completed the BDI-II, CES-D, and BDI-FS. The sensitivity, specificity, and positive likelihood ratio (PLR) of each measure were then calculated.

**Results:** A cutoff of 13 on the BDI-II obtained a sensitivity of 91%, specificity of 76% and a PLR of 3.72 in identifying depressed PWE. This cutoff accurately identified 21 of the 23 depressed patients but inaccurately identified 13 of the 53 non-depressed patients as depressed. A cutoff of 16 on the CES-D resulted in a sensitivity of 96%, specificity of 76% and PLR of 3.90. Given the comparable specificity, this cutoff also resulted in 10 false positives but only 1 false negative. Finally, the BDI-FS (cutoff of 4) obtained a sensitivity of 91%, specificity of 72% and PLR = 3.23.

**Conclusions:** Findings suggest that the BDI-II and CES-D are adequate screening tools for identifying depression in PWE but result in a high rate of false positives. Surprisingly, the BDI-FS did not prove to be a superior measure despite its proposed utility for use in medically-ill populations.

\*This research was funded by the Epilepsy Foundation

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**L. STROBER, B. ROBYN, J. CHAPIN, G. TESAR, A. VIGUERA & I. NAJM. Beyond endorsement: A closer look at the impact of seizure activity and antiepileptic medication side effects on patients' reports of depression.**

**Objective:** Many epilepsy-related symptoms and antiepileptic side effects overlap with symptoms of depression (e.g., fatigue, irritability, sleep disturbance). The present investigation sought to explore the contribution these factors may have on self-report depression measures.

**Participants and Methods:** Seventy-seven patients with epilepsy completed a modified Beck Depression Inventory in which they were asked to rate the extent to which their medications and/or seizures contribute to each depressive symptom they endorsed. Symptoms endorsed in greater than one third of patients are reported. Symptoms were considered to be influenced by seizures or medications if patients rated their contribution as 3 or higher on a 1 to 5 Likert scale (1 = "not at all" and 5 = "completely").

**Results:** Between 50% and 70% of patients reported that their seizures contributed to their endorsement of sadness, pessimism, dissatisfaction, disappointment, irritability, indecision, and work difficulty. Between 30% and 50% of patients reported that seizures contributed to their endorsement of sleep difficulty, fatigue, self-criticism, and negative self-appraisal. Medication side effects were found to contribute to reports of fatigue in 53% of patients and between 30% and 50% of patients reported that medication side effects contributed to their endorsements of irritability, sleep difficulty, indecision, and work difficulty.

**Conclusions:** Findings suggest more than half of patients attributed self-rated depressive symptoms to seizures; a smaller percentage attributed their symptoms to AEDs. This discrepancy is interesting since it suggests that patients are able to discriminate seizure and medication effects. Further exploration of the influence of these factors on self-reported depression and attribution style is warranted.

\*This research was funded by the Epilepsy Foundation

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#### **J.L. WALKOWIAK, K. BLACKSTONE, W.D. GAILLARD & M. BERL. Reading Performance in Children with Localization Related Epilepsy.**

**Objective:** Research in children with epilepsy (CWE) has revealed reading underachievement (Williams and Sharp, 2000). This study examined component reading skills, including phonological awareness, rapid naming, single word decoding, and comprehension, as well as the role of executive functioning (EF) in CWE and controls. We hypothesized that higher-order reading, as opposed to fundamental, skills would be impaired in CWE.

**Participants and Methods:** 48 CWE were matched on age and gender to 48 normal controls. Selected subtests from the CTOPP, WJ-III Achievement, and GORT assessed reading skills. IQ (WASI), parental ratings of EF (BRIEF), and seizure characteristics were also examined. MANCOVA's with IQ as the covariate assessed group differences; regression analyzed the variance due to EF.

**Results:** CWE and controls were comparable for single word decoding and phonological skills, while rapid naming (CTOPP,  $p < .01$ ) and functional reading for paragraph-length stories (GORT,  $p < .01$ ) was lower in CWE. On the BRIEF, group comparisons revealed higher ratings of overall metacognitive difficulty in CWE, especially sustained working memory ( $p < .01$ ). After accounting for the variance due to intellectual functioning, working memory accounted for a modest additional 4% of the variance in functional reading performance ( $F(2, 95) = 15.90, p < .001$ ).

**Conclusions:** Findings suggest that reading impairment in CWE is attributable to weaknesses in managing speed and complexity, rather than fundamental decoding or phonological weaknesses. Difficulty with higher order reading was associated with poor EF. These results have implications for reading intervention with CWE, who would likely benefit from additional support in the executive aspects of reading.

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#### **R. WILSON, S. MARION, J. LEE, G. MATHERN (UCLA DEPARTMENT OF NEUROSURGERY) & R. ASARNOW (UCLA DEPARTMENT OF PSYCHIATRY). Language and Visual-Spatial Function Following Hemispherectomy.**

**Objective:** Brain plasticity is integral to the developing brain, though it is often confined conceptually as a catalyst of restitution after damage. Studying individuals with a history of hemispherectomy for intractable epilepsy provides an opportunity to better understand functional plasticity. There is continued debate regarding the primacy of language vs. visual-spatial abilities in the preserved hemisphere. Consistent with laterality studies, we hypothesized that verbal skills would be better for right- vs. left-hemispherectomy patients and vice versa.

**Participants and Methods:** Data for 35 subjects participating in the UCLA Pediatric Epilepsy Surgery Program were analyzed. All surgeries (25 = left, 10 = right) occurred before the age of 14 (mean = 5.5 years). The cohort consisted of 22 females and 13 males ages 4 to 29 years. The vocabulary subtest from the Wechsler scales was used as a correlate of for language skills and the Test of Visuospatial Skills-Revised (TVPS-R) served as a correlate of motor-free visual-spatial skills.

**Results:** Results of analysis of variance revealed that verbal skills were comparable in individuals for whom the left- and right- hemispheres were removed or disconnected at an early age. Similarly, visuospatial skills were not significantly different by side of resection.

**Conclusions:** The fact that verbal and visuospatial skills were comparable both within and between right- and left-hemispherectomy groups was surprising, yet previous literature is mixed. These results are consistent with a functional plasticity model; however, the precise mechanism of this plasticity could not be uncovered. While our sample was relatively small, it represents one of the larger studies of long-term cognitive functioning following hemispherectomy.

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#### **D. WITTENBERG & J. NASLUND. Verbal and Nonverbal Memory Function in Right vs. Left MTS.**

**Objective:** Hippocampal sclerosis is a common pathology in temporal lobe epilepsy. Patients with left mesial temporal sclerosis (LMTS) have different neuropsychological deficits when compared to patients with right mesial temporal sclerosis (RMTS); however, the pattern of deficits is not consistently reported, especially regarding memory. We hypothesized that LMTS would have greater verbal memory dysfunction while RMTS would have greater nonverbal memory dysfunction corresponding with their respective lesions.

**Participants and Methods:** Participants were 44 patients (53% female) with LMTS and 39 patients (54% female) with RMTS who underwent comprehensive neuropsychological evaluation as part of their pre-operative evaluation. Both groups were matched on demographic variables including age (LMTS =  $40.1 \pm 9.9$ ; RMTS =  $42.1 \pm 12.1$ ) and education (LMTS =  $11.4 \pm 3.1$ ; RMTS =  $12.4 \pm 3.1$ ). Subjects were administered the Logical Memory (LM) subtest of the WMS-III and the Rey Auditory Verbal Memory Test (RAVLT) to assess verbal memory. The Rey Complex Figure Test (RCFT) and the Brief Visuospatial Memory Test-Revised (BVM-T-R) were used to assess nonverbal memory. Performance differences were determined using independent samples t-test.

**Results:** Examination of performance on the RAVLT delayed recall portions and LM revealed significant differences between groups ( $p < .05$ ), with LMTS demonstrating greater dysfunction as compared to the RMTS group. No significant differences were found between groups on nonverbal/visual memory tests.

**Conclusions:** Consistent with previous research, LMTS patients demonstrated significant verbal memory dysfunction as compared to RMTS. However, contrary to expectation, RMTS patients did not demonstrate greater dysfunction on nonverbal memory tests. Future studies with larger groups are warranted to further explore nonverbal memory performance in this population.

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#### **L. ZAYTSEV, V. KRISHNAMURTHY & K. FREIER-RANDALL. Long-Term Sequelae of Neonatal, Early Childhood, and Late Childhood Onset Seizures.**

**Objective:** The literature notes that early onset seizures can lead to poorer cognitive and neuropsychological outcomes. This study compares outcomes of neonatal (NEO: <44 weeks gestational age), early childhood (EC: 4-24 months), and late childhood (LC: >2 years) onset seizures to determine whether there are functional differences.

**Participants and Methods:** Participants were 34 children with a documented history of seizures (18 neonatal, 8 early childhood, 8 late childhood; 62% Male, 38% Female; Mean Age = 7.74, SD = 3.70). Measures used include Wechsler Scales (WPPSI-III/WISC-IV: Verbal (VIQ), Performance (PIQ), Processing Speed (PSI)) and the NEPSY (Attention/Executive Functioning (A/EFx), Language (Lang), Sensorimotor (SM), Visuospatial (VS), and Memory (Mem)). The data was collected from 2000-2009 with IRB approval.

**Results:** Mean domain scores for all three groups were 1-1½ SD below the normative average and statistically significant at  $p < .01$ . Neuropsychological scores were as follows:  $VIQ_{NEO} = 82.7, VIQ_{EC} = 87.1;$

VIQ<sub>LC</sub>=82.0; PIQ<sub>NEO</sub>=81.9, PIQ<sub>EC</sub>=91.3; PIQ<sub>LC</sub>=85.1; PSI<sub>NEO</sub>=77.8, PSI<sub>EC</sub>=85.0, PSI<sub>LC</sub>=87.6; A/EF<sub>xNEO</sub>=83.4, A/EF<sub>xEC</sub>=90.6, A/EF<sub>xLC</sub>=71.3; LANG<sub>NEO</sub>=84.1, LANG<sub>EC</sub>=83.2; LANG<sub>LC</sub>=79.3; SM<sub>NEO</sub>=72.6, SM<sub>EC</sub>=94.8; SM<sub>LC</sub>=72.3; VS<sub>NEO</sub>=82.1, VS<sub>EC</sub>=96.3; VS<sub>LC</sub>=99.0; MEM<sub>NEO</sub>=79.9, MEM<sub>EC</sub>=84.8, MEM<sub>LC</sub>=79.5. Univariate ANOVAs comparing the groups revealed statistically significant differences on Sensorimotor domain ( $F=3.37$ ,  $p=0.05$ ). Notable differences between groups were observed on PIQ, PSI, A/EF<sub>x</sub>, and VS domains.

**Conclusions:** Regardless of age of seizures onset, cognitive and neuropsychological functioning was negatively impacted. Differences between the groups were noted on various nonverbal domains, with the NEO group demonstrating the poorest outcomes, consistent with existing literature. The small sample size, however, limits power and generalizability of these results, and future studies will need to address this limitation.

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## Language and Speech Functions/Aphasia

### L.J. ALTMANN. Training Effects on Repetition Priming of Picture Naming: Generalization to Untrained Items.

**Objective:** Repetition priming (RP) refers to improved performance when a person repeats a task with identical stimuli. Anomia rehabilitation relies heavily on repeated naming of pictures during treatment. However, little is known overall about the properties of RP in picture naming. We examined effects of 3 types of training on RP for trained and related items from the same semantic categories.

**Participants and Methods:** Sixty college students completed: pre-test picture naming, a training protocol, and post-test picture naming, with followup picture naming a week later. Stimuli comprised 24 items from 4 semantic categories. Six items from 3 categories were trained using repeated naming (NM), generation of semantic information (SEM), or generation of semantic information plus naming (SEM+NM). The fourth category remained untrained. The untrained items from each category represented generalization items. Dependent variables were changes in accuracy and RT.

**Results:** All items showed robust RP of response times at post-test that was exaggerated for trained items in NM and SEM+NM categories. RP declined at followup but remained significant. Generalization items from the SEM and SEM+NM categories showed greater RP than those from other categories.

Accuracy improved overall at post and followup testing. Items trained using NM or SEM+NM improved most. Although item names were provided after pretest, improvements in naming generalization items were small regardless of the category received training.

**Conclusions:** As is common following treatment for anomia, trained items were named faster and more accurately, and RP remained robust at followup. Interestingly, greater RP for SEM and SEM+NM generalization items suggests long-term spreading activation in categories with semantic training. However, generalization items improved little in accuracy even after item names were provided.

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### J.P. WILSON, A.E. WADESON & L.J. ALTMANN. Effects of Working Memory and Executive Function on Language Production.

**Objective:** The relationship between memory capacity, executive function and disruptions of sentence production is largely unexplored. This project uses a constrained sentence production task requiring grammatical awareness and switching between verb types to test the relationship between cognitive variables and the ability to produce fluent, grammatical sentences.

**Participants and Methods:** Participants aged 18 to 30 completed tests of vocabulary, executive function and working memory. In the experimental task, participants produced a sentence that included 3 stimulus words, a verb in past participle plus 2 nouns). Verbs were chosen to require awareness of argument structure (feared, scared) and syntactic constraints (regular and irregular agent-theme verbs, e.g., kicked, thrown). Dependent variables included fluency, grammaticality, and overall accuracy of production. We predicted that the disruptions would correlate with inhibitory control and working memory.

**Results:** Participants were less accurate with irregular verbs than other verb types. Overall production accuracy correlated significantly with working memory. Grammaticality was high and error rates correlated with vocabulary size and working memory. Fluency represented the greatest disruption, and correlated significantly with vocabulary, working memory, and inhibitory control.

**Conclusions:** Disruptions in sentence production affecting grammaticality and fluency were associated with working memory and executive function, and sentences with stricter grammatical constraints imposed a greater cognitive burden. This suggests that neurological disorders that impair working memory and executive function (e.g., dyslexia, ADHD, Parkinson's Disease) may be accompanied by increased disruptions of fluency and grammaticality during language production.

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### J. BENNETT & S.P. VERNEY. Hispanic Bilinguals and Verbal Fluency Performance.

**Objective:** Bilingual research results vary as to whether verbal fluency is impaired compared to English speaking monolinguals. These studies often include bilingual individuals of various abilities and languages, creating heterogeneous research populations. Verbal fluency is used as a critical indicator of premorbid functioning in neuropsychological assessment. The Hispanic ethnic group is the fastest growing US population; thus, proper diagnosis and treatment becomes more critical for these individuals. The purpose of this study is to compare bilingual Hispanic to monolingual English-Speaking European-American (MESEA) students in tests of phonemic (FAS) and semantic ("animals," "fruits and vegetables") fluency. In addition, other letter combinations (BCT, PMR) were explored to determine whether different triads would be more valid for both groups.

**Participants and Methods:** MESEA ( $n=32$ ) and Hispanic bilingual English and Spanish speaking undergraduate students ( $n=47$ ) completed the Controlled Oral Word Association Test (COWA). Bilingual students were recruited into three groups along self-reported language dominant lines (Spanish dominant, SD; balanced, BB; English dominant, ED).

**Results:** Initial results showed significant differences in phonemic and semantic fluency between the monolingual and all bilingual students, with the bilingual group performing lower on all fluency tasks. However, when comparing the three bilingual groups to the monolingual group, only SD students had a significantly different fluency performance. The SD group scored two-thirds or lower than the monolingual students for all phonemic triads and semantic categories.

**Conclusions:** Overall, the Hispanic bilingual students' fluency performance varied depending upon their linguistic characteristics. This highlights the need to assess bilingual individuals' language abilities when evaluating their verbal fluency.

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### R.C. FOLSOM, C.M. YOUNG, A.A. TURK, L.K. PAUL & W.S. BROWN. Semantic Analysis of Awareness of Consequences in Agnesis of the Corpus.

**Objective:** Previous studies have indicated that persons with agenesis of the corpus callosum (ACC) have deficits in social cognition that make

it difficult for them to navigate the complex world of social relationships, including deficits in inferring the mental states of others and imagining realistic social scenarios. This study examined the semantic content of responses to the Awareness of Consequences Scale (AOCS) which demands finding solutions to social or moral dilemmas. Responses were analyzed using the Linguistic Inquiry and Word Count (LIWC). It was predicted that individuals with ACC would show diminished emotional, social, and cognitive content and a different distribution of words belonging to grammatical categories compared to controls.

**Participants and Methods:** Twenty-nine adults with ACC (ages 16–55; FSIQs 78–129) were compared to 22 normal controls (ages 18–51; FSIQs 88–116), covarying FSIQ. LIWC was applied to a composite of responses to the six vignettes of the AOCS.

**Results:** Individuals with ACC used significantly fewer words denoting emotionality ( $p < .01$ ) and cognitive processes ( $p < .05$ ), but no differences were found in social content or grammatical usage. Unexpectedly, individuals with ACC were found to use more words than controls pertaining to physical states and bodily functions ( $p < .05$ ).

**Conclusions:** These results suggest that absence of the corpus callosum may result in under-utilization of solutions to dilemmas that involve the emotional and cognitive processes of others. These findings are consistent with our previous findings of reduced capacity for problem solving, deficient social inference, and alexithymia in ACC.

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#### J.C. GIDLEY LARSON, K. PARRY, T. JONES, J.A. TRESCOTT & Y. SUCHY. The Contribution of Language to Motor Control.

**Objective:** Research has begun to examine Vygotsky's theory of self-guiding speech (SGS) in relation to motor skill acquisition and motor rehabilitation. However, it is unclear as to which aspect of motor functioning is affected by SGS. The current study sought to examine the contribution of SGS to motor control (M-CNT), as measured by the smoothness of a double-tap movement, in a novel computerized motor sequence learning task.

**Participants and Methods:** Eighty-one healthy participants, ages 18–27, learned to perform a five-movement sequence that included a double-tap, after being randomly assigned to one of the following training modes: TM1-action+verbalization; TM2-action+verbal interference; TM3-verbalization+action interference; or TM4-no pre-training. Following training to criterion for TMs 1–3, all participants completed two assessment Blocks. During Block-1 verbal prompts of the actions in the motor sequence appeared on the screen and all participants were required to vocalize the action as they made their movement. During Block-2 the verbal prompts disappeared and participants were instructed to continue to perform the motor sequence, and were no longer required to verbalize their action.

**Results:** Repeated measures ANOVA revealed a change in mean M-CNT time across Block ( $p = .008$ ) and differences in mean M-MCT time across TM ( $p = .030$ ). Post-hoc analyses suggest that participants who did not learn the sequence verbally exhibit poorer motor control than those who learned the sequence verbally; even in the group who had previously learned the sequence motorically (TM2).

**Conclusions:** Together the findings suggest that SGS may serve as a useful tool to facilitate smooth and rapid execution of discrete movements. Correspondence: *Jennifer C. Gidley-Larson, M.A., Psychology, University of Utah, 310 S. 1300 E., Salt Lake City, UT 84102, United States. E-mail: jen.larson@utah.edu*

#### E.H. LACEY, S.N. LOTT & R.B. FRIEDMAN. Development of an Overlearning Treatment Paradigm for Naming in Aphasia.

**Objective:** Aphasia treatment often ends after a pre-set performance criterion is reached, a practice that is not conducive to consolidation of new memories. We predicted that treatment maintenance would improve if initial treatment for anomia were followed by a period of over-

learning. However, we have found that errorless treatment paradigms, which the overlearning period would be, can be prohibitively tedious for the patient. Therefore, it was necessary to design an effortful treatment paradigm for overlearning that could also monitor attentional engagement in order to collect reliable data on how overlearning affects maintenance.

**Participants and Methods:** Pictures that patients could not name were separated into matched sets. After criterion performance was reached, treatment continued for 6 more weeks with one set of pictures. Patients practiced these pictures within a continuous performance task designed for errorless treatments, the CPT-EL. Patients responded to randomly-appearing targets among similar, non-target stimuli (abstract designs) as well as naming randomly-appearing treatment pictures.

**Results:** 1 person with aphasia (JMC) completed initial treatment and overlearning; 3 more patients are currently in treatment. During overlearning, JMC continued to name the treatment items at 90–100% accuracy and responded to the target designs at 95%–100% accuracy, indicating engagement in the task. 6 month maintenance data will compare performance on initial treatment words to overlearned words.

**Conclusions:** The CPT-EL is a valid method for keeping aphasia patients engaged during overlearning or other errorless treatment situations. Data collection is ongoing to determine the efficacy of the CPT-EL and to determine the effects of overlearning on maintenance of treatment.

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#### H. TELLEZ, S. CHAPA DE LEÓN, V. CONTRERAS CHAPA, V. BLANCO ROCHA & P. LÓPEZ SAUCEDO. Neuropsychological Study of Pragmatics.

**Objective:** To investigate the emergence and evolution of the pragmatics of language in children and its relationship to the level of socialization, making a comparative analysis of two tests, error rates, gender and age.

**Participants and Methods:** Ninety children of both sexes between 5 and 10 years of age. Randomly selected from different schools, they are individually applied two tests then were asked to analyze a situation and answer a few questions to assess the pragmatic function.

**Results:** In both tests the performance of girls was better, proof 1 proved to be more sensitive to detect pragmatic skills test 2, it was found that variables such as the development of attention and verbal comprehension may properly influence the acquisition of pragmatics of language. The comparison between urban and rural community showed no significant differences in the quantitative analysis but with obvious qualitative differences.

**Conclusions:** The implementation of language as a communication tool demand contextual settings in each verbal interaction. The development of pragmatic competence in children is a necessary function for effective communication, achieving a proper social interaction is involved where values according to cultural context. Studying the emergence and evolution of language, focusing on the syntactic level, phonological and semantic, has developed an interest in the pragmatic analysis, is of supreme importance placed in the place of another person in terms of thoughts, feelings or actions to make a proper assessment of the context. Correspondence: *Humberto Tellez, Mtro., Neuropsicología, Facultad de Psicología, Universidad Autónoma de Nuevo León, Mutualismo #110 col. Mitras centro, Monterrey 64460, Mexico. E-mail: humberto.tellezol@uanl.edu.mx*

#### J. WAMBAUGH, S. MAUSZYCKI & R. CAMERON. Generalization Effects of Semantic Feature Training for Word Retrieval Deficits in Agrammatic Aphasia.

**Objective:** This investigation was designed to examine the generalization effects of a semantic treatment for word-retrieval deficits in aphasia.

**Participants and Methods:** Four individuals with chronic,agrammatic aphasia received treatment applied in the context of a multiple baseline design across behaviors and subjects. For each participant, four different semantic categories of items were trained, with treatment applied separately to typical and atypical category exemplars. Living (e.g., birds, vegetables) and artifact (e.g., furniture, tools) categories were studied. Items were designated as typical or atypical on the basis of normative data obtained from 40 non-brain-injured participants. Generalization of treatment effects was measured to untrained typical and atypical items of the trained categories and to untrained items from different categories. Following training of the four categories, an additional category received a modified version of treatment. Treatment was changed such that participants were explicitly trained to utilize the treatment approach as a compensatory strategy.

**Results:** All participants evidenced improved naming of trained items for all trained categories. Generalization to untrained items was not observed. That is, training of typical items did not generalize to untrained atypical or untrained typical items. Similarly, training of atypical items did not generalize to untrained typical or untrained atypical items. Across-category generalization was not evident. The modified treatment did not result in improved generalization effects.

**Conclusions:** Although previous research has indicated that training atypical category exemplars may promote within category generalization, this was not the result with this investigation. Participant characteristics, category determinations, treatment factors, and measurement conditions may be important considerations in promoting generalization.

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#### **H.H. WRIGHT, M. NEWHOFF, L. CARTER, S. MURPHY & B. WAGNER. Narrative Discourse Processing in Aphasia.**

**Objective:** The language deficits experienced by persons with aphasia (PWA) affect their ability to communicate at the discourse level. For example, PWA may have difficulty sharing stories, participating in conversation, and recounting personal experiences successfully. Further, discourse processing is the most complex form of language processing and requires comprehension as well as production abilities. Finally, even PWAs who have primary language deficits may also present with cognitive impairments, such as limited memory and/or attention and several claims have been made that linguistic impairments found in PWA are related to these impaired cognitive functions. The purpose of this study was to determine the extent to which performance on cognitive measures of attention and memory relate to comprehension and production of narrative discourse performance by PWA.

**Participants and Methods:** Eleven PWA participated in the study. The presence of aphasia was confirmed through performance on standardized aphasia tests as well as clinical judgment. The participants completed several standardized measures to assess their attention and memory ability. The experimental activities included telling stories depicted in wordless picture books. Following each story, the participant answered 15 multiple choice questions about the stories.

**Results:** Results from Pearson correlation analyses indicate a significant relationship among performance on the cognitive measures and the narrative discourse comprehension task. Further, it appears that a strong relationship is emerging between proportion of story propositions conveyed and performance on the narrative comprehension task.

**Conclusions:** Application of results to a discourse processing framework will be presented. Clinical implications of the results will also be discussed.

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#### **ADHD/Attentional Functions**

##### **C. GOPIN, D.J. MARKS, A. SANTRA & J.M. HALPERIN. The Influence of IQ on Neuropsychological Profiles in Preschoolers with ADHD and ADHD+ODD.**

**Objective:** Some researchers assert that covariation is essential for determining whether unique deficiencies in executive functioning are present in ADHD children, yet others argue that doing so parcels out abilities common to executive functioning and IQ, thereby obfuscating differences. The current study compares the neuropsychological functioning of typically developing (TD), ADHD, and ADHD+ODD preschoolers with and without stratifying the participants on IQ.

**Participants and Methods:** 72 TD, 53 ADHD, and 44 ADHD+ODD preschoolers were administered the WPPSI and NEPSY. Group differences were analyzed using a MANOVA. Participants were then stratified into approximately equally-sized groups based on "low" ( $\leq 99$ ), "medium" (100-112), and "high" ( $\geq 113$ ) IQ scores, and the data were reanalyzed.

**Results:** Significant differences were found on 8 of 11 subtests investigated (i.e., Design Copying, Comprehension of Instructions, Imitating Hand Positions, Visuomotor Precision, Narrative Memory, Block Construction, Sentence Repetition, Statue). Post-hoc analyses indicated that the TD group differed from both ADHD groups, regardless of ODD status, with no significant difference between ADHD subgroups. When stratified on IQ, group differences were not evident amongst those with "low" and "medium" IQs. However, when IQ score was "high", the ADHD+ODD group performed worse than the TD group on Sentence Repetition ( $p < .05$ ), with the difference between the two diagnosed groups approaching significance ( $p = .056$ ). The TD group performed significantly better than the diagnosed groups on Statue ( $p < .01$ ).

**Conclusions:** Findings suggest that most children with ADHD, regardless of comorbid ODD status, display global neurocognitive dysfunction. However, when IQ is considered, specific deficits are apparent only amongst ADHD children with "high" IQs.

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##### **C. GOPIN, O.M. BERWID, D.J. MARKS, A. MLODNICKA & J.M. HALPERIN. ADHD Preschoolers with and without ODD: Sensitivity to Task Engagement/Reward?**

**Objective:** Given that dysfunctions in dopamine (DA) based reward mechanisms have been associated with both ADHD and ODD, individuals diagnosed with comorbid ADHD+ODD might be expected to be more responsive to reward system manipulations relative to those with ADHD alone. The current study examined the impact of task engagement/reinforcement on reaction time (RT) and RT variability (RTSD) in Typically-Developing (TD), ADHD, and ADHD+ODD preschoolers. **Participants and Methods:** 36 TD, 20 ADHD, and 17 ADHD+ODD preschoolers were administered a computerized task consisting of 2 conditions: simple RT (SRT) and reinforced SRT (SRTr). Data were analyzed using 2-way (Group x Condition) mixed ANOVAs and followed-up using pairwise comparisons.

**Results:** The main effect for condition was significant such that RTs were shorter and less variable during the SRTr than the SRT condition. A significant Group x Condition interaction was also observed for RTSD; post-hoc analyses indicated that the RTSD of the ADHD+ODD group was significantly more variable than that of the TD group (but not the ADHD-only group) during the SRT condition ( $F = 4.81, p < .05$ ). However, it was statistically indistinguishable from the other groups during the SRTr condition.

**Conclusions:** Preschool children who are defiant and hyperactive are the most responsive to feedback/reward. These data suggest that there may be incremental disturbance in the frontostriatal DA circuitry such that the reward system associated with ADHD+ODD is more sensitive than that of ADHD alone. Given that ADHD+ODD youngsters require more rewarding stimulation to elicit and maintain their interest, it is not surprising that they are often described as the most challenging to engage.

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**B. RABINOVITZ, A. BEDARD, L. TANZMAN & J.M. HALPERIN. Language Ability and Lateralized Motor Functions in Children: Evidence for Reduced Hemispheric Specialization in ADHD.**

**Objective:** Cerebral language dominance has been related to lateralization of motor functions, suggesting a link between right-hand motor dominance and left hemisphere-based language abilities. Conversely, visuospatial processing is typically subserved by the right hemisphere. Given preliminary findings suggesting reduced language and hand dominance in ADHD, we hypothesized that, among non-ADHD children, language abilities would be significantly associated with right hand motor control, and visuospatial processing with left hand motor control. Such patterns were hypothesized to be absent in youngsters with ADHD due to decreased lateralization.

**Participants and Methods:** Right-handed, unmedicated 5-6 year-old children with (n=33) and without (n=46) ADHD were administered a comprehensive neuropsychological assessment (NEPSY) and measures of right- and left-hand motor skills (Purdue Pegboard). Multivariate analyses of variance (MANOVAs) in each diagnostic group examined differences between children with and without right- and left-hand motor impairment (defined as  $\geq 1$  SD below the mean). MANOVAs examined differences between motor groups on the NEPSY Language and Visuospatial domains and scores from the five subtests comprising these domains.

**Results:** Non-ADHD children with right-hand motor impairment (vs. intact right hand motor skills) performed significantly worse on measures of language and visuospatial ability. These differences were not evident between children with and without left-hand impairment. Measures of verbal comprehension and spatial orientation significantly correlated with right, but not left, hand performance. No such patterns were evident in the ADHD group.

**Conclusions:** These findings indicate that typically-developing preschoolers already exhibit patterns of cerebral specialization which are commonly reported in adults, and children with ADHD exhibit atypical patterns of cerebral asymmetry.

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## Paper Session 6: Dementia

4:00–5:30 p.m.

**T. GIOVANNETTI, B.M. BETTCHER, D. WAMBACH, C. SETER, D.J. LIBON, L. BRENNAN & J. EPPIG. Distractor Interference in Everyday Action: Evidence from Participants with Dementia.**

**Objective:** The influence of distractor objects on everyday functioning has not been directly evaluated in people with dementia. This study examined 1) the extent to which visual/functional similarity between distractors and targets elicits interference and 2) whether distractor interference perturbs all aspects of performance or only target selection.

**Participants and Methods:** Twenty participants with dementia were videotaped while they performed 3 discrete tasks: 1) make a cup of coffee, 2) wrap a gift, and 3) pack a lunch under two conditions: 1) Target-Related Distractor Condition – distractor objects that were functionally and visually similar to target objects were included in the workspace and 2) Unrelated Distractor Condition – distractors were neither visually nor functionally similar to targets. Ratings from con-

trols confirmed that distractor-target similarity differed and familiarity ratings were comparable across the conditions. The following performance variables were coded for each condition: number of times distractor objects were touched or used, percent of steps accomplished, number and type of errors (sequence, substitution, etc.), and time to completion.

**Results:** Participants touched ( $t = 4.19, p < .01$ ) and used ( $z = 3.00, p < .01$ ) significantly more distractors, made more distractor errors (i.e., substitutions;  $t = 2.93, p < .01$ ), and took longer to complete tasks ( $t = 2.27, p < .05$ ) in the Target-Related Distractor condition. The percent of steps accomplished and non-distractor errors did not differ across conditions ( $t < 1.26, p > .05$  for both). Control similarity ratings were significantly higher for the distractors that were used ( $r's > .40, p < .01$ ) but not for those that were only touched ( $r's < .25$ ).

**Conclusions:** Distractors that were similar to targets elicited greater interference than unrelated distractors. Interference effects were circumscribed to target selection. Thus, strategic efforts to avoid clutter of target-similar objects may facilitate everyday functioning in dementia.

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**T. KANE & J.H. KRAMER. Visual Confrontation Naming Associated with Left Inferior Temporal Gray Matter Volume in Alzheimer's Disease and Mild Cognitive Impairment.**

**Objective:** Studies of naming have variably implicated a broad neural network, including parietal, temporal and frontal structures. Our goal was to investigate the neuroanatomical correlates of visual confrontation naming in Alzheimer's disease (AD) and mild cognitive impairment (MCI).

**Participants and Methods:** 88 participants (mean age = 66.1, mean education = 16.1) diagnosed with probable AD (n = 45) or MCI (n = 43) and a Mini Mental Status Exam (MMSE) score of at least 15 (mean = 25.3) were administered the Boston Naming Test (BNT), a measure of visual confrontation naming. Structural MRI was obtained within 6 months of testing. We used Freesurfer, a semi-automated parcellation program, to measure regional gray matter volumes.

**Results:** After controlling for intracranial volume, MMSE, age and education, BNT total scores correlated with left temporal lobe volumes ( $r = .306, p = .005$ ), but not with frontal or parietal volumes. Even after controlling for all other cortical regions, temporal volumes uniquely explained 7.3% of the variance in BNT. Further regression analysis using subregions of the left temporal lobe indicated that only the inferior temporal gyrus contributed unique variance to BNT ( $R^2$  change = .041,  $p < .05$ ).

**Conclusions:** Results indicate that the left temporal lobe, and more specifically, the left inferior temporal gyrus, predicts visual confrontation naming performance in AD and MCI. Thus, even in neurodegenerative conditions with diffuse atrophy, impaired naming may offer anatomically specific information about underlying neuropathology.

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**K.L. POSSIN, V. LALUZ, B. MILLER & J. KRAMER. Visual Spatial Construction Deficits are Due to Impairments in Different Neural Mechanisms in Alzheimer's Disease and Frontotemporal Dementia.**

**Objective:** The goal of this project was to elucidate the neural mechanisms of visual spatial construction deficits in Alzheimer's disease (AD) and in the behavioral variant of frontotemporal dementia (bvFTD). We hypothesized that the impaired mechanism in AD is primarily visuospatial and due to right parietal atrophy, and in bvFTD is primarily dysexecutive and due to right dorsolateral prefrontal atrophy.

**Participants and Methods:** MRI scans were collected on 60 patients with bvFTD (mean age = 61+/-9) and 60 patients with AD (mean age = 63+/-9), and segmented using Freesurfer. All patients copied a simplified version of the Rey-Osterrieth figure and completed the Number Location Test of spatial perception, and a subset (23 AD and 30 FTD) completed the CA Tower Test of spatial planning.

**Results:** To determine whether the relationship between figure copy and gray matter volumes of the right parietal lobe (rPL) and the right middle frontal gyrus (rMFG) depended on diagnosis, a regression analysis was performed with MMSE, intracranial volume (icv), diagnosis, rPL, and rMFG entered as covariates. The rPL X diagnosis interaction predicted figure copy,  $p < .01$ ; the rMFG X diagnosis approached a trend,  $p = .11$ . The partial correlation between figure copy and rPL was more significant in the AD patients ( $r = .43$ ,  $p < .001$ ) than in the bvFTD patients ( $r = .26$ ,  $p = .04$ ), controlling for MMSE and icv. In contrast, the partial correlation between figure copy and rMFG was only significant in the bvFTD patients ( $r = .27$ ,  $p = .04$ ). Partial correlations, controlling for MMSE, revealed that figure copy significantly correlated with spatial perception in the AD patients only ( $r = .39$ ,  $p < .01$ ), whereas figure copy correlated with spatial planning in the bvFTD patients only ( $r = .40$ ,  $p = .03$ ).

**Conclusions:** Visuospatial construction deficits in AD can be primarily attributed to rPL atrophy and poor spatial perception, whereas in bvFTD, these deficits can be primarily attributed to rMFG atrophy and poor spatial planning. Study supported by: NIH/NIA grants P01AG019724 and P50AG23501 and Hillblom 2008-A-020-FEL

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**B.M. BETTCHER, T. GIOVANNETTI, D. LIBON, D. WAMBACH, J. EPPIG & J. KLOBUSICKY. The Task Training Naturalistic Action Test: Increasing Everyday Error Detection, One Picture At A Time.**

**Objective:** The reduced ability to monitor tasks is a salient problem in dementia. The cognitive neuroscience literature suggests that planning vs. execution errors in everyday action are associated with different detection probabilities. The aim of this study was to evaluate a novel action intervention (Task Training Naturalistic Action Test; TT-NAT) designed to increase error detection in dementia by curtailing planning errors. The intervention was compared to a control condition (Standard NAT) and a retrospective intervention designed to improve performance by reducing execution errors (User-Centered NAT; UC-NAT).

**Participants and Methods:** Participants ( $n = 45$ ) with dementia were administered the Standard NAT, a performance-based test requiring completion of 3 everyday tasks. A second group ( $n = 42$ ) was administered the TT-NAT, which includes a training session prior to the commencement of the Standard NAT tasks. A comparison group ( $n = 34$ ) was administered the UC-NAT, which includes environmental adaptations to improve sequence ordering and reduce distractibility. All participants were compared on the following variables: total errors, proportion of errors detected, and proportion of errors corrected.

**Results:** Participants in the TT-NAT group exhibited a trend toward detecting more errors than the UC-NAT group (proportion detected = 49% and 39%;  $p = .15$ ), who in turn detected more errors than the Standard NAT group (31%,  $p = .08$ ); however, only the TT-NAT condition was associated with statistically higher detection rates ( $t = 3.36$ ,  $p = .001$ ) and fewer total errors ( $z = -3.0$ ,  $p = .002$ ) than the Standard Condition. No differences in correction were noted.

**Conclusions:** The TT-NAT intervention was associated with a significant diminution in error production and marked increase in error detection compared to the Standard NAT. The relative superiority of the TT-NAT over the UC-NAT for circumventing planning errors and enhancing error detection suggests that it may be a promising intervention for monitoring deficits in dementia.

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## Symposium 5: Beyond the Mean: Variability as an Outcome in ADHD, MS, and Concussion

Chair: Peter Arnett

4:00–5:30 p.m.

**P. ARNETT, A. RABINOWITZ, F. BARWICK, J. BRUCE, G. VARGAS & S. KARALUNAS. Beyond the Mean: Variability as an Outcome in ADHD, MS, and Concussion.**

**Symposium Description:** Typical outcome variables in neuropsychological research and in clinical settings involve comparison of an individual examinee's test value with the mean of a relevant population. Beyond the typical speed or accuracy outcome, the variability of an individual's performance may provide important neuropsychological data. In this symposium, we consider indices of variability as outcome variables in three conditions: Sports-Related Concussion, Multiple sclerosis (MS), and ADHD. Amanda Rabinowitz will discuss variability between tests in a typical sports-concussion baseline battery and the relation of this intraindividual variability measure to motivation in a group of collegiate athletes. Fiona Barwick will report on the association of personality variables involving neuroticism and agreeableness to variability in symptom reporting from pre- to post-concussion in collegiate athletes. Jared Bruce will discuss how increased response time variability (RTV) is more associated with cognitive fatigue in MS than standard cognitive indices. He will further discuss how increased RTV may reflect frontal systems dysfunction and white matter damage. Gray Vargas will show how increased cognitive performance variability over time, but not changes in overall cognitive performance, predicts worry in MS patients. Finally, Sarah Karalunas will examine intra-individual reaction time variability (IRV) in children with ADHD on tasks with low working memory demands and show that IRV is greater compared with control children in low frequency bands of IRV. She will further discuss alternative conceptualizations of IRV in relation to physiological, cognitive, and motivational indices. A discussion moderated by Peter Arnett will then ensue regarding the issues raised by the individual presentations. Correspondence: *Peter Arnett, Ph.D., Psychology, Penn State University, 522 Moore Building, University Park, PA 16802-3105, United States. E-mail: paa6@psu.edu*

**A. RABINOWITZ & P. ARNETT. Intraindividual Variability and Baseline Concussion Testing: Implications for Motivation.**

**Objective:** Baseline cognitive testing is becoming the gold standard in return-to-play decision-making after sports-related concussion. However, motivation may influence athletes' test performance and complicate interpretation. This study examines the relationship between intraindividual variability (IIV) in cognitive performance, full-scale IQ (FSIQ), and motivation.

**Participants and Methods:** Four-hundred and seventy-seven non-concussed college athletes were administered a battery of neuropsychological tests at baseline. For each task, z-scores were calculated using the athlete group as a reference. The standard deviation of these z-scores was used as an index of IIV, and the mean was derived as a measure of overall performance. An estimate of FSIQ was derived using the WTAR. Examiners rated athletes' motivation on a 7-point scale.

**Results:** Analyses revealed significant zero-order correlations between examiner ratings of motivation and IIV ( $r = -.10$ ), FSIQ ( $r = .16$ ), and overall performance ( $r = .27$ ); and between IIV and overall performance ( $r = -.40$ ). A hierarchical linear regression model predicting motivation was evaluated, controlling for overall performance in step one. IIV, FSIQ, and their interaction were entered separately in steps 2-4. The full model was significant ( $F = 11.8$ ;  $p < .001$ ), as was the F change for step four ( $\Delta F = 4.0$ ;  $p < .05$ ).

**Conclusions:** Results suggest that IIV is related to motivation in healthy college athletes, and that FSIQ moderates this relationship. Athletes with high FSIQ who demonstrated high variability in performance received lower motivation ratings. In athletes with lower FSIQ, motivation ratings were unrelated to IIV. Clinical implications of these findings will be discussed.

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**F. BARWICK & P. ARNETT. Relationship between Personality Factors and Post-Concussion Changes in Neuropsychological Performance Mean and Variability among College Athletes.**

**Objective:** To determine whether NEO-PI personality factors in college athletes relate to changes in performance mean and variability across different neuropsychological domains from pre- to post-injury.

**Participants and Methods:** Participants were 436 healthy athletes who had undergone baseline testing and 45 injured athletes who had undergone additional post-concussion testing. Mean and standard deviation indices were created at two time points (pre- and post-injury) for neuropsychological domains typically evaluated in sports concussion (reaction time, processing speed, memory, and symptom report). Baseline NEO-PI factor scores were used in cluster analysis to generate groups differing on personality variables. These groups were then compared for pre- to post-concussion changes on mean and variability indices within each neuropsychological performance domain.

**Results:** Cluster analysis generated 2 groups that significantly differed on Neuroticism (N) and Agreeableness (A). These groups also differed on symptom reporting (all  $p < .01$ ). The low-N/high-A group ( $n = 19$ ) reported significantly more symptoms at post-concussion and showed more variability in reporting compared to baseline ( $p < .05$ ), whereas the high-N/low-A group ( $n = 26$ ) reported significantly fewer symptoms at post-concussion and showed significantly less variability in reporting compared to baseline ( $p < .05$ ). No significant differences in performance mean or variability emerged for processing speed or memory domains, but there was a trend toward increased variability across reaction time tasks in the high-N/low-A group as compared to the low-N/high-A group despite equivalent mean performance.

**Conclusions:** Personality factors influence both symptom scores and reporting consistency in concussed college athletes and may also influence performance variability, but not mean performance, on reaction time tasks. Correspondence: *Peter Arnett, Ph.D., Psychology, Penn State University, 522 Moore Building, University Park, PA 16802-3105, United States. E-mail: paa6@psu.edu*

**J. BRUCE, A. BRUCE & P. ARNETT. Response Variability is Associated with Self-Reported Cognitive Fatigue in Multiple Sclerosis.**

**Objective:** Cognitive fatigue is a common, often debilitating symptom of multiple sclerosis (MS). Although many MS patients report that fatigue contributes to their cognitive difficulties, few studies have found a direct relationship between neuropsychological performance and self-reported fatigue. Response time variability (RTV) is a measure of focus and sustained mental effort. Associated with frontal systems dysfunction and white matter damage, increased RTV is common among fatiguing conditions and fatigue due to sleep deprivation. The purpose of the present study was to examine the relationship between fatigue and RTV in MS.

**Participants and Methods:** A measure of RTV was administered to 87 MS patients and 24 normal controls. Participants also completed a self-report fatigue questionnaire and a battery of neuropsychological tests.

**Results:** As expected, MS patients reported more cognitive fatigue than controls ( $t(88) = 8.22, p < .001$ ). Compared to controls, MS patients also exhibited slowed response times and increased RTV ( $t(109) = 2.33, p < .01$  and  $t(109) = 2.79, p < .01$ , respectively). RTV was associated with self-reported cognitive fatigue among normal controls ( $r = .48, p < .05$ ) and patients with relapsing-remitting ( $r = .40, p < .01$ ) and secondary progressive MS ( $r = .63, p < .01$ ).

**Conclusions:** This was the first study to examine RTV among patients with multiple sclerosis. MS patients exhibited increased RTV when compared to controls. Moreover, RTV was significantly associated with self-reported cognitive fatigue. Results highlight the need to implement newer methods to further elucidate the relationship between cognitive fatigue and neuropsychological functioning in MS.

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**G. VARGAS, F. BARWICK & P. ARNETT. Change in Performance Variability Predicts Worry in Multiple Sclerosis Patients.**

**Objective:** While worry and anxiety are recognized as prevalent concerns in Multiple Sclerosis (MS), little research has been conducted on the topic. Worry and anxiety are associated with executive functioning deficits in MS patients. Variability in neuropsychological test performance, another neglected topic of study, is a promising target for studying the correlates of anxiety and worry in MS.

**Participants and Methods:** 51 MS patients were tested at two time points approximately four years apart. At both time points they were given two tests of verbal fluency, two tests of memory, and three tests of processing speed. At time one, participants were given the State-Trait Anxiety Inventory (STAI) and at time two they were given the Penn State Worry Questionnaire (PSWQ). Z scores were calculated for each cognitive test and the standard deviation of these Z scores was used as a measure of performance variability.

**Results:** Increased performance variability over time and increased variability in the processing speed tasks were correlated with higher worry levels at time two ( $p < .05$ ). In regression analysis, change in performance variability over time predicted worry at time two after controlling for disability, performance variability, and anxiety at time one ( $p < .05$ ). Anxiety and worry were not correlated with individual task performance at either time point.

**Conclusions:** These results suggest that performance variability is a clinically useful measure and might be more related to anxiety and worry than task performance. Additionally, increasing variability in performance, especially on processing speed tasks, predicts greater worry. Possible causal relationships will be discussed.

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**S. KARALUNAS & C. HUANG-POLLOCK. Patterns of Variability in ADHD & Association with Symptom Domains.**

**Objective:** Intra-individual reaction time variability (IRV) has largely been ignored as “noise” when looking at cognitive deficits associated with clinical disorders. However, greater than expected RT variability is now recognized as an important indicator of cognitive functioning and, in particular, is one of the most prominent cognitive features associated with Attention Deficit Hyperactivity Disorder (ADHD; Klein et al., 2006). If fluctuations in RTs follow specific patterns they may serve as a valuable endophenotype that can help to elucidate physiological mechanisms underlying the disorder, and currently some evidence suggests that ADHD children show a distinct pattern of low-frequency IRV (.05-.08Hz) on high-WM demand tasks (Castellanos et al., 2005). However, patterns of variability on low-WM demand tasks have not been thoroughly explored, nor have potential subtype differences in IRV.

**Participants and Methods:** In the current study, 57 children (N of control=36, N of ADHD-C=9, N of ADHD-I=12) completed a stop task low in WM load.

**Results:** ADHD children had slower stop signal reaction times than non-ADHD controls ( $F[1, 55] = 7.89, p = .007$ ), but did not have slower mean RTs. Consistent with studies of high-WM demand tasks, fast-fourier transform (FFT) analyses indicated that ADHD children were more variable than their non-ADHD counterparts in specific low-frequency bands (.05-.08Hz;  $F[2, 56] = 3.88, p = .027$ ). Adding to previous findings, group differences were driven by ADHD-I children, who showed more low-frequency variability than controls ( $p = .021$ ). Power in the low frequency band correlated with errors of omission on the task ( $r = .644, p < .001$ ).

**Conclusions:** Results will be discussed in terms of alternative conceptualizations of IRV, including physiological, cognitive, and motivational factors. Correspondence: *Peter Arnett, Ph.D., Psychology, Penn State University, 522 Moore Building, University Park, PA 16802-3105, United States. E-mail: paa6@psu.edu*

**Invited Address:  
Neuroimaging In Single-Case Neuropsychological Studies**

**Speaker: Mitchell Valdes-Sosa**

**4:15–5:15 p.m.**

**M.J. VALDES-SOSA. Neuroimaging in single-case neuropsychological studies.**

Cognitive neuropsychology has used single case studies of brain lesioned patients, that offer valuable information on dissociation (and double dissociation) of functions, to constrain models of information processing in the human brain. These models have guided theory and research for decades yet suffer from underspecification, and are insufficiently grounded on neuroanatomy and neurophysiology. The steady development of new neuroimaging methods (e.g. functional magnetic resonance imaging, computational morphometry, diffusion guided tractography) is re-energizing this method of research. A recent spate of articles has applied these methods to single case studies and has helped refine our theoretical understanding of object recognition, attention, and language. In this course we will review the principal imaging modalities

(ERPs and source localization, fMRI, morphometry, DTI and tractography) highlighting their advantages and limitations, as well as methods for combining the information provided by each. Methodological requirements and specialized statistics for the application of imaging methods to single cases will be examined. Finally the application of this approach to visual object recognition (specially faces) and neglect will be used as examples of this approach.

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**Birch Lecture:  
The Importance Of Cross-Syndrome Comparisons:  
A Neuroconstructivist, Domain-Relevant Approach**

**Speaker: Annette Karmiloff-Smith**

**5:30–6:30 p.m.**

**A.D. KARMILOFF-SMITH. The Importance Of Cross-Syndrome Comparisons: A Neuroconstructivist, Domain-Relevant Approach.**

I will contrast domain-specific or domain-general approaches to what I call the neuroconstructivist, domain-relevant approach, taking examples from the FOXP2 gene, connectionist models of atypical developmental, the overlapping phenotypes of autism spectrum disorder and Williams syndrome, and the implications of these approaches for clinical intervention.

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**FRIDAY MORNING, FEBRUARY 5, 2010**

**Invited Address:  
Searching For The Rules Governing Brain  
Plasticity Throughout Life**

**Speaker: Bryan Kolb**

**9:00–10:00 a.m.**

**B. KOLB. Searching for the rules governing brain plasticity throughout life.**

Neocortical development represents more than a simple unfolding of a genetic blueprint but rather represents a complex dance of genetic and environmental events that interact to adapt the brain to fit a particular environmental context. Although most cortical regions are sensitive to a wide range of experiential factors during development and later in life, the prefrontal cortex appears to be unusually sensitive to perinatal experiences and relatively immune to many adulthood experiences relative to other neocortical regions. This course will first review the basic stages of brain development spanning from conception to adulthood. The course then will review the factors that influence how the brain develops. Such factors include prenatal experiences in utero as well as postnatal experiences throughout development. Examples include the effects of sensory and motor stimulation, psychoactive drugs, including both illicit drugs and prescription drugs, stress, gonadal hormones, and diet. As a result of participation in this course, the learner will achieve two

objectives: 1) have a deeper understanding of the anatomical, physiological, epigenetic, and behavioral aspects of brain development; and, 2) be familiar with leading edge work showing how experience, broadly defined, can influence brain organization in adulthood and interact with brain perturbations throughout life.

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**Symposium 6:  
Recent Advances in Prospective Memory and  
Aging: From the Laboratory to Daily Life**

**Chair: Sarah Raskin**

**Discussant: Elizabeth Glisky**

**9:00–10:30 a.m.**

**S. RASKIN & E. GLISKY. Recent Advances in Prospective Memory and Aging: From the Laboratory to Daily Life.**

**Symposium Description:** Prospective memory, or the ability to remember to execute a future intention, has been shown to be affected by age. However, the specific age effects have not been fully understood. This symposium will review prospective memory and aging from both

laboratory and clinical studies. One of the papers will discuss findings on implementation intentions and ways that this could lead to enhanced prospective remembering. Another will directly address the “aging paradox” that older adults show impairments in laboratory based prospective memory tasks but can show enhanced performance with more naturalistic tasks. The first clinical study will examine what happens to prospective memory in individuals who are HIV+ as they age. The final paper examines whether prospective memory is related to daily functioning in older adults and whether it is an early marker of global cognitive decline.

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#### **J. ELLIS & L. BUTLER. Why are retrieval cues more accessible after an implementation intention is formed?**

**Objective:** We report findings from two experiments designed to study factors hypothesised to underlie the benefits, on intention cue accessibility, of forming an implementation intention.

**Participants and Methods:** In Experiment 1 we used a standard paradigm in which performance (response latency to the cue that should prompt intention enactment) following instructions to form an implementation intention with an explicit commitment was contrasted with performance following a cue-familiarisation control condition. This was extended by including an implementation intention without an explicit commitment condition. In a second experiment a basic implementation without commitment instruction was augmented by one of two imagery perspectives: field or observer. In both studies the cues were embedded in a word search task and the experimental manipulations focused on one of four cue words embedded in a series of word search puzzles.

**Results:** The findings reveal faster response times to this ‘target cue’ following explicit commitment (Experiment 1) and field or 3rd person imagery (Experiment 2) instructions compared to the control condition.

**Conclusions:** These findings not only illuminate the mechanisms underlying the benefits of forming an implementation intention but also identify manipulations that could enhance prospective remembering.

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#### **M. KLIEGEL, I. ABERLE, P. RENDELL, N. ROSE & M. MCDANIEL. The role of cognitive control and motivation in the age prospective memory paradox.**

**Objective:** Previous research has identified ‘the age-prospective memory paradox’ of age related declines in laboratory settings in contrast to age benefits naturalistic prospective memory tasks. Various factors are assumed to account for this paradox, yet empirical evidence on this issue is scarce. In two experiments, the present study examined the effect of cognitive control in a laboratory task and the effect of motivation in a naturalistic task on prospective memory performance in young and older adults.

**Participants and Methods:** For the laboratory task (Experiment 1,  $n = 40$ ), we used a board game to simulate a “week” of daily activities and varied features of the prospective memory task (e.g., task regularity) in order to manipulate the amount of cognitive control needed to initiate prospective memory. For the naturalistic task (Experiment 2,  $n = 80$ ), we instructed participants to try to remember to contact the experimenter repeatedly over the course of one week manipulating motivation by performance-based monetary incentives.

**Results:** Results from the laboratory prospective memory tasks indicated significant age-related decline for the irregular tasks ( $p = .006$ ) but not for regular and focal tasks. In addition, in the naturalistic task, a significant interaction ( $p < .05$ ) indicated that the age benefit was eliminated when young adults were motivated by incentives.

**Conclusions:** In conclusion, the present results suggest that the variability of age differences in laboratory prospective memory tasks may partly be due to differences in the features of the prospective memory task. Furthermore, increases in motivation to perform the prospective task seem to help remedy everyday prospective memory deficits in young adults.

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#### **S. WOODS, M. DAWSON, E. WEBER, I. GRANT & I. GRANT. Event-Based Prospective Memory in Older Adults with HIV Infection.**

**Objective:** Aging and HIV disease are each independently associated with deficits in the strategic aspects of prospective memory (ProM). Considering the growing number of older adults living with HIV infection, the present study evaluated the combined effects of HIV and aging on event-based ProM impairment.

**Participants and Methods:** One hundred and eighteen participants were classified into one of four groups based on their HIV serostatus and age (i.e.,  $< 40$  years and  $> 50$  years).

**Results:** A series of Jonckheere-Terpstra tests revealed significant additive effects on event-based ProM in the expected direction ( $ps < .001$ ), with the greatest deficits apparent in the older HIV+ cohort. Follow-up regression analyses demonstrated that these between-group effects were not better explained by other demographic factors and potential medical, and psychiatric confounds. The additive effects of HIV and aging were most apparent on trials for which the retrieval cue and intention were not semantically related. In the older HIV+ cohort, performance on the semantically unrelated ProM trials was associated with executive dysfunction, older age, and lower nadir CD4 counts in the older HIV+ cohort.

**Conclusions:** Findings from this study suggest that older adults with HIV disease may experience particular difficulty with the strategic encoding and retrieval aspects of ProM, particularly when the cue is semantically unrelated to the intended action, which may be related to the neuropathological effects of these risk factors in prefrontostriatal systems that are known to underlie ProM functioning.

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#### **S. RASKIN & D. DECUIR. The relationship between prospective memory, medication adherence and the onset of dementia.**

**Objective:** There is some preliminary evidence that prospective memory may be an early marker of the development of dementia. Despite interest in prospective memory performance in older populations, there are no studies that we know of, that specifically address daily functioning.

**Participants and Methods:** . In this study, we administered the Memory for Intentions Screening Test (MIST), the Dementia Rating Scale, a self-report measure of prospective memory and Patterson’s Medication Management Adherence Scale (MMAS) to 25 healthy control subjects in each of three age groups (20-30 years of age; 40-50 years of age; and 60-70 years of age) for a total of 75 subjects. The oldest group was then re-tested on the same measures one year later.

**Results:** Comparing Group 1 (ages 20-30) to Group 2 (ages 40-50) there were no group differences for time- versus event-based cues. However Group 2 performed significantly more poorly than Group 1 on the longer time delays (15 minutes) but not on the shorter time delays (2 minutes). Group 3 (ages 60-70) performance was significantly worse on time-based cues, longer delays, and verbal response items than the other two groups. MMAS performance correlated significantly with total MIST score and MIST error score. Self-report of prospective memory was significantly related to the 24 hour delay item on the MIST.

**Conclusions:** When the oldest group was separated into low and high performance on the MIST at first testing, those in the low performance group were more likely to demonstrate impaired performance on the Dementia Rating Scale and the MMAS at the second testing..

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**Poster Session 5:  
Cross-Cultural, Executive Function/Frontal Lobes,  
Imaging(Functional)**

**9:30–11:00 a.m.**

**Cross Cultural**

**A. AGRANOVICH, A.E. PUENTE & A.T. PANTER. The Culture of Time in Neuropsychological Assessment: Do Culture-Specific Time Attitudes Explain the Differences in Timed Test Performance between Russian and American Adults?**

**Objective:** The presence of cultural differences in attitudes toward time is well documented, but no published research yet addressed the challenges that individuals from cultures dissimilar to that of test-makers may face in formal timed testing.

**Participants and Methods:** This study examined the cultural differences in time attitudes and their effect on timed neuropsychological performance in carefully matched 100 Russian and American non-clinical adult volunteers using a battery of reportedly “culture-fair” measures: Color Trails Test (CTT); Ruff Figural Fluency Test (RFFT); Symbol Digit Modalities Test (SDMT); and Tower of London-Drexel Edition (ToLDx). Participants also completed a measure of time attitudes, the Culture of Time Inventory- 33 items (COTI-33; Agranovich & Panter, in press).

**Results:** Americans significantly outscored Russians on both trials of CTT, SDMT, and ToLDx; the group differences in RFFT only approached significance. Cultural differences also emerged in COTI-33 factor scores, where Americans rated planning and punctuality significantly higher than Russians. Time attitudes partially mediated cultural differences in performance on CTT1, SDMT, and ToLDx initiation time, but did not account for the effect of culture in CTT2. Significant effect of culture was revealed in ratings of familiarity with testing procedures, where a half of the Russian sample endorsed the lack of prior experience with timed and/or standardized tests. Familiarity with standardized testing was negatively related to the scores on CTT, ToLDx, and SDMT.

**Conclusions:** These findings suggested that individuals who lack familiarity with standardized testing procedures tend to obtain lower scores on these timed “culture-fair” tests.

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**X.E. CAGIGAS, R. CASAS, C. ORIETA, C. TOLEDO, R. LAVIAN, F.W. SABB, E.D. LONDON, T.D. CANNON, N.B. FREIMER & R.M. BILDER. Are bilingual norms the answer for research within the Latina/o community? Preliminary data from a large community sample [the UCLA LA2k].**

**Objective:** A growing body of research suggests that a person’s degree of bilingualism can help to explain differences in neuropsychological test performance more readily than simply making ethnic comparisons. Although some researchers argue that the bulk of these effects are more readily explained by differences in education, the potential added benefit of further increasing specificity in historically underrepresented populations, which tend to be multilingual, warrants further study.

**Participants and Methods:** The present study included 119 Caucasian and 65 Latina/o adults living in the greater-Los Angeles area ranging from foreign-born bilingual immigrants to monolingual American nationals recruited through the UCLA LA2k study, which aims to systematically study neurocognitive phenotypes, such as memory and im-

pulse control, on a genome-wide scale. All participants completed a battery of neuropsychological tests and experimental cognitive tasks in addition to various questionnaires and genetic analyses. Degree of bilingualism was operationalized as a difference score between English and Spanish phonemic fluency.

**Results:** Hierarchical regression analyses revealed that although years of education was the strongest predictor for the Matrix and Vocab subtests of the WAIS-IV, degree of bilingualism was a stronger predictor than education for the CVLT-II, Color Trails Test, and the Letter-Number Sequencing and Digit Span WAIS-IV subtests. Interactions between bilingualism and education were marginally significant.

**Conclusions:** Although the present results are preliminary, they add to a growing body of literature suggesting that other measurable indices of cultural practices may account for unique variance in neuropsychological tests. The ramifications of these findings are significant given the exponential rates of growth in the Latina/o community within the United States and the relative paucity of research conducted within this linguistically and culturally diverse population.

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**L. CARR & J.M. FLETCHER. Neuropsychological Profiles of English and Spanish Speaking Children with Spina Bifida.**

**Objective:** The objective of this study was to evaluate the effect of language and ethnicity on neurocognitive performance in Hispanic children with spina bifida meningocele (SBM).

**Participants and Methods:** Two hundred and twenty-nine children were divided into groups based on ethnicity (White or Hispanic), language of instruction (English or Spanish), and etiology (SBM or normal control). Neuropsychological task pairs measuring automatic and integrated skills were evaluated. Multivariate analyses of variance were conducted to evaluate the effect of language, ethnicity, and etiology on task performance.

**Results:** The results did not demonstrate the hypothesized interactions of ethnicity x etiology x task or language of testing x etiology x task when SES was included as a moderator variable in the analysis. There were consistently significant effects of etiology, and varied effects of language based on language of instruction (testing) as well as ethnicity.

**Conclusions:** Power may not have been adequate to detect 3-way interactions with SES as a moderator. Further research is necessary to explore cognitive performance in Hispanic children with SBM with more attention to factors involving SES and acculturation.

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**R. CASAS, X.E. CAGIGAS, E.D. LONDON, T.D. CANNON, N.B. FREIMER & R.M. BILDER. Cross-Ethnic Equivalence of the Hopkins Symptom Checklist in Caucasian and Latino Adults in a Large Community Sample [the UCLA LA2k].**

**Objective:** The Hopkins Symptom Checklist (HSCL) is a cost-effective and time-efficient self report inventory of psychological distress that is commonly used in neuropsychological research and practice. However, normative data for the HSCL is largely limited to Caucasian and monolingual English-speaking samples, and it is unknown whether or not cultural factors impact performance on this measure. In the current study, we examined whether there were any cultural differences in performance between Latino and Caucasian adults on the HSCL.

**Participants and Methods:** Participants included 120 Caucasian and 65 Latino adults living in the greater-Los Angeles area who ranged from foreign-born bilingual immigrants to monolingual American nationals. Participants were recruited through the UCLA LA2k study, which aims to investigate the genetic bases of cognitive phenotypes such as memory and impulse control. All participants completed the Hopkins Symptom Checklist in addition to other neuropsychological tests, experimental cognitive tasks, and genetic analyses

**Results:** ANOVA analyses examining total score differences on the HSCL revealed that Caucasian and Latino participants exhibited similar levels of overall distress. However, Latino participants, and in particular those that were bilingual Spanish-English speakers, scored significantly higher on the somatization symptom dimension of the HSCL.

**Conclusions:** These results suggest that cultural factors can affect performance on the HSCL, and that researchers and clinicians should be cautious when interpreting HSCL test scores for non-Caucasian individuals. Consistent with other findings, these results also suggest that Latinos may be more likely to express psychological distress through subjective somatic symptoms.

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**M. CHERNER, P. SUAREZ, M. RIVERA MINDT, M.J. TAYLOR, L. DEBORAH, I. GRANT, L. ARTIOLA I FORTUNY & R.K. HEATON. Demographically Adjusted Norms for the Paced Auditory Serial Addition Task (PASAT) in Spanish.**

**Objective:** There are an estimated 425 million Spanish speakers in the world, approximately 30 million of whom live in the United States. A large proportion of people whose best language is Spanish reside in the region bordering the US and Mexico. Appropriate interpretive standards are needed for neuropsychological assessment in this population. As part of a larger normative effort, we generated norms for a Spanish language version of the PASAT applicable to the US-Mexico borderland.

**Participants and Methods:** A native Spanish-speaker produced audio recorded numbers for the PASAT stimuli. Computerized post-processing was used to order the numbers as in the English version, with inter-stimulus times of 3.0, 2.4, 2.0, and 1.6 seconds per digit for each subsequent trial. Participants were 180 healthy native Spanish speakers from the Mexico border regions of Arizona and California. The sample was 58% women, ranged in age from 20 to 55 years ( $M=37.2$ ,  $SD=9.5$ ) and in education from 0 to 20 years ( $M=9.9$ ,  $SD=4.2$ ). PASAT scores were converted to scaled scores to create a distribution with a mean of 10 and SD of 3. The contribution of age, education, and sex to PASAT scaled scores was examined using a fractional polynomial regression equation to arrive at a demographically adjusted T-score ( $M=50$ ,  $SD=10$ ).

**Results:** The proportion of neurologically normal subjects categorized as impaired based on the existing English language norms was reduced by 11% when applying the Spanish language norms. Some degree of misclassification was present across education ranges, although it tended to be more frequent among those with lower education. Scaled scores were 2 to 3 points higher, and T-scores were an average of 4 points higher, with the new norms. We verified that age, education, and sex were unrelated to the resulting T-scores. Raw-to-scaled conversions and the adjusted T-score formula will be presented.

**Conclusions:** Norms for this population result in fewer classification errors and add to the armamentarium of available assessment tools.

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**R. KAMAT, T.D. MARCOTTE, B. BOKIL, R. MEYER, R. DEUTSCH, S. LETENDRE, D. FRANKLIN, R.K. HEATON, S. MEHENDALE & M. GHATE. Literacy and Education Predict Neuropsychological Performance in a Cohort with a Broad Spectrum of Educational Levels.**

**Objective:** To examine the relationship between education and literacy in predicting neuropsychological (NP) performance in a group with a broad range of education and socioeconomic levels. It was hypothesized that literacy (ability to read, write and use numbers [numeracy] in daily life), would be significantly predictive of NP performance, particularly in individuals with lower levels of education.

**Participants and Methods:** 93 male and 88 female HIV seronegative control volunteers recruited for a neuroAIDS study Pune city in India.

Agings ranged from 19 to 57 years ( $M=32.88$ ,  $SD=8.12$ ), and education ranged from 0 to 19 years ( $M=9.96$ ,  $SD=4.181$ ). Participants completed a comprehensive NP battery translated into Marathi (adjusted for age and gender), and a literacy test assessing basic reading, writing, and numeracy. Numeracy was the only literacy subtest to significantly predict NP performance beyond education.

**Results:** In a combined model, both education ( $p<.0001$ ) and overall literacy ( $p<.01$ ) were predictive of overall NP performance ( $R^2=.34$ ). In order to determine whether this relationship differed according to amount of education, we split the group at 6 years of education, a common point for ending basic education in India. Both education and numeracy (both  $p<.0001$ ) predicted NP performance in the group with > 6 years ( $R^2=.30$ ). However, in those with less than 6 years of education, only numeracy ( $p<.05$ ) was predictive of NP performance ( $R^2=.19$ ).

**Conclusions:** Literacy levels provide additional information beyond education in predicting NP performance. Particularly in individuals with limited educational experience, literacy may be useful in determining expected levels of cognitive performance. Although not examined here, clinicians must remain cognizant that basic literacy may be affected by more severe dementias.

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**C.A. OJEDA & A.E. PUENTE. A List of Neuropsychological and Psychological Tests Available in Spanish: The Challenge of Testing Spanish Speakers.**

**Objective:** The objective of this study is to develop a current and comprehensive list of neuropsychological and psychological tests available in Spanish.

**Participants and Methods:** The list of Spanish tests was developed by consulting the following sources: a) Buros Mental Measurements Yearbook (Website and Online Database), b) prior research about tests in Spanish (e.g., Salazar, Perez & Puente, 2007; Puente & Lazarus, 2009), c) Hispanic Neuropsychological Society List of Spanish Tests, d) Databases such as PsychInfo or WorldCat, and e) Spanish Test publishers such as Manual Moderno Mexico Editorial and TEA Ediciones (Spain).

**Results:** We found 555 tests available in Spanish.

**Conclusions:** This comprehensive list is much longer than others previously published and reflect a more exhaustive approach to determining which tests exist. However, the list of 555 tests still represents less than 15% of tests currently available in the English language. We are now embarking on a systematic analysis of how these tests meet the criteria outlined by the Joint Committee for Guidelines of Educational and Psychological Tests.

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**P. PEREZ-ARCE, R. BOWLER, V. GOICHEVA, M. HARRIS & L. MORA. A Neurocognitive Comparison of Hispanic and White Welders Exposed to Manganese.**

**Objective:** This study presents baseline (2005) and follow-up (2008) data on the comparative performance on neurocognitive and clinical measures of Hispanic and non-Hispanic White (Whites) welders who were exposed to manganese (Mn) in confined spaces.

**Participants and Methods:** Participants included 22 Whites and 15 Hispanics at baseline. A battery of neuropsychological tests was administered and Mn blood levels taken.

**Results:** At baseline Whites scored significantly higher on 23 out of 37 neuropsychological tests (15 of the 23 were WAIS-III scores and indices). No inter-ethnic differences were found on WAIS' L-N Sequencing, Symbol Search, Arithmetic, and Matrix Reasoning tests, nor on tests of executive function, working and verbal memory. At follow-up, White welders continued to significantly outperform Hispanic welders on the same WAIS-III subtests and indices, minus Picture Completion and WMI.

At follow-up, Hispanics' blood Mn levels significantly improved compared both to the Hispanic group's own baseline levels and to those of the White welders. Hispanics' performance also improved on ROCT immediate ( $p < .003$ ) and delayed ( $p < .01$ ) memory conditions. For the entire follow-up cohort (2008), holding Mn constant, ethnicity was a significant predictor of both dominant and non-dominant finger tapping performance, with Hispanics scoring lower. No inter-ethnic differences were evident on the SCL90-R. Contrary to expectation, the significant correlation of Hispanic welders' ROCT Copy scores with PIQ ( $p < .02$ ) and Matrix Reasoning ( $p < .001$ ) was not observed in the White group.

**Conclusions:** The results elucidate the interaction between Mn exposure and cognitive measures, real-life functioning, and possibly cultural/ethnic/language influences on performance.

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#### M.O. RIVERA. Reading Instruction for English Language Learners.

**Objective:** Over the last decade research has begun to accumulate in the domain of ELLs' reading difficulties and corresponding interventions. The purpose of this study was to collect and disseminate knowledge of effective reading interventions, for ELLs in grades K through 12 who are at risk for reading difficulties or identified with a disability.

**Participants and Methods:** We examined evidence of enhanced instruction in elements of literacy and interventions aimed at improving literacy for ELLs performing below grade level. This information was culled from a variety of sources, including major literature reviews, and additional studies (especially those recently published) found through a database search.

**Results:** The findings from this review indicate that assessment plays a crucial role in the educational experience of all ELLs and assessments inform educational placements, which in turn influences academic outcomes. Instructional interventions for ELLs should be guided by and delivered within a Response to Intervention (RTI) model. In addition, at-risk ELLs need comprehensive, early, explicit, intensive intervention that reflects a close match between their source(s) of difficulty and the intervention. Ultimately, high-quality teacher preparation and professional development programs on teaching ELLs should address theoretical knowledge and pedagogical methods on second language acquisition.

**Conclusions:** Effectively meeting ELLs' needs, particularly the needs of those who struggle, requires a multi-pronged strategic approach, with significant attention to three areas: 1) assessment, 2) intervention programs or models, and 3) professional development. The findings demonstrate the significant positive impact that a reading intervention can have, particularly for the neediest ELLs. Finally, teachers with strong content knowledge and specialized training have a positive impact on student performance.

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#### M.A. SEDO, S.I. NAVARRO & C.A. MANGONE. A STROOP FOR ALL PEOPLE IN ALL LANGUAGES?

**Objective:** (Rational) FDT is a low-verbal-load test of mental interference, based on measuring the speed and efficiency of mental processing in two unstressed fluent situations and two stressed situations under much higher cognitive pressures. FDT aims at opening a multilingual window for the testing of now untestable populations.

**Participants and Methods:** (Methods) 38 demented and 20 healthy illiterates were tested, comparing the test to the Stroop, the MMSE and the CDR.

**Results:** (Results) FDT evoked reading reactions in all non-readers; and discriminated both populations, which produced curves with little or no overlap. Demented and healthy subject showed very different patterns of scores: the curve of scores is <asymmetrical> and <peaked> and

shows experimental groups wide apart, nearly without overlap (in times and in errors). Errors are only present of clinical subjects and only on the two stressed situations. Illiterates were also compared to senescent readers of English and of Spanish. The validity of the different instruments (Stroop, FDT) is compared for populations of non-readers of foreign languages or for illiterates.

**Conclusions:** (Results) FDT evoked reading reactions in all non-readers; and discriminated both populations, which produced curves with little or no overlap.

(Conclusions) FDT is appropriate for foreign language speakers, who can answer in their own language; and appropriate for non-readers of the language. The importance of the two high-mental pressure situations is suggested; and the importance of the error scores as a sign of difficulty in the flexible monitoring of the task.

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#### M.A. SEDO & G. GONZALEZ ALEMAN. EXECUTIVE TESTING OF THREE INDIGENOUS GROUPS IN THE ANDES IN SPANISH AND IN QUECHUAN.

**Objective:** FDT and FNT are low-verbal-load oral forms of the Stroop test and the TMT,

based on measuring the speed and efficiency of conscious mental processing. Those tests aim at opening a testing window to now untestable populations. They consist of two unstressed fluent situations and two stressed conscious situations with higher cognitive pressures.

**Participants and Methods:** Thirty trios of schizophrenic, siblings and control populations were tested in region of Jujuy, in Spanish or in Quechuan with a language-neutral neuropsychological battery, researching the pharmacological treatment and the risks of phenotypic subjects.

**Results:** Reliabilities were considerable (.84 to .94) and well-related to the treatment process. FNT discriminated well genotypical and phenotypical subject; and measures in its fifth situation the overload at continuous contradictory mental pressures.

**Conclusions:** FDT and FNT are appropriate for the testing of cross-cultural and cross-linguistic populations, who can answer in their own language. The importance of the highly stressed conscious situations is suggested, and the importance of error scores as proper to only clinical subjects, and only in the more difficult situations.

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#### Executive Functions/Frontal Lobes

##### S. AERTS, M. SCHENKMAN, L. RIOLO, C. ZHENG, R. KUMAR & B. KLUGER. Executive Function and Functional Mobility in Parkinson's Disease.

**Objective:** Parkinson's Disease (PD) is known to be associated with cognitive deficits, particularly in executive domains. More recent data suggests that these cognitive deficits may be important causes of disability, decreased quality of life (QOL), and potentially related to functional mobility. The goal of this study was to determine how specific measures of executive function correlated with a wide battery of subjective and objective measures of functional mobility and QOL.

**Participants and Methods:** 121 subjects with PD (over 70% male, mean age 66.5 + 9.8) participated in a longitudinal exercise study. As part of this study, data was collected on quality of life, disease severity, depression, gross motor function, objective functional mobility, activities of daily living (ADL), and three measures of executive function: spatial span backward (SSB), Stroop task, and Brief test of attention (BTA).

**Results:** Spearman correlation demonstrated a strong correlation with all measures of executive function, disease severity, and gross motor

speed. Stroop interference was uniquely associated with quality of life and self assessment of ADL. Objective tests of functional mobility correlated most with Stroop interference, less so with SSB and least with BTA and Stroop word reading. None of these measures were correlated with depression.

**Conclusions:** These results support prior research demonstrating an association between executive function and disability. Our results further suggest that unique aspects of executive function may be more important in determining both subjective and objective measures of disability, particularly response inhibition a function mediated by medial frontal structures.

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**C. AMEZCUA GUTIÉRREZ, M. RUIZ DÍAZ, M. HERNÁNDEZ GONZÁLEZ & M. GUEVARA PÉREZ. Cerebral Functionality During Visual Erotic Stimulation and While Solving the Towers of Hanoi: Effects of Sexual Arousal.**

**Objective:** Characterize the degree of coupling among the prefrontal, parietal and temporal areas during visual erotic stimulation and to determine if this affects the solving of the Towers of Hanoi.

**Participants and Methods:** 33 young men assigned to 3 groups. The Neutral Group was shown a video of a subject walking from the movie "The Long Shadow" (Zsigmond); the Erotic Group watched scenes of explicit sexual interaction from the movie "The Catwoman" (Leslie) and the Aggressive Group watched aggressive scenes of the movie "Hostel" (Roth). EEGs were recorded at rest, during visual stimulation and while executing the Towers of Hanoi.

**Results:** No significant differences were found between the groups in the execution of the Towers of Hanoi. The erotic group presented a higher prefrontal-parietal and prefrontal-temporal correlation that was not associated with efficacy in executing the Towers of Hanoi.

**Conclusions:** These different degrees of cortical coupling may be associated with the distinct strategies employed to resolve the problem.

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**L. ANDERSON, M.F. SYMINGTON, L.K. PAUL & W.S. BROWN. Decision Making in Agenesis of the Corpus Callosum: Computational Analysis of the Iowa Gambling Task.**

**Objective:** People with agenesis of the corpus callosum (ACC) have been shown to exhibit deficiencies in the domains of decision-making and complex novel problem-solving. Nevertheless, the specific nature of the problems in cognitive functioning that contribute to these deficits are not clearly understood. This study used the Iowa Gambling Task (IGT) to test decision-making ability and complex novel problem-solving in ACC.

**Participants and Methods:** Thirty-four individuals with complete or partial ACC (age 11-62; FSIQ 78-129) were compared to 19 controls (age 18-51; FSIQ 85-111) on the IGT. A trial-by-trial computational analysis called the expectancy-valence (EV) model (Busemeyer & Stout, 2002) was applied to the results of the IGT to elucidate specific differences in cognitive strategies utilized by the groups.

**Results:** The ACC and control groups did not differ significantly in overall performance on the IGT, or on the learning or choice consistency values of the EV model. However, the ACC group exhibited significantly higher attention to losses on the motivation parameter ( $p < .05$ ; ACC  $M = .62$ , Control  $M = .38$ ).

**Conclusions:** Participants with ACC performed similarly to control participants overall on the IGT, and thus the issues with decision-making are not like those seen in persons with frontal lobe disorder. However, the EV model reveals that participants with ACC are more influenced by losses than controls. Further research involving other decision contexts is needed to ascertain the specific contribution of loss aversion to decision-making and complex-novel problem-solving deficits in people with ACC.

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**K.C. BORJA & F. OSTROSKY-SOLÍS. Decision making in drug users.**

**Objective:** To assess and compare the performance of three groups of drug users (alcohol, marijuana and cocaine) and a group of young adults without drug abuse history on a gambling task.

**Participants and Methods:** 112 young adult participants were recruited (mean age 23.8 years) and all subjects gave written informed consent. 12 cocaine, 32 cannabis and 36 alcohol users were required to abstain from using the substance 24-hours before the examination. An Iowa Gambling Task adaptation standardized for Mexican population was utilized to examine the process of decision making. A control group of 32 young adults without history of drug abuse was assessed.

**Results:** An ANOVA analyses showed that both cocaine and cannabis groups had the worst performance and made more decisions that led to larger immediate gains despite higher losses. No differences were found between the alcohol group and the other groups, however, a similar strategy to the cannabis users was observed.

**Conclusions:** Drug abusers, specially those engaged in more deleterious substances, may be prone to poor decision making, showing a persistent pattern of consumption despite adverse future consequences. They prefer to engage in activities that involve immediate pleasure regardless of attempting against their health and personal and professional development. The poor decision making observed in drug users may be a preexistent deficiency that led them to start using toxic substances rather than to be a result of this exposure.

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**J. BORRANI, T. HERNANDEZ, N. ALEJOS, X. ORTIZ, M. FRIAS & P. VALDEZ. Behavioral Inhibition and Cognitive Flexibility in Juvenile Delinquents.**

**Objective:** Delinquent behavior has been related to a deficit in executive functions, which is mainly dependent on prefrontal cortex. Two components of executive functions that require a more specific analysis in juvenile delinquents are behavioral inhibition and cognitive flexibility. The aim of this study is to analyze these components of executive functions in delinquents.

**Participants and Methods:** Participants were 45 male delinquents and a control group of 88 males with no criminal records and similar age (range: 14 to 21 years, Delinquents:  $17.81 \pm 1.4$ , Control:  $17.75 \pm 1.5$ ,  $T=0.22$ , NS). All participants answered a modified version of the Stroop task that required to read 48 words written in an incongruent color ink; to name the color of the ink; and to shift from one criterion to the other. Execution on the color naming task was taken as an index of behavioral inhibition, and performance on the shifting criterion task was taken as an index of cognitive flexibility.

**Results:** On the color naming task, delinquents required more time (Delinquents:  $55.49 \pm 12.13$  sec, Controls:  $46.33 \pm 9.1$  sec,  $F=21.05$ ,  $p < 0.001$ ) and had more errors (Delinquents:  $6.29 \pm 4.98$ , Controls:  $2.23 \pm 2.98$ ,  $F=33.84$ ,  $p < 0.0001$ ) compared to controls. On the shifting criterion task, delinquents required more time (Delinquents:  $141.43 \pm 30.85$  sec, Controls:  $125.32 \pm 26.28$  sec,  $F=7.36$ ,  $p < 0.01$ ) and had more errors (Delinquents:  $22.04 \pm 12.06$ , Controls:  $14.63 \pm 9.54$ ,  $F=17.15$ ,  $p < 0.001$ ) compared to controls.

**Conclusions:** These results indicate that juvenile delinquents have problems in restraining from inadequate responses and adjusting their behavior flexibly to changes in environmental demands. This could be related to a developmental delay in the acquisition of prefrontal functions. Correspondence: *Jorge B. Borrani, Psychophysiology, Universidad Autónoma de Nuevo Leon, Mutualismo 110, Col. Mitas Centro, Monterrey 64460, Mexico. E-mail: jorgeborrani@yahoo.com.mx*

**D. BRITO, F. OSTROSKY-SOLIS, A. LOZANO, D. GRANADOS & S. CANO. Development of inhibitory response in pre-school age.**

**Objective:** To describe and analyze the effect of age on inhibitory processes in pre-school children.

**Participants and Methods:** 150 preschool regular children from Mexico City, from 3 to 6 years old (69 male and 81 were female) were studied. Subjects were divided according to age into three groups: Group 1: 50 subjects with mean age of:  $3.3 \pm 1.4$ ; group 2: 50 subjects with mean age of:  $4.8 \pm 1.9$ ; and group 3: 50 subjects with a mean age of:  $5.4 \pm 1.7$ .

Children were tested individually with four inhibitory tasks presented in a fixed order: Angel-Devil (adapted from Strommen, 1973), Day-Night stroop (adapted from Gerstadt, Hong & Diamond, 1994), Fist-Palm (adapted from Hughes, 1998) and Delay gratification (adapted from Kochanska et al., 2000).

**Results:** In all the neuropsychological measures the ANOVAs show significant differences between all age groups. Group 1 vs group 2 and 3 ( $p < 0.001$ ); and group 2 vs group 3 ( $p < 0.003$ ). Scores improved significantly with age.

**Conclusions:** Inhibitory control improves between 3 and 5 years. Discussion emphasized the effects of age on executive function and how inhibitory processes affect cognitive development.

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**C.Z. BURTON, L. VELLA, J.A. WELLER & E.W. TWAMLEY. Differential Effects of Executive Functioning on Suicide Attempts.**

**Objective:** Suicide is a major public health concern and is common among individuals with psychiatric illness. Executive functioning ability (e.g., planning, impulsivity, and problem-solving abilities) may be associated with risk of suicide attempts. We examined demographic, clinical, and executive functioning variables in suicide ideators and suicide attempters, hypothesizing that poorer executive functioning performance would increase the odds of a suicide attempt.

**Participants and Methods:** Seventy-seven participants diagnosed with major depressive disorder ( $n=30$ ), bipolar disorder ( $n=18$ ), schizophrenia/schizoaffective disorder ( $n=18$ ), or borderline personality disorder ( $n=11$ ) completed an hour-long neuropsychological battery. All were either hospitalized or residing in crisis houses following suicidal ideation ( $n=40$ ) or a suicide attempt ( $n=37$ ). Logistic regression was used to predict suicide ideator vs. suicide attempter status, with demographic variables entered on step 1, clinical variables entered on step 2, and neuropsychological variables entered on step 3.

**Results:** Consistent with our hypothesis, worse inhibition performance was associated with the suicide attempter group (Stroop interference total correct;  $OR=0.79$ ,  $p=0.010$ ); however, better problem-solving ability was also associated with the attempter group (Wisconsin Card Sorting Test total errors;  $OR=1.22$ ,  $p=0.007$ ). In addition, being married ( $OR=9.01$ ,  $p=0.042$ ) or female ( $OR=7.22$ ,  $p=0.038$ ) increased odds of membership in the attempter group. Age, education, minority status, psychotic disorder diagnosis, history of suicide attempts, and history of substance use disorder did not predict group membership.

**Conclusions:** If these findings are replicated with a larger sample, it would appear that suicide attempt risk may be associated with better problem-solving skills, but worse inhibitory control.

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**N. CADAVIDI, P. DEL RÍO, J. EGIDO & P. GALINDO. What do Socio-economic Variables can tell us about Children Executive Functioning?**

**Objective:** Nowadays, Executive Function (EF) literature characterizes by an increasing knowledge about the psychological mechanisms and

related neurological substrates that drive this cognitive process. Little is known about how social and cultural variables may influence its development. The present paper aims to highlight the role played by socio-economic status and type of school variables in the acquisition of executive skills.

**Participants and Methods:** 200 Colombian children of four, six and eight years old were tested with a group of psychological tests standardized and validated for Spanish populations, and that assess the executive skills of inhibition, working memory, planning, self-regulation, and verbal fluency. The resulted data was analysed with a novel statistical technique for psychological studies, the HJ-Biplot analysis. Specifically, this technique offers a visual representation of the children performance in each executive skill in relation to their socio-cultural characteristics.

**Results:** Although, results showed that the EF developmental trajectory of all children is ascendant, socio-economic status and type of school marked differences between children.

**Conclusions:** Strikingly, socio-economic status and type of school define which executive skills children may enforce depending on their cultural learning opportunities.

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**N. CADAVIDI & P. DEL RÍO. Approaching Executive Function (EF) studies with Functional Analysis: An Ecological perspective.**

**Objective:** The purpose of this paper is to highlight the relevance of alternative EF studies that explore the process of executive functioning in daily activities and not just the executive skills that integrate it, as has been done so far. Specifically, the aim of the study is to describe what aspects of the behavior of children can tell us something about how they use their executive functioning to regulate and control their activity in their classroom.

**Participants and Methods:** The EF assessment of 240 Colombian children of four, six and eight years that assist to public and private schools in Bogotá-Colombia was used to identify the children with the highest and lowest executive profiles. 37 children that met this requirement were videotaped during one hour of school class. The content of the resulting videos was totally transcribed and examined what of the behavior of children could tell us something about their executive functioning.

**Results:** 14 of the 37 children showed to regulate and control their behavior during a school class, principally children that obtained a high EF profile, that assist to private schools and that had four years old. On the other hand, the verbal behavior of children tended to go along with the class activity in an 80% of the time, while their body language tended to go along over a 90% of the time.

**Conclusions:** The methodological design of this research allowed discovering executive realities in children impossible to detect with traditional research designs used in EF studies.

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**J. CAMPBELL & S. CROWE. Using Cognitive Models to Explore Performance on Decision Making Tasks: The Importance of Dorsolateral Prefrontal Cortex Functioning in Establishing Payoff Expectancies.**

**Objective:** This research explored the mechanisms underpinning successful performance on two commonly used measures of risky decision making, the Iowa Gambling Task (IGT) and the Balloon Analogue Risk Task (BART). Previous research has revealed a limited relationship between the measures and suggested that while the IGT is sensitive to ventromedial prefrontal cortex damage, the BART may be related to dorsolateral prefrontal cortex (DLPFC) functioning. Recent advances in cognitive modelling however, may aid our understanding of the mechanisms underpinning performance, as the psychologically meaningful parameter estimates of the respective IGT and BART models can be compared.

**Participants and Methods:** The performance of 17 individuals with chronic alcohol abuse was compared to neurologically-intact social drinkers of similar age and education. Participants completed the IGT, the BART and battery of other neuropsychological tests.

**Results:** Analysis of the traditional measures of the IGT and BART indicated that the clinical group failed to grasp the payoffs related to the potential choices on the IGT and surprisingly, made less 'risky' choices on the BART. Analysis of the respective cognitive models demonstrated that the differences between the two groups were related to choice consistency on the IGT and possibly payoff sensitivity on the BART. Performance on the Wisconsin Card Sorting Task, a measure of DLPFC functioning, was related to both parameter estimates.

**Conclusions:** The results suggested that integrity of the DLPFC is important to establish the associations between the potential choices and the expected payoffs. This may suggest that DLPFC damage forces individuals to make choices under ambiguity rather than under risk.

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#### A. CANCELLIERE & N. MCCURDY. DKEFS Subtest Sensitivity in Traumatic Brain Injury.

**Objective:** Consecutive Canadian outpatient traumatic brain injury (TBI) referrals for neuropsychological assessment wherein the DKEFS (usually entire battery) was administered were selected for analysis. Hypothesis: DKEFS subtests would often demonstrate borderline impairment or impairment in this group expected to frequently have frontal lobe damage.

**Participants and Methods:** Thirty two moderate or severe head injury patients were selected for review. After exclusion for failing tests of engagement 27 remained (mean age and education was 23.5 and 11.5, respectively). Twenty three had positive MRI, CT scan or EEG (19 had PTA greater than 24 hours).

**Results:** Thirteen of these 27 patients had documented frontal lobe involvement on CT or MRI (more frequent involvement expected given the neuropathological process). A scaled score of seven or less yielded a hit. The Proverb Test (Total Achievement: Free Inquiry), Sorting Test (Sort Recognition Description), Color-Word Interference Test (Inhibition/Switching) and Verbal Fluency Test (Category Fluency: Total Correct) generated the most sensitive measures with hit rates of 33.3% (6/18), 35.8% (8/23), 39.1% and 47.6%, respectively. The poorest performance came from the Design Fluency Test (Total Correct) and Tower Test (Total Achievement) with hit rates of only 8.7% and 12.5%, respectively. Intermediate performance was observed on the Trail Making Test (Number-Letter Switching), 20 Questions Test and Word Context Test at 18.2%, 19.1% and 22.7%, respectively.

**Conclusions:** Many DKEFS subtests showed reasonable sensitivity. The two poorest subtests should be reconsidered. The intermediate performers may need to be reworked although practice effects may have negatively impacted sensitivity on the Trail Making Test.

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#### K.S. CHIOU, S. COSENTINO, R.A. CARLSON, P.A. ARNETT, B.M. WARDECKER & F.G. HILLARY. Relationship Between Executive Functioning and Metacognitive Monitoring Following Traumatic Brain Injury.

**Objective:** Executive functioning and metacognition are higher order, regulatory cognitive processes. The theoretical models for metacognition and executive functioning proposed by Nelson and Narens (1994) and Norman and Shallice (1986) respectively, have important similarities, including similar neural substrates in the prefrontal cortex. What remains undetermined in the clinical neurosciences is the degree to which deficits in executive functioning and metacognition overlap after disruption to frontal systems. This study used objective measures to examine the relationship between performance on executive functioning and metacognitive accuracy in individuals with traumatic brain injury (TBI).

**Participants and Methods:** 17 adults with moderate to severe TBI and 20 healthy adults completed neuropsychological tests of executive func-

tioning and metacognition. Retrospective confidence judgments were collected after each response and Goodman-Kruskal gamma coefficients were calculated. Metacognition was examined on tests of memory (i.e., metamemory) and mental flexibility (i.e., meta-mental flexibility). Independent samples t-test and correlation analyses were conducted.

**Results:** Adults with TBI performed worse than healthy adults on select executive functioning tasks. Adults with TBI demonstrated deficits in meta-mental flexibility but not metamemory accuracy. Performance on tasks of executive functioning after TBI was differentially correlated with meta-mental flexibility ( $r=0.36$ ,  $p=0.03$ ) and metamemory ( $r=0.22$ ,  $p=0.20$ ) accuracy. Correlational analysis also revealed metamemory and meta-mental flexibility to be largely orthogonal constructs.

**Conclusions:** The results suggest that subtypes of metacognitive deficit may be dissociable after TBI. A relationship was found between tasks of problem solving and meta-mental flexibility accuracy; potential moderators of this relationship will also be discussed.

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#### A.C. COOLIN, W. J.L. THORNTON, A.L. FISCHER, R. JAYAKAR & D.M. BERNSTEIN. Toward a Process-Pure Measure of False-Belief Reasoning in Adults.

**Objective:** Theory of mind (ToM) involves the ability to hold a false belief, that is, understanding that another's beliefs may differ from one's own. Studies have found that ToM correlates with traditional neuropsychological measures of inhibitory control and working memory. The present study directly examines the role of executive functioning in a novel variation of a standard ToM task using dual task methodology. This novel task is significantly positively correlated with a standard ToM task.

**Participants and Methods:** We assessed whether simultaneous completion of a secondary task that required inhibitory control and working memory decreased ToM performance in a sample of 47 adults aged 18 to 34 ( $M = 22.45$ ,  $SD = 3.62$ ). Participants completed four conditions: Memory control and false belief, both with and without distraction.

**Results:** Results of a 2 (memory control versus false belief) x 2 (distraction versus no distraction) repeated measures ANOVA revealed a main effect for distraction,  $F(1,46) = 4.11$ ,  $p < .05$ . Planned comparisons indicated that distraction decreased performance on the memory control trials,  $t(46) = 2.45$ ,  $p < .05$ , but not on the false belief trials,  $t(46) = 0.47$ ,  $p > .05$ .

**Conclusions:** Because the working memory and inhibitory control demands implemented by the secondary task decreased performance on the memory control trials but not the false belief trials, we believe this novel ToM task offers a more process-pure measure of false belief reasoning. This differs from standard ToM tasks that typically involve inhibitory control and working memory. Our findings have implications for models that examine component processes underlying mental state reasoning.

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#### S. CORREIA, D.C. AHERN, I. PIRYATINSKY & P.F. MALLOY. Frontal Systems Behavioral Scale and Cortical Atrophy in Frontotemporal Dementia.

**Objective:** To determine the association between patterns of cortical atrophy and frontal behavioral symptoms on the Frontal Systems Behavioral Scale (FrSBe) in frontotemporal dementia (FTD).

**Participants and Methods:** FrSBe ratings (family rating form) and MRI were obtained on seven patients with mild-to-moderate FTD (mean age =  $68.3 \pm 10.2$ ). Bivariate correlations were computed between pre- and post-illness T-scores on FrSBe subscales (Apathy, Disinhibition, and Dysexecutive) and estimates of anterior and posterior cortical atrophy (CSF area/total midsagittal intracranial area). MRI was available on film only. For each participant, three T1-weighted sagittal slices were

selected, including one lateral (para-insula) from each hemisphere and one midsagittal slice and converted to digital images. Manual tracing and thresholding were used to create a CSF mask of each slice which was then divided evenly into anterior and posterior regions. Anterior and posterior CSF ratios were computed for the mid-sagittal and combined lateral slices. All measurements were obtained twice, once by each of two raters, then checked for agreement and pooled.

**Results:** For the combined lateral slices, significant correlations were found between anterior (but not posterior) CSF ratios and pre-illness (but not post-illness) ratings on all FrSBe subscales (all  $r \geq .86$ , all  $p \leq .01$ ). For the mid-sagittal slice, correlations between CSF ratio and all FrSBe variables were non-significant.

**Conclusions:** This coarse preliminary provides additional validation of the FrSBe as a measure of frontally-mediated behavioral disturbance. The results suggest that FTD patients with greater lateral (but not mid-line) anterior atrophy are perceived by their families as having greater behavioral dysregulation historically.

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#### A. CURIEL, K. POLLARD, K.J. MILLER, J. KIM, G. LOWENHAUPT & G.W. SMALL. Predicting Cognitive Status Using Executive Functioning Measures.

**Objective:** A considerable body of research has focused on the neuropsychological sequelae of degenerative diseases in terms of memory functioning. However, executive functioning deficits are also common features associated with degenerative disease, both in cortical and sub-cortical dementias (Hannay, Howieson, Loring, Fischer, & Lezak, 2004). The present study sought to examine how accurately cognitive status could be predicted based upon performance on executive functioning measures.

**Participants and Methods:** Participants (N = 256) were divided into three groups according to cognitive status: intact cognition (n = 181), mild cognitive impairment (MCI; n = 31), and dementia (n = 44). Executive functioning was defined as the mean z score of five executive functioning measures: Verbal Fluency (FAS), Animal Fluency, WAIS-III Similarities subtest, Trail Making Test B, and Stroop C.

**Results:** A discriminant analysis was performed with cognitive status as the dependent variable and the mean z score of the five executive functioning measures as the predictor variable. Overall the discriminant function accurately predicted 69.9% of cases, with accurate predictions being made for 77.3% of intact participants, 38.7% of participants with MCI, and 61.4% of participants with dementia.

**Conclusions:** Results suggest that performance on executive functioning measures is an important predictor of cognitive status. Future studies and implications are discussed.

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#### S. DOLAN, S. MARTINDALE, S. MCGOWAN, L. SEJUD & A. GIARDINA. Executive Functioning is Related to Use of Relapse Prevention Coping Skills Utilized by Substance Abusers in Recovery.

**Objective:** The objective of this study is to evaluate whether various aspects of executive functioning, typically found to be impaired in substance abusers, are related to a real-world (i.e., treatment-specific) behaviors.

**Participants and Methods:** Participants were 48 substance dependent individuals in residential treatment, abstinent for at least 21 days. The verbal fluency (VF), trails (TMT), and color-word interference (CWI) measures from the D-KEFS (Delis, Kaplan & Kramer, 2001) were administered, along with an interview which assessed both the frequency of use and self-reported effectiveness of abstinence and relapse-prevention coping skills taught in treatment, both in urge-specific situations (Urge-Specific Strategies Questionnaire, USS; Monti et al., 1993; Rohsenow et al., 2005) and in their general life (General Coping Strategies, GCS; Rohsenow et al., 2005).

**Results:** Results indicated that scores on the VF Letter Fluency subtest are significantly related to the frequency of use and effectiveness of relapse prevention skills measured by the USS but not the GCS. The Category Fluency subtest was not related to either the USS or GCS. Performance on the Switching vs. Visual Scanning contrast condition of TMT was significantly related to frequency and effectiveness of coping skills on both measures.

**Conclusions:** Certain aspects of executive functioning are related to how many and how well patients use coping skills. This study leads to the conclusion that impaired executive functioning in substance abusers is meaningful for their success in achieving and maintaining abstinence. Treatment can be improved by offering different treatments to patients with different executive functioning profiles.

Supported by the Baylor University Research Committee.

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#### E. DZIERZAK. Dynamics of Changes of Executive Functions in Patients with Mild Traumatic Brain Injuries (MTBI).

**Objective:** The purpose of the study was to observe the dynamics of changes of executive functions in patients with light and mild traumatic frontal lobes injuries.

**Participants and Methods:** Seventeen patients, with changes indicated in CT, and the control group accordingly, were presented with a set of neuropsychological frontal lobes tests and methods three times during three weeks following the brain trauma (i.e. Tower of London, (TOL), Trail Making Test (TMT), Stroop Test, etc.) and after half a year after the brain trauma (e.g. Wisconsin Card Sorting Test (WCST)).

**Results:** Dynamics of change may differ according to individual factors (Leon-Carrion et al.), however in results obtained an interesting pattern of improvement may be observed. Quantitative analysis (repeated measures ANOVA) together with qualitative descriptions showed that, during the short period after the brain trauma, patients' level of functioning reaches its peak in the first and third week of recovery, whereas decreases rapidly during the second week (e.g. see TOL,  $F(1; 16) = 2.4$ ,  $p < 0.05$ ;  $\eta^2 = 0.44$ ).

**Conclusions:** Above results presents an interesting, possible brain recovery pattern and may be helpful in the future evaluation of methods in neuropsychological rehabilitation.

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#### L. FELIX, K. O'BRIEN, A. KING, M. STEPANSKY, C.R. AINSWORTH, A.V. DAVIS & J. DORFLINGER. Executive Functioning Skills in High Functioning Autism Spectrum Disorders and Attention Deficit Hyperactivity Disorder, Combined Type.

**Objective:** Research on Executive Functioning (EF) in children with Autism Spectrum Disorders (ASD) has been inconsistent. In contrast, a core feature of Attention Deficit Hyperactivity Disorder, Combined Type (ADHD) is executive dysfunction. The current study evaluated differences on performance and parent rated EF in ASD and ADHD samples.

**Participants and Methods:** Pediatric patients who met criteria for ASD (n=25) or ADHD (n=9) with an IQ above 85 were included in this study. Measures included the Wechsler Intelligence Scale for Children – Fourth Edition, the Tower and Color-Word Interference Tests from the Delis-Kaplan Executive Functioning System (D-KEFS), and the Behavioral Rating Inventory of Executive Functioning (BRIEF) Parent Report. Independent samples t-tests were conducted to evaluate for groups differences on performance and parent-rating of EF skills. Bivariate correlations were also conducted to evaluate for relationships between objective and subjective data.

**Results:** Full Scale IQ was average for both groups. Mean performances on EF measures were in the average range, with no between groups differences. Parent-ratings of day-to-day EF skills were in the clinically

significant range on the Behavioral Regulation and the Metacognition Indices, with no between groups differences. Across the subscales of the BRIEF, the only group difference was for Shift, on which the ASD group was rated to be relatively more impaired than the ADHD group [ $t(32) = -2.1, p < .05$ ]. Bivariate correlations between parent ratings and D-KEFS performances were not significant.

**Conclusions:** Overall, children with ASD and ADHD showed little differences in their executive function skills. Performance in the average range on tests administered in a structured environment translates poorly to the real world setting because both groups demonstrated significant day-to-day executive function impairment, highlighting the need for executive function based classroom and home interventions.

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**F. FIGUEROA, D. BRITO, F. OSTROSKY, A. LOZANO, E. AGUILERA & B. BETANCOURT. "Correlation between neuropsychological and functional evaluation of the executive functions"**

**Objective:** To compare results of an ecological and a neuropsychological evaluation of executive functions.

**Participants and Methods:** The neuropsychological battery (Executive Functions Battery for pre-school level) consist of 16 tasks divided in 3 subscales. The battery was applied to 71 pre-schoolers from 5 years to 5 years 11 months old ( $x = 65$  months,  $S.D. = 3.3$ ).

The Behavior Rating Inventory of Executive Function Pre-school version (BRIEF-P) consist of 8 subscales and was answered by the kid's parents.

The subscales of both batteries and the total score were correlated through a Pearson correlation.

**Results:** There was a poor correlation between both evaluations. The only positive correlation was between the neuropsychological scale of working memory with cognitive flexibility (.22) and emotional control (.21) of the BRIEF-P test.

**Conclusions:** There is a lack of correlation between the parents evaluation of their child daily behavior with the performance on the neuropsychological evaluation. This lack of correlation might be related to the fact the BRIEF-P is a subjective inventory answered and/or due to the difference in the environment in which the evaluation take place. According to Acker (1990) there are differences between a lab situation and a real life one; in an artificial situation, the structure and motivation is provided by the examiner, it focuses on specific tasks and the environment isn't punitive, while in a real life situation it is common to face non-structure and spontaneous tasks, and it is a necessary self-motivation among other factors.

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**C. FLAHERTY CRAIG, Z. SIMMONS, R. SVOBODA & A. BROTHERS. Validation of the Penn State Brief Exam for Frontal and Temporal Dysfunction Syndromes (PSFTS) in Amyotrophic Lateral Sclerosis: Application of Guilford's Structure of Intellect Theory.**

**Objective:** This study aimed to validate the PSFTS by correlation of findings to those obtained from a neuropsychological battery of measures focused on decision-making.

**Participants and Methods:** Thirty-five age, education and ALSFRS-R matched patients with an El Escorial diagnosis of probable ALS participated in the study. We applied the Structure of Intellect Theory of Guilford during the selection of both brief exam and comprehensive neuropsychological measures to which we correlated brief exam findings. Non-parametric Spearman correlations were conducted between the brief exam and comprehensive exam measure findings classified by the Guilford Operations of Cognition, Evaluation, Convergent Production, and Divergent Production.

**Results:** Statistically significant relationships were evidenced for all four Operations evaluated. Evaluation (decision making) relationships were evidenced for the brief exam task of Judgment and battery tasks of Consequences Obvious ( $p < .014$ ) and Consequences Remote ( $p = .054$ ). Problem Solving relationships included significance between 1) a brief exam task of Convergent Production (Similarities) and a battery task of Convergent Production (Missing Cartoons) ( $p < .007$ ), as well as a battery task of Divergent Production (Alternate Uses), and 2) brief exam task of Divergent Production (letter fluency) and a battery task of Divergent Production (Alternate Uses) ( $p < .0001$ ).

**Conclusions:** We validated our brief exam by demonstrating the high degree of concordance between findings generated by 35 ALS subjects who completed both the brief exam and a comprehensive neuropsychological assessment, selected by applying Guilford's Structure of Intellect Theory. The PSFTS is a valid approach to early detection of frontal and temporal dysfunction syndromes. The ability to identify emerging difficulties with decision making and problem solving in the ALS multidisciplinary clinic is of vital importance for optimal treatment planning.

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**J.C. FLORES LÁZARO & F. OSTROSKY-SOLÍS. Neuropsychological Study of Executive Functions Development from 6 to 30 years old.**

**Objective:** To study the developmental characteristics of 16 executive functions (EF) during childhood and adolescence, with a neuropsychological approach based on the sequential development of different prefrontal lobes regions.

**Participants and Methods:** 200 normal subjects from 6 to 30 years old have been selected. The 16 EF studied are representative of neuropsychological functioning of orbital, medial and dorsolateral prefrontal cortex, also representing some hemispherical differences. For this purpose a Neuropsychological Executive Functions Battery has been used (Flores Lázaro, Ostrosky-Solís & Lozano), a battery specially designed to be sensitive to developmental aspects in children and adolescents.

**Results:** Results supports in a general form, Anderson hypothesis about the sequential development of EF influenced by the sequential development of the diverse prefrontal regions; however this sequential development presents particular (qualitative) characteristics for each EF studied; they also shows a faster development of EF that depends on orbital, medial and right prefrontal cortex, and show that some EF are more strongly influenced by neurodevelopmental prefrontal sequences, but others are more dependent on environmental demands, for example verbal fluency and semantic categorization.

**Conclusions:** Although a general influence in prefrontal cortex sequential development over EF developmental sequence can be found, some EF are more sensitive of environmental demands than others, therefore are less dependent of neurodevelopmental influence. Discussion is performed in contrast with neuropsychological and neuroimaging (morphometric and functional) studies reported in literature.

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**J.C. FLORES LÁZARO & F. OSTROSKY-SOLÍS. Risk Detection Development: Complexity Processing Models vs. Traditional Neuropsychological Interpretation.**

**Objective:** To design an Iowa Card Task (ICT) developmental variant, to investigate the developmental characteristics -and test-complexity effect- on risk-detection and risk-benefit processing, during child and adolescent development.

**Participants and Methods:** Based on Crone & van de Molen (2004) and Kerr & Zelazo (2003) proposals, a developmental variant of ICT has been constructed, manipulating punishment frequency and magnitude. Sample included 160 normal subjects from 6 to 24 years old. The sample was divided in four age groups: 6-8, 9-11, 12-15 and 16 to 24.

**Results:** Results indicate no-significant age range differences between risk-detection (avoiding risk-decks), reaching maximum performance since 6-8 age range, these results are coincident with literature (Crone et al. 2005). In contrast for risk-benefit processing (total points earned), significant age-range differences has been found; reaching maximum performance at 12-15 years old range.

**Conclusions:** Test complexity analysis results coincides with literature: developmental changes in risk-benefit processing are not only related to hyper-sensibility to reward or to insensitivity to punishment (depending mainly in orbito-frontal cortex development), but also to the development of complex processing capacities, including the capacity to anticipate future outcomes: whether negative or positive ones. Therefore ICT-developmental variants design -particularly punishment frequency- is an important variable to take in consideration for "orbital-developmental-tests" analysis.

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#### **I. FOURNIER, A.A. DUROCHER & P. NOLIN. Executive functions in children : the contribution of socioeconomic status.**

**Objective:** The purpose of this study is to verify the relationships between socioeconomic status (SES) and children's performance on executive tasks.

**Participants and Methods:** The sample is composed of 98 children from 6 to 12 years of age, all regrouped using the SES index from the Hollingshead Index of Social Position (ISP). Group 1 has a SES medium-low to low (IPS mean: 61.86, SD : 12.81) and is composed of 21 boys and 21 girls. Group 2 has a SES from medium to medium-high (IPS mean : 32.20, SD : 9.32) and is composed of 23 boys and 34 girls. Each participant completed seven neuropsychological tasks, well known to evaluate executive functions (EF).

**Results:** MANOVA indicates a significative multivariate effect with all the executive tasks and both groups formed by the SES ( $F(7, 90) = 2.63, p < .05$ ), whereas group 1 has the lowest productions. Results also show that only Visual Attention, Verbal Fluency, and Design Fluency from the NEPSY significantly contributes to the effect ( $p < .05$ ), but not Auditory Attention and Response Set, Statue, Tower, and Knock&Tap ( $p > .05$ ).

**Conclusions:** Results indicate that it is important to take SES into account when elaborating norms in neuropsychological tests and as well as in assessment of children, to avoid false diagnostics. They also indicate the importance of giving accessible stimulation programs to family with low SES to better help these children. The heterogeneity of the results between executive tasks will be discussed.

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#### **A. GARCIA, B. MARTINEZ, J. TALAMANTES, C. RAMIREZ & P. VALDEZ. Analysis of Behavioral Inhibition and Flexibility on a Shifting Criteria Task.**

**Objective:** Executive functions are responsible for decision making and problem solving. These processes have been related to prefrontal cortex. Two components of these functions are behavioral inhibition and flexibility. The purpose of this study was to analyze indices of these components on a shifting criteria task.

**Participants and Methods:** Participants were 55 undergraduate students, aged  $18.07 \pm 1.19$ yr, 18 male and 37 female. Participants answered a shifting criteria task. In this task numbers "1" or "2" were displayed in color blue or red, in the center of a computer screen. Participants had to press numbers 1 or 2 of a numeric key pad. First, they had to press a key that matches the number displayed on the screen. Second, they had to press the non-matching key of the number shown on screen.

These responses were taken as an index of inhibition. Third, participants had to shift criteria according to the color of the number: if the number was blue, they had to respond pressing the matching key, and if the number was red, they had to respond pressing the non-matching key. These responses were taken as an index of flexibility.

**Results:** Non-matching responses were less efficient (matching=95.82±2.84%; non-matching=93.63±4.37;  $t=3.11, p<0.01$ ) and slower (matching=392.63±58.32ms; non-matching= 480.06±82.54ms;  $t= -6.41, p<0.001$ ) than matching responses. Also, responses to shifting criteria were less efficient (shift=82.76±10.38%; non-shift=92.05±5.92%,  $t=-5.76, p=0.001$ ) and slower (shift=690.12±95.01ms; non-shift=465.80±75.30ms;  $t=13.72, p=0.001$ ) than non-shifting responses.

**Conclusions:** The shifting criteria task could be useful to assess behavioral inhibition and flexibility in patients with a lesion or a developmental disorder in prefrontal areas.

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#### **A. GARCIA, D. JUAREZ, L. ARROYO, M. REYNA, X. ORTIZ, C. RAMIREZ & P. VALDEZ. Design of a map task to assess prevision.**

**Objective:** Executive functions are responsible for problem solving and decision making. One component of executive functions is prevision; which implies the capacity to anticipate the conditions to solve a problem. The objective of this study was to design a map task to assess prevision.

**Participants and Methods:** Ten maps were designed with as many options as possible. To that purpose the maps had an area of 20 x 18 cm, four entries at the top and four exits at the bottom; with six numbers, from 1 to 6, located in different positions on the map. All maps were solved by 29 undergraduate students, 12 males and 17 females, from 17-21 yr (aged  $18.34 \pm 1.37$  yr). The participants had to choose an entrance and to trace a path that pass by each of the 6 numbers in consecutive order. Participants had to follow the shortest path as quick as possible. They were required not to use the same path twice, not to cross a previously drawn line and not to lift the pencil from the paper.

**Results:** All participants arrived correctly to number 4, 86% arrived to number 5, 48% arrived to number 6, and only 3% finished the task. They required  $16 \pm 5$ sec to go from one number to the next. Participants could not use a simple strategy to solve the maps.

**Conclusions:** The results suggest that these types of maps could be useful to assess prevision in patients with lesions or developmental disorders in prefrontal areas.

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#### **M.G. GONZÁLEZ-OSORNIO & F. OSTROSKY-SOLÍS. Personality correlates of Executive Functions in Problem Drinkers.**

**Objective:** To compare executive functions in a sample of problem drinkers with a control group and to explore the relationship between personality and executive function .

**Participants and Methods:** Sixty college students, clasificated into two groups according to the Alcohol Use Disorders Identification Test (AUDIT) (who, 1992) score: 30 problem drinkers and 30 controls.

Personality was measured using the Temperament and Character Inventory (TCI) (Cloninger, 1993, 1994) which evaluates two dimensions, temperament and character. Neuropsychological measures included an adapted version of Wisconsin Card Sorting Test (WCST) and of the Iowa Gambling Task (IGT) (Flores, Ostrosky and Lozano 2008).

**Results:** No statistically difference between the groups in age and years of education. In the TCI we found significant higher scores in the problem drinkers in temperament : Novelty Seeking (NS) subclass and the overall NS scale. Correlation analysis showed a positive correlation between NS and preservative errors in the total score on the WCST ( $r=.407, p=.039$ ) and with the amount of risk cards in IGT.

**Conclusions:** The biological basis of NS its association with dopamine D4 receptor in the human brain which is highly distributed in prefrontal and limbic regions ( Meador-Woodruff et al., 1996) Neuropsychological performance could be related to different mechanisms, for example IGT results suggests a hypersensitivity to reward in the problem drinkers group whereas the preservative errors on the WCST could be associated with the severity of neurotoxic mechanism in the use of addictive substances.

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**K.M. HARRELL, E.J. MARCO, L.K. PAUL, E.H. SHERR & W.S. BROWN. Processing Speed on the Trail Making Test in Agenesis of the Corpus Callosum.**

**Objective:** Previous research with the Delis-Kaplan Executive Function System (D-KEFS) demonstrated that individuals with agenesis of the corpus callosum (ACC) had significantly poor performance on the Color-Word Interference task. Post hoc analyses indicated that slowed processing speed was the fundamental contributing factor (Harrell et al, 2008). This research further explored processing speed in executive functioning using the Trail Making subtest of the D-KEFS

**Participants and Methods:** Individuals with complete or partial ACC (N = 28; age = 26.8 +/- 14.5; FSIQ = 97.6 +/- 13.8) were administered all five conditions of the D-KEFS Trail Making subtest. Age-, gender-, and IQ-matched controls (N = 53; age = 27.0 +/- 16.1; FSIQ = 98.6 +/- 10.9) were selected from the D-KEFS normative dataset. Age corrected scaled scores were used for comparison.

**Results:** Individuals with ACC scored significantly lower than controls on Visual Scanning (p < .01), Number Sequencing (p < .01), Letter Sequencing Conditions (p < .01) and Number/Letter Switching (p < .05). No significant group differences were noted on the Motor Speed Condition. Contrast measure analysis indicated no disproportionate impairment in cognitive flexibility relative to baseline component skills. There were no significant differences between partial and complete ACC group on any demographic or performance measure.

**Conclusions:** This outcome supports previous findings that individuals with ACC have significant impairment in cognitive processing speed, while executive function (inhibition and cognitive switching) is preserved. This processing speed deficit did not involve motor speed, suggesting that the problem is specific to the speed of cognitive operations. Correspondence: *Warren S. Brown, Ph.D., Travis Research Institute, Fuller Grad Sch of Psych, 180 N. Oakland Ave., Pasadena, CA 91101, United States. E-mail: wsbrown@fuller.edu*

**K.P. HEINRICH, M. BEST & C. GOLDBERG. CANTAB Performance in Children Undergoing Open Heart Surgery.**

**Objective:** Children with congenital heart defects are at increased risk for neurocognitive impairment (Miatton et al., 2006). Despite studies suggesting average intellectual functioning following surgical correction, these children may show deficits in executive functioning, working memory, or attention skills (Bellinger et al., 2003) although conclusive research is lacking. As part of an ongoing longitudinal study of children with surgical correction of congenital heart defects, this study examined performance on a battery of tests including measures of executive functioning, working memory, attention, and reaction time. It was hypothesized that children would show decrements in performance post-surgery.

**Participants and Methods:** Participants were seventeen children with surgically corrected congenital heart defects. Nine children underwent surgical repair of atrial septal defect and eight children underwent RV-PA conduit placement. Cognitive measures included tests from the Neuropsychological Test Automated Battery (CANTAB; CeNeS, 1998). Children were tested prior to surgery and at one month post-surgery follow-up.

**Results:** Mixed model ANOVA analyses were conducted to examine the impact of surgery on CANTAB test performance in the two groups of children. No significant differences in test score performance pre-surgery compared to post-surgery were found for any CANTAB test. There was no significant difference in test score performance between the two different cardiac groups.

**Conclusions:** In this preliminary study no significant changes in executive functioning, working memory, attention, or reaction time were found following surgical correction of congenital heart defects. Longer term follow-up will allow for monitoring of neurocognitive changes over time. Future study with larger sample size and additional cognitive and behavioral measures is needed.

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**M. HERNÁNDEZ, L. RIZO MARTÍNEZ & M. GUEVARA PÉREZ. Age-effect on the prefrontal-parietal correlation: Performance of the Tower of Hanoi task.**

**Objective:** studied the functional coupling during execution of Towers of Hanoi in relation to the age.

**Participants and Methods:** 51 healthy males classified into three groups: G1, 11-13; G2, 18-20 and G3, 26-30 years of age. EEG recording was carried out at the F3, F4, P3 and P4 derivations under two conditions: basal and performance of the Towers of Hanoi task. Inter-hemispheric (INTERr) and intrahemispheric (INTRAr) correlations were calculated for six frequency bands: delta, theta, alpha1, alpha2, beta1 and beta2.

**Results:** The execution parameters of the Towers of Hanoi task showed no significant differences among the groups, though the majority of younger subjects failed to complete it. The older subjects presented a higher correlation in all derivations and bands. In the comparison between conditions, younger subjects who failed to complete the task, showed only increased parietal INTERr in the theta and alpha2 bands. The G2 group showed an increased prefrontal INTERr in the delta and theta bands, as well as an increased parietal INTERr and prefrontal-parietal INTRAr in all frequency bands, while the subjects in G3 showed increases of selective frequency bands in the parietal INTERr and INTRAr, mainly in the right hemisphere.

**Conclusions:** These correlation data show that the degree of coupling between the prefrontal and parietal cortices changes with age during the performance of the HANOI task. Taken together, these data could be related to the efficacy in the execution of this test and, therefore, to the degree of cerebral maturity underlying said execution.

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**L. JACOBSON, M. RYAN, R. MARTIN, M.B. DENCKLA & E. MAHONE. Verbal Working Memory Influences Processing Speed and Reading Fluency Deficits in ADHD.**

**Objective:** Processing speed deficits can affect reading efficiency, even among individuals who can recognize and decode words accurately. Children with ADHD who recognize and decode words accurately can have inefficient reading fluency, leading to a bottleneck in other cognitive processes. This "slowing" in ADHD is associated with deficits in a fundamental component of executive function underlying processing speed—response preparation.

**Participants and Methods:** Participants (31 ADHD, 14 controls), ages 9-14, screened for language disorders, word reading deficits, and psychiatric disorders, were administered measures of processing speed, reading fluency, working memory, and auditory attention.

**Results:** Compared to controls, children with ADHD had reduced oral (GORT-IV Fluency; p=.001) and silent (WJ-III Reading Fluency; p=.05) reading fluency, and reduced processing speed (WISC-IV PSI,  $\Delta R^2=.08$ , p=.03), primarily driven by deficits on Coding ( $\Delta R^2=.08$ , p=.02). In

contrast, groups did not differ on WISC-IV-I Coding Copy speed ( $p=.93$ ) or consistency ( $p=.36$ ) of response. After controlling for copying speed, sex, and group, this slowed “processing” speed (e.g., WISC-IV Coding) was best predicted by verbal working memory measures ( $\Delta R^2=.15$ ,  $p=.01$ ), but not by measures of auditory attention span or spatial working memory. In turn, “processing” speed (i.e., Coding, residualized copying speed and sex) was a significant predictor of oral, but not silent, reading fluency (GORT-IV- Fluency,  $\Delta R^2=.11$ ,  $p=.03$ ; WJ-III Reading Fluency,  $\Delta R^2=.01$ ,  $p=.53$ ).

**Conclusions:** Abnormalities in working memory and response preparation (which are frontally-mediated and enter into the output side of processing speed) contribute to deficits in reading fluency in ADHD more than posteriorly-mediated problems with orienting of attention or visual processing of the stimulus.

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#### L. JACOBSON & T. ZABEL. Executive Functions and Self-Care Initiation in Adolescents and Young Adults With Spina Bifida.

**Objective:** Executive functioning deficits have been well-documented in youth with Spina Bifida (SB). These deficits impact implementation of medical self-care and adaptive skills, but few data exist regarding ongoing development of executive abilities in SB and their impact upon the attainment of functional outcomes in adulthood.

**Participants and Methods:** Parents ( $N = 38$ ) rated daily functioning of their children with SB (mean child age = 17.47 [range: 10-29]; 47% female) using an online version of the Kennedy Independence Scales-Spina Bifida Version, a measure of the executive control components of medical and adaptive self-care skills.

**Results:** Although most caregivers expect independent initiation of bladder (94%) or bowel (72%) self-care, fewer reported that they believed their children would independently initiate their self-catheterization (58%) or bowel management program (32%) without reminders. Parent-reported independent initiation of medical self-care (defined by independent self-catheterization and/or bowel management) was correlated with age ( $\rho = .426$ ,  $p = .009$ ), with improvement in anticipated medical initiation in individuals over age 16 (75% initiate self-catheterization, 44% initiate bowel management). The majority had lumbar level lesions (71%; 11% thoracic); lesion level was not associated with medical initiation. For those over age 16, medical initiation, but not lesion level, was associated with employment status [ $\chi^2(1) = 4.02$ ,  $p = .045$ ].

**Conclusions:** The observed trend suggests improvements in independent initiation of self-care skills as individuals with SB enter adulthood. Additional research is needed to determine whether this trend represents ongoing executive development (physiologic maturation) or an improvement in functioning due to continued emphasis and practice of core skills.

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#### J.M. JOB, J. PEI, K.V. KULLY-MARTENS & C. RASMUSSEN. Executive Function and Memory in Children with Fetal Alcohol Spectrum Disorder.

**Objective:** Recently, executive function (EF) and memory have been implicated as major deficits in Fetal Alcohol spectrum Disorder (FASD) (Rasmussen, 2005). One widely used instrument for evaluating the relationship between EF and memory is the Rey-Osterreith Complex Figure Test (ROCF; Osterreith, 1944; Rey, 1941). The ROCF has proven useful among children with learning disabilities, autism, and Attention-Deficit Hyperactivity Disorder (ADHD) (Kirkwood et al., 2001). However, little research has been conducted among children with FASD to determine a profile of strengths and weaknesses and how these deficits vary with age.

Thus, the objectives for the present study were twofold: to determine whether children with FASD (a) perform differently than controls (CTRL), and b) present with a distinct pattern of performance.

**Participants and Methods:** Seventy children (30 FASD, 40 CTRL), aged 6 to 12 years, were tested using the RCFT (Meyers & Meyers, 1995). The application of the Developmental Scoring System for the ROCF (DSS-ROCF; Bernstein & Waber, 1996) allowed for the objective evaluation of performance within a developmental context and determination of age-appropriateness of the child’s Copy and Recall productions.

**Results:** Significant group differences were revealed with children with FASD demonstrating substantial difficulties in organization, accuracy, and memory. Among children with FASD, a distinctive profile of weaknesses emerged across age, lending support to the argument that children with FASD experience continual deficits in EF and memory throughout their development.

**Conclusions:** Characterizing the EF and memory deficits in children with FASD is vital to the development of effective interventions aimed at improving functioning and enhancing academic ability. It is suggested that information from the present study will help to improve understanding of functioning in this population as well as provide insight into how to address EF and memory deficits in assessment and intervention approaches (Rasmussen, 2005).

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#### J. JOSEPH, H. COLLINS, X. LIU, Y. JIANG & T. KELLY. Exploring Different Facets of Impulsive Sensation Seeking in a Response Inhibition Task.

**Objective:** Impulsivity and sensation seeking are broad terms that encompass various behaviors and different aspects of personality, but the underlying neural substrates are not well characterized.

**Participants and Methods:** In the present fMRI study, twenty high and twenty low sensation seekers (10 males in each group) completed a go/no-go task.

**Results:** Overall, low sensation seekers activated an inhibitory network (right inferior and right middle frontal cortex and mid-cingulate) more strongly on no-go than on go trials as compared to high sensation seekers. In contrast, high sensation seekers more strongly recruited limbic (bilateral insula, temporal pole) and motor regions (right precentral cortex and right supplementary area) on go trials as compared with low sensation seekers. Together, these findings indicate that low sensation seekers more strongly engage an inhibitory system whereas high sensation seekers more strongly engage an “activation” system that may ready the individual for action. Different aspects of impulsivity were explored beyond the influence of sensation seeking status. Boredom susceptibility was positively associated with magnitude of fMRI response on go trials in several brain regions in either the inhibitory or activation system, but Urgency predicted magnitude of “go” fMRI response only in the activation system. Interestingly, the anterior cingulate and right inferior parietal cortex were more strongly engaged on no-go trials for low sensation seekers but more strongly engaged on go trials for high sensation seekers.

**Conclusions:** We speculate that these regions may be driven by different motivational incentives in high and low sensation seekers.

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#### N.C. KELLY, R.T. AMMERMAN, M.D. RIS, J.R. RAUSCH & S.C. OP-PENHEIMER. Executive Functioning and Psychosocial Adjustment in Young Adolescents with Spina Bifida.

**Objective:** Research indicates children with spina bifida are at risk for metacognitive but not behavioral regulation deficits as measured by the Behavior Rating Inventory of Executive Function (BRIEF). They

also have more psychosocial difficulties in comparison to healthy children. The contribution of neuropsychological assets and liabilities to psychosocial adjustment has received limited attention. This study examined the role of metacognition in psychosocial adjustment in children with spina bifida.

**Participants and Methods:** Participants were children with spina bifida ( $n=51$ ; Mean age = 13.0, SD = 2.4) and healthy controls ( $n=45$ ; Mean age = 11.8, SD = 1.9). Executive functioning was measured by Metacognition composite scores from the BRIEF (completed by mothers). Measures of psychosocial adjustment included subscale domains of the Behavior Assessment System for Children (BASC-2, completed by mothers), Child Depression Inventory (CDI, completed by children and mothers), and Loneliness Scale (completed by children).

**Results:** Analyses were conducted to determine the relationship between Metacognition and psychosocial adjustment, and the contribution of neurodevelopmental disorder status (spina bifida vs. controls) after controlling for Metacognition. Results indicated Metacognition related strongly to psychosocial adjustment; Metacognition mediated the relationship between neurodevelopmental disorder status and psychosocial outcomes. Often, Metacognition fully explained this relationship. Effect sizes ranged from 0.32 to 0.99.

**Conclusions:** Differences in psychosocial adjustment between young adolescents with and without spina bifida can largely be explained by metacognition. These results have implications for therapeutic interventions in young adolescents with spina bifida. Targeting executive functioning skills, such as self-monitoring, may prove important in optimizing psychosocial outcomes in this population.

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#### **S. KHEN, M. DANIEL, L. HOSKINS, K. GILLIS & K. BROCKWOOD. Gender Effects on Executive Functions in Behaviorally Disturbed Adolescents.**

**Objective:** Research suggests adolescents with Conduct Disorder (CD) may have selective impairment in executive functions (EF). However, most of these studies have been done with boys and there is a paucity of studies with CD girls. This study examined the association of gender and EF in CD adolescents.

**Participants and Methods:** One-hundred four participants, ages 13-18, were divided equally into four groups: 1.) delinquent girls, 2.) delinquent boys, 3.) control girls and 4.) control boys. Control participants lived in the community, had no history of behavioral/medical/developmental problems, and were matched on age ( $\pm 4$  months) and gender to delinquent participants. All delinquent participants resided in either a state youth corrections facility or a court mandated secure residential treatment facility. As part of a larger neuropsychological battery, participants were administered the 2-subtest Wechsler Abbreviated Scale of Intelligence and the Delis-Kaplan Executive Function System (DKEFS). All participants had FSIQ  $> 79$ . Attention deficit-hyperactivity was controlled for in the delinquents.

**Results:** There were no interaction effects for gender and delinquency on any DKEFS subtest. After Bonferroni correction, main effects were found for gender on Verbal Fluency ( $F[1,100]=13.100$ ,  $p=.000$ ) and for delinquency on Card Sorting ( $F[1,100]=8.182$ ,  $p=.005$ ).

**Conclusions:** These results suggest there are no unique patterns of EF related to gender in juvenile delinquents. Gender based differences in verbal fluency likely reflect well established gender-related differences in language ability rather than differences in EF per se. Control – delinquency differences in abstraction and organization are similar to other research findings and may reflect EF deficits in CD adolescents.

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#### **W.D. KILLGORE, D.B. KILLGORE, G.H. KAMIMORI & T.J. BALKIN. Caffeine Minimizes Behavioral Risk-Taking During 75 Hours of Sleep Deprivation.**

**Objective:** Moderate sleep deprivation (up to two nights) has only minimal effects on risk-taking propensity and caffeine appears to have a negligible effect on these behaviors. Presently, the effects of caffeine on risk-taking were examined over a longer duration of sleep deprivation (i.e., three nights) using a behavioral risk taking measure that requires the expenditure of effort (i.e., Balloon Analog Risk Task; BART).

**Participants and Methods:** Twenty-five healthy participants (21 men) ranging in age from 20 to 35 were deprived of sleep for 75 hours. In a double-blind administration, subjects received 200mg caffeine ( $n=12$ ) or placebo ( $n=13$ ) in a chewing gum formulation bi-hourly from 0100-0700 each morning during the sleep deprivation period (i.e., total 800 mg/session). The BART was administered at 10:20 each morning. Mixed-model analysis of covariance, controlling for education level, handedness, study week, and total BART pumps at baseline was used to analyze the BART Cost/Benefit Ratio.

**Results:** A significant drug x session interaction ( $p=.023$ ) was found. Caffeine and placebo groups did not differ for the first two days of sleep deprivation, but by the third day (75 hours awake), the placebo group showed significant increases in risk-taking whereas the caffeine group remained stable and was significantly lower in risk-taking than the placebo group.

**Conclusions:** Overall, risky behavior was not affected by sleep loss of up to two nights duration. However, when extended to three nights, sleep deprivation was associated with greater risk-taking, but this increase was prevented by caffeine. Caffeine may provide some protection against risky behavior during conditions of extreme sleep deprivation.

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#### **W.D. KILLGORE & T.J. BALKIN. Vulnerability to Sleep Loss is Affected by Baseline Executive Function Capacity.**

**Objective:** Individuals differ in their ability to sustain performance during sleep loss. Some evidence suggests that this trait-like capacity may be partially related to prefrontal control mechanisms and may have some genetic basis. We tested the hypothesis that individuals with better functioning of the prefrontal cortex, as measured by executive function tasks, may be less vulnerable to fatigue.

**Participants and Methods:** While rested, 54 healthy adult volunteers (29 men; mean age = 23.5 years, SD = 4.0) completed a battery of neurocognitive tests including executive functioning (i.e., Letter Fluency; Stroop Color-Word Test; Color Trails Test) and non-executive tasks (i.e., demographics, intelligence, perception, handedness, morningness-eveningness, and control portions of the Color Trails and Stroop Tests). Participants were deprived of sleep for 41 hours and completed psychomotor vigilance testing (PVT) bi-hourly. Two groups were formed comprising the upper ("Resistant"  $n=13$ ) and lower ("Vulnerable"  $n=13$ ) quartiles of performance on the PVT.

**Results:** Resistant subjects scored significantly higher than Vulnerable subjects on the three baseline tasks designed to assess prefrontal executive function abilities ( $p<.05$ ), whereas groups did not differ on any of the non-executive function tasks, intellectual functioning, or demographic variables including age, education, morningness-eveningness, or recent sleep history.

**Conclusions:** Individuals with higher baseline executive function capacities were more resistant to the effects of sleep deprivation on and vigilance, providing support for the hypothesized role of prefrontal functioning in fatigue vulnerability. Further work is needed to determine the extent to which differential performance at baseline is itself a function of habitual sleep duration.

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**S. LINDQVIST & L.B. THORELL. Hot and Cool Executive Function in 4-12-year-olds: Development and Relations to Emotional Aspects.**

**Objective:** The present study investigates developmental trends of hot and cool EF in 4-12-year-olds. Regarding cool EF, latent variables are created for inhibitory control (IC), working memory, and complex EF (tasks tapping both WM and IC). The present study also investigates the relation between EF and regulation and recognition of emotions, which in most previous studies have only been done in restricted age-groups and with a focus on one component of EF.

**Participants and Methods:** Participants were 47 children in four age-groups (4-5 yrs, 6-7, 8-9, 10-12) on three tasks for each cool EF component, two hot EF-tasks and one emotion recognition task were administered to the children in a sample at preschool/school. Parents completed a questionnaire about their child's emotion regulation.

**Results:** Significant age effects were found for all latent cool EF variables as well as for the DA-task. Developmental curves were steeper for performance on the cool EF tasks compared with the DA-task. Regarding the relation between EF and emotional functioning, there was a significant positive relation between IC and regulation of positive emotions. There were significant positive relations between all cool EF variables and emotion recognition. Regarding hot EF, the only significant relations were between CGT and recognition of surprise and happiness.

**Conclusion:** The results indicate that the development of cool EF in young children is more pronounced compared to hot EF. The relations between cool EF and emotional functioning along with the lack of relations between hot EF and emotional functioning implies that cognitive, compared to motivational, aspects play an important role in some emotional functioning. Correspondence: *Sofia Lindqvist, Dept. of psychology, PO Box 1225, Uppsala SE-751 42, Sweden. E-mail: sofia.lindqvist@psyk.uu.se*

**S.M. LIPPA & R.N. DAVIS. Inhibition/switching is Not Necessarily Harder Than Inhibition: An Analysis of the D-KEFS Color-Word Interference Test.**

**Objective:** Switching between inhibiting an automatic response and not doing so (inhibition/switching) is not always harder than simply inhibiting an automatic response (inhibition). We examined the prevalence and correlates of this atypical performance pattern on the Color-Word Interference Test (CWIT) from the Delis-Kaplan Executive Function System (D-KEFS).

**Participants and Methods:** Patients seeking outpatient neuropsychological evaluation (n = 119) completed the D-KEFS CWIT as part of a larger test battery. Participants were classified as "atypical" if they were faster or made fewer errors on the switching trial than the inhibition trial.

**Results:** Most patients (57.1%) demonstrated an atypical pattern of performance for either completion time or errors. Patients with an atypical pattern for completion time were significantly slower at color naming and word reading than patients with a typical pattern. Patients with an atypical pattern for errors performed better on measures of learning and semantic verbal fluency than patients with a typical pattern.

**Conclusions:** A majority of patients in our sample exhibited atypical performance on the CWIT, and some preliminary correlates of this pattern might aid clinical interpretation. Patients who perform the inhibition/switching trial faster than the inhibition trial may do so because the inhibition/switching trial involves only half as much color naming as the inhibition trial, and color naming is typically a slower process than word reading. Patients who demonstrate fewer errors on the inhibition/switching trial than the inhibition trial may have learning characteristics that interact with the order of administration of the CWIT (i.e., inhibition always precedes inhibition/switching).

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**A. LOZANO, B. BETANCOURT, E. AGUILERA & F. OSTROSKY-SOLIS. Multifactorial Characteristics of Executive Functions Development in Pre-schoolers.**

**Objective:** To identify factors in which various subtests that assess EF in children are grouped.

**Participants and Methods:** Two hundred preschool children from 3 to 6 years old were selected. They were assessed individually with 11 executive function (EF) tasks that were adapted for pre-school children: digits backwards, stroop task, Corsi blocks backwards, Go/NoGo tasks (Carlsson, 2005), the WCST, Tower of Hanoi, the Iowa Gambling task and a multilocation search task (Andersson, 2005).

**Results:** The sample included 115 female and 85 men with an age range from 37 to 72 months ( $x = 58.2 \pm 11.7$ ). Statistical analyses included a descriptive analysis of demographic variables and a factorial analysis with varimax rotation in order to identify factors in which the EF tasks are grouped.

Three factors explained 57.3% of the total variance. The first factor (36.8%) included working memory and inhibitory control tasks, the second one (11.2%) included decision making and cognitive flexibility tasks whereas the third one (9.2%) included a multilocation search task which requires an adjustment of behavior in response to a change in contingencies

**Conclusions:** Current results, although preliminary, showed that cognitive processes that underlie EF in preschoolers grouped in a different way from that reported in older children and adult samples (Huizinga, Dolan & van der Molen, 2006; Miyake, 2002; Miyake et al, 2000). This may suggest that during early development, EF are more dependant of one another and as children develops and prefrontal areas mature, they become dissociable.

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**E. LUBOYESKI KALKUT, D.C. DELIS & S. HAN. Subjective and Objective Neuropsychological Assessment of Executive Functioning in Young Adults.**

**Objective:** This study examined the measurement of executive functions (EFs) through objective and subjective methods. EFs have traditionally been assessed through objective assessment. Recently, self-report EF measures have emerged. The current study investigated the association between subjective and objective EF measures and the latent factor structures of these measures.

**Participants and Methods:** Ninety-five undergraduates (82% female), ages 18-24 (mean age = 19, SD = 2.2 years) were administered the Delis-Kaplan Executive Function System (D-KEFS) and the Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A). Between-measure association was assessed with correlational analysis. Confirmatory Factor Analysis (CFA) tested a priori factor models. Four BRIEF-A and three D-KEFS models were assessed for adequate fit using criteria proposed by Hu and Bentler (1998).

**Results:** Moderate correlations ( $r \geq .22$ ) were found between variables within the same measure. Two significant correlations emerged between the BRIEF-A and D-KEFS. D-KEFS Sort Recognition was significantly associated with BRIEF-A Plan/Organize subscale ( $r = -.23, p < .05$ ), and D-KEFS Design Fluency Switching was significantly associated with BRIEF-A Inhibit subscale ( $r = .22, p < .05$ ).

The three-factor model out of our tested models provided the best fit to BRIEF-A data, with all fit indices suggesting adequate fit (RMSEA < .10; SRMR < .08; NNFI and CFI > .90). The five-factor model out of our tested models provided the best fit to D-KEFS data, with all fit indices suggesting adequate fit (RMSEA < .10; SRMR < .08; NNFI and CFI > .90).

**Conclusions:** Objective and subjective measures of EF were largely unrelated. The three-factor BRIEF-A model and the five-factor D-KEFS model emerged as the respective best fitting models. Results have implications for the use of objective and subjective EF assessments in clinical practice, and provide recommendations for the conceptualization of EF.

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**S. MCCANN, T. WARNER, S. HEATON, F. DAVIS EYLER & M. BEHNKE. Latent Growth Curve (LGC) Analysis of the Development of Working Memory (WM) and Set-Shifting Abilities in a Prospective, Longitudinal Cohort of Children with Prenatal Cocaine Exposure (PCE).**

**Objective:** Evaluate the effect of PCE, other prenatal drug exposures (alcohol, tobacco, marijuana), adjusted birth head circumference (ABHC), gender and the caregiving environment (HOME) on the development of two domains of executive functions, WM and set-shifting.

**Participants and Methods:** Participants were 237 children of prenatal cocaine users identified by structured interviews and urine toxicology and a matched non-cocaine-using comparison group, who were prospectively-enrolled in a longitudinal study. Repeated assessments at ages 7, 10½, and 12½ by blinded evaluators included the Wechsler Digit Span subtest (WM) and the Trail Making Test (set-shifting). Two LGC models with predictors (PCE, ABHC, gender, and HOME) and covariates (other drugs exposures) were created to describe the cognitive development of the individuals and the group over time.

**Results:** The data fit both models well. Prenatal cocaine exposure did not directly predict the level (mean performance at age 7) or the development of WM or set-shifting. Prenatal cocaine exposure was negatively associated with ABHC and positively associated with the amounts of the other prenatal drug exposures. Better home environments had a positive effect while ABHC had a negative effect on both the level and development of WM. Being female was related to better initial set-shifting but did not predict development over time in either domain.

**Conclusions:** In this large sample of rural, low SES, predominantly African American children, variables associated with PCE and stimulating caregiving environments played a role in the development of some executive functions, though there appeared to be no direct effect of PCE. Implications and future directions will be discussed.

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**A.E. MOLNAR, R. BRAHMACHARI, M.Y. KIBBY & G.W. HYND. Relations Between Regions of the Cingulate and Cognitive Measures in Children with Dyslexia or ADHD.**

**Objective:** Research suggests that the anterior cingulate is related to executive functioning. However, other regions of the cingulate, including the middle and posterior segments, have not been well-studied in relation to cognitive functioning. Therefore, the purpose of this study was to examine the relations between the right and left anterior, middle, and posterior cingulate and measures of cognitive functioning in children with dyslexia, ADHD, or controls.

**Participants and Methods:** Data were obtained from a study on dyslexia (NIH R01 HD26890). Data analysis and write-up were supported by a separate grant (NIH R03 HD048752). Participants, ages 8 to 12 years, completed a neuropsychological battery and a MRI scan: 20 had dyslexia, 18 had ADHD, and 16 were controls. The cingulate was traced on every slice in the sagittal plane. Neuroanatomical boundaries for the anterior, middle, and posterior sections of the cingulate were based on the work of Crespo-Facorro et al. (1999).

**Results:** No differences in cingulate volumes were found between groups ( $p > .05$ ). Pearson correlations revealed significant relations between the left posterior cingulate and phonological STM and rapid automatic naming; left middle cingulate volume was related to vocabulary knowledge. All right cingulate volumes were related to aspects of executive functioning, and the posterior region was related to measures of phonological awareness and STM.

**Conclusions:** Although we did not find group differences in cingulate volume, the right cingulate was related to measures of executive functioning. Moreover, the posterior region was related to measures of phonological processing bilaterally.

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**T. NOVAKOVIC-AGOPIAN, A. CHEN, S. ROME, A. ROSSI, R. MCKIM, G. TURNER, J. GARFINKLE, C. KENNEDY & H. CASTELLI. Assessment of Executive Functioning with Goal Processing Scale - a Complex "Real-Life" Functional Performance Test: Pilot Results.**

**Objective:** An important, but often neglected, aspect of assessment of executive functioning is the evaluation of performance on "real life" functional tasks requiring planning, multitasking and goal management in a low structure environment. We will present the Goal Processing Scale (GPS), a novel functional assessment instrument designed to address this, as well as preliminary data on inter-rater reliability and convergent validity. GPS assesses an individual's performance on sub-domains of executive functioning including: planning; initiation; attentional maintenance, sequencing and switching; self-monitoring; divergent thinking; task execution; memory and awareness.

**Participants and Methods:** Ten individuals, ages 29-62, with chronic brain injury, and mild to moderate executive dysfunction completed two functional assessment tasks, the Goal Processing Scale (GPS), and the Multiple Errands Test (MET), as well as a comprehensive neuropsychological test battery.

**Results:** Participants' performance on the GPS was rated by two independent raters. The Interclass Correlation Coefficient (ICC) for their ratings was above .9 for the GPS Overall Performance and 6 Domain Scores, suggesting good inter-rater reliability. Lower number of Rule Breaks on the second functional task (MET) significantly correlated with better performance on GPS Overall Performance, Task Execution, and Self Monitoring Domains. Additionally, better performance on the neuropsychological tests assessing auditory working memory (Auditory Consonant Trigrams) significantly correlated with better performance on the GPS Sequencing and Switching of Attention Domain.

**Conclusions:** These preliminary results suggest that GPS may be useful in assessing an individual's performance in different domains necessary for goal management of complex functional tasks in real-world settings. We will discuss the GPS assessment protocol and additional results from this ongoing pilot study in the context of current research on assessment and rehabilitation of executive dysfunction.

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**C.J. O'HALLORAN, G. KINSELLA, B. ONG, E. STOREY, H. DEWEY, M. COOK & P. HAND. Impairments in Dorsolateral, Mesial, and Orbito-Frontal Executive Functions Following Localised Cerebellar Lesions.**

**Objective:** The cerebellum has been implicated in a wide range of cognitive processes and neuropsychiatric conditions in recent years. While most cognitive studies have focussed on executive functions classically attributable to the dorsolateral pre-frontal cortex, less attention has been directed to the role of the cerebellum in mesial and orbito-frontal functions, such as social faux pas discrimination. The current study aimed to explore the role of the cerebellum in a range of dorsolateral, mesial, and orbito-frontal executive functions.

**Participants and Methods:** Twenty participants who had recently sustained a localised cerebellar vascular lesion were compared to 19 demographically-matched healthy volunteers. Participants were tested within eight weeks of their vascular event. All stroke participants underwent neuroimaging prior to cognitive assessment.

**Results:** Results of the assessment indicated that the stroke participants presented with deficits attributable to dorsolateral, mesial and orbito-frontal executive functions. Specifically, deficits in verbal fluency, abstract reasoning, set shifting, inhibitory control, sequencing, and faux pas discrimination were observed. A correlational trend analysis was conducted, which revealed that mesial and orbito-frontal executive functions correlated to a mesial cerebellar lesion.

**Conclusions:** Overall, the current study demonstrated impairments in executive functioning following a localised cerebellar lesion. Along with dorsolateral and mesial executive impairments, impaired social faux pas

discrimination was also observed; an ability generally attributable to the orbito-frontal cortex. Mesial and orbito-frontal executive measures additionally demonstrated a trend for a mesial cerebellar locus. These findings suggest that mesial cerebro-cerebellar networks may account for the emerging role of the cerebellum in emotional processes and neuropsychiatric conditions, and warrant further investigation.

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**K.L. POSSIN, V. LALUZ, A. BERHEL & J. KRAMER. The EXAMINER 1-Back Test of Spatial Attention is Associated with Right Frontal-Parietal Grey Matter Volume in Neurodegenerative Disease.**

**Objective:** A new test of spatial attention and short term working memory, based on the 1-back paradigm, was developed as part of a NINDS funded executive function battery ("EXAMINER"). To investigate the test's validity, we determined whether performance relies on brain regions known to be important for spatial attention, namely the right frontal-parietal network.

**Participants and Methods:** T1-weighted MRI images and 1-Back data were collected from participants diagnosed with Alzheimer's disease (3), frontotemporal dementia (6), MCI (5), progressive supranuclear palsy (2), or as neurologically healthy (11). The relationship between accuracy and regional differences in grey matter (GM) was examined using voxel-based morphometry (VBM) in SPM5 with DARTEL registration.

**Results:** A covariates-only statistical model was used with age, sex, total intracranial volume, and MMSE scores entered as nuisance covariates. After whole-brain correction for multiple comparisons (FDR), 1-back accuracy showed the most significant and extensive relationships with GM volume in the right inferior frontal gyrus and right superior frontal gyrus ( $ps < .01$ ). Significant relationships were also observed with the right posterior parietal cortex, the right anterior cingulate, the left middle and inferior frontal gyri, the left precentral gyrus, the left thalamus, and the orbitofrontal cortex bilaterally ( $ps < .05$ ).

**Conclusions:** Performance on this new test of spatial attention was strongly associated with GM volume in the right frontal-parietal attentional network. Results suggest that this new test is a valid measure of spatial attention in neurodegenerative disease and provide a neuroanatomical context for interpreting test performance. Supported by NIH grants P01AG019724, P50AG23501, and HHSN271200623661, and Hillblom 2008-A-020-FEL.

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**L.A. RABIN, K.E. NUTTER-UPHAM & J. FOGEL. Academic Procrastination: The Role of Self-Reported Executive Function.**

**Objective:** Procrastination, or the intentional delay of due tasks, is a widespread phenomenon in college settings. Chronic procrastination can negatively impact academic performance, learning and mastery of material, and quality of life. Although numerous behavioral, affective, and cognitive variables influence procrastination, to our knowledge, no research has investigated the subcomponents of executive functioning most related to this tendency in undergraduates.

**Participants and Methods:** In a demographically-diverse sample of 215 college students aged 30 and below, we conducted linear regression analyses with self-reported academic procrastination (Lay, 1986) as the outcome variable. We included each of the nine BRIEF-A subscales (Roth et al., 2005) in two models for a total of 18 analyses. Model 1 included besides the Brief-A subscale, nine variables of demographics and presence of medical and psychiatric conditions. Model 2 included these variables and estimated IQ, depression, anxiety, neuroticism, and conscientiousness.

**Results:** In Model 1, all Brief-A subscales (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organize, Task Mon-

itor, and Organization of Materials) were significantly associated with greater procrastination. Increased age was also significantly associated with greater procrastination in 5 of 9 analyses. In Model 2, 7 of 9 Brief-A subscales were significant. Shift and Emotional Control were no longer significant while lower conscientiousness was associated with greater procrastination. Models including significance for Self-Monitor and Working Memory also had significance for lower conscientiousness.

**Conclusions:** Results enhance understanding of the neuropsychological correlates of procrastination and may lead to practical suggestions or interventions to reduce its harmful effects on students' academic performance and well-being.

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**H.K. RAU, Y. SUCHY, P. WILLIAMS & J. BUTNER. Profiles of Executive Functioning in Healthy Adults.**

**Objective:** Maintaining and switching mental set can be considered opponent processors within the broader domain of executive functioning (EF). Some evidence suggests that these opponent processes may be lateralized to opposite cerebral hemispheres. To examine the hemispheric contribution to these two opponent processes, the study applied latent profile analysis to neurocognitive markers reflecting EF domains and their hemispheric associations.

**Participants and Methods:** 305 undergraduates were administered a modified switching task (Suchy & Kosson, 2006) via computer. This task was specifically designed to allow assessment of left- and right-hemisphere (LH, RH) associations with forming, switching, and maintaining mental set.

**Results:** Using latent profile analysis, participants were grouped according to performance patterns. Three EF profiles emerged. Group 1 ( $n=261$ ; 85.6% of the sample) was characterized by favorable performances across both tasks and all executive variables. Group 2 ( $n=37$ , 12.1%) performed poorly across all RH task variables, but showed a set maintenance strength on the LH task. Group 3 ( $n=7$ , 2.3%) demonstrated poor set formation under LH conditions, as well as a relative set switching weakness on both the LH and the RH tasks.

**Conclusions:** These results suggest that most neurologically intact individuals exhibit adequate EF performances, regardless of hemispheric task demands. For the remaining minority, imbalances between LH and RH efficiency appeared to translate into imbalance in the opponent executive processes (i.e., maintaining, switching), yielding profiles of maladaptive EF. The results provide additional evidence for left and right hemispheric contributions to switching and maintaining mental set, respectively.

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**A. REYES AGUILAR & I. DEL RÍO PORTILLA. Gender Differences in Executive Function: Emotional-Social Reasoning.**

**Objective:** Gender differences have been reported in cognition: women have a better performance than men in verbal tasks, tasks of finger dexterity and perceptual speed, while men overtake women in the solution of spatial problems. Few studies have focused on gender differences in executive function, cognitive styles in decision making, and in the interaction with social context. The present study main objective was to identify the gender differences in the performance in executive functions tasks; both in cognitive and emotional-social areas.

**Participants and Methods:** The evaluation includes the Trail Making Test, Wisconsin Card Sorting Test, Hanoi Tower, Stroop, and tasks and questionnaires that aim to describe the operation of executive functions in emotional-social areas, in young Mexican population.

**Results:** The study suggests that differences exist in the abilities of verbal fluency, script generation, and attention-working memory. In the emotional-social area, the differences seem to exist in behaviour of social interaction, in decision making with an emotional bias

(Gambling Task), in self-judgement and judgment of unknown people. The data indicate that women are more sensitive to novelty, to their own mistakes and punishment for decision making; their cognitive styles reflect greater cognitive flexibility and self-monitoring skills. Men, instead, execute the task in a more systematic and logical way; they perceive themselves as having greater impulsivity and lack of concentration.

**Conclusions:** Therefore, confrontation and problem solving seem to operate differently between women and men, mainly in the emotional-social area.

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### T. RIDDLE, K. CHISHOLM & J. SUHR. Aging Effects on Contingency Naming Test Performance.

**Objective:** The Contingency Naming Test (CNT; Taylor et al, 1987) is a measure initially designed to assess speeded processing, shifting attention and response inhibition in children. The measure has shown initial utility in identifying differences in executive function among adult clinical groups; however, there is currently no published information regarding use of the CNT in older adult samples.

**Participants and Methods:** We explored CNT performance among a sample of 43 community-dwelling older adults (mean age= 69.1; range: 50-84) who completed the CNT as part of a neuropsychological battery within a study of cognitive correlates of aging. Additional measures administered included the RBANS, TMT, COWA, and multiple WAIS-IV subtests.

**Results:** The older adult sample significantly differed on CNT time and efficiency variables, as compared to data reported from research in younger adult control samples. Within the older adult sample, results showed significant correlations with age and both CNT time ( $r$  range: .44 to .59,  $p < .001$ ) and efficiency ( $r$  range: -.49 to -.59,  $p < .001$ ). CNT performance was significantly correlated with multiple neuropsychological measures, including measures of processing speed and working memory. Results showed a general pattern of stronger correlations with measures of executive function on CNT trials involving response inhibition and switching. Additional correlations will be reported.

**Conclusions:** Significant age-related effects were noted on CNT performance, as expected given theories of cognitive change with aging. Results support construct validity of the CNT as a potentially useful executive measure which may have increased applications within older adult populations, although further research of this measure remains necessary.

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### C.S. SANDOVAL & F. OSTROSKY. FUNCTION EXECUTIVE EVALUATION. COGNITIVE FLEXIBILITY BASIS.

**Objective:** To study the development of cognitive flexibility (CF) in pre-school children.

**Participants and Methods:** 189 children from 3 to 6 years old, 96 girls and 91 boys were evaluated using the Dimensional Change Card Sort (DCCS) (Zelazo, et al., 2003) test, which is part of the Function Executive Battery for children (Ostrosky et al, 2009). Sample was divided into three age ranges: 63 (3 - 3.11), 64 (4 - 4.11), and 65 (5 - 6).

**Results:** The ANOVA showed significant differences between age groups (3 - 3.11) and (4 - 4.11), the youngest group had more perseverative errors, and the (5-6) group had less perseverative errors than the (3-3.11) group.

**Conclusions:** As Zelazo (1996) points out, despite the fact that most of the three-year-old children could verbalize the rules they keep up using the same rule throughout the task, thus making many perseverative errors. This phenomenon has been called praxic-verbal dissociation (Luria, 1973).

Our results showed that in the older age group, they achieved more categories and made less perseverative errors and suggest that cognitive flexibility is subject to brain maturation associated with age. The importance of cognitive flexibility and its relationship to other complex psychological function is discussed.

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### C. SIRA. Psychometric Evaluation of The Twelve Elements Test and Other Commonly Used Measures of Executive Function.

**Objective:** The Six Elements Task (SET; Shallice and Burgess, 1991; Burgess et al., 1996) measures examinees' ability to plan and organize their behaviour, form strategies for novel problem solving, and self-monitor. The task has questionable sensitivity to mild executive impairments (Jelicic, et al., 2001) and is vulnerable to practice effects. This study sought to evaluate the utility of a modification of the SET by increasing the difficulty of the test, and expanding the range of possible scores in order to make it more suitable for serial assessments.

**Participants and Methods:** 26 individuals with ABI, and 26 healthy matched controls (20 - 65 years). Participants completed a battery of neuropsychological tests on two occasions eight weeks apart.

**Results:** The 12ET had significant correlations with measures of flexibility and planning, as well as with intelligence. No demographic variables significantly predicted 12ET performance at Time 2 over and above performance at Time 1, and both participant groups obtained the same benefit from practice. The 12ET did not suffer from ceiling effects on the second administration, and the test-retest reliability of the 12ET variables ranged from  $r = 0.22$ - 0.78.

**Conclusions:** The increase in difficulty on the 12ET did not increase the test's sensitivity to mild impairment, nor did it more clearly separate the brain-injured and control groups, as the mean scores on the 12ET variables did not significantly differ. However, the increase in range did reduce the tendency for participants to perform at ceiling levels. The 12ET was significantly correlated with other executive measures, particularly for the brain-injured group, though these correlations may have been moderated by general intelligence. Two variables of the 12ET, deviation from the optimal amount of time per task and Number of Tasks Completed, showed promise as measures of reliable change in this sample over an 8-week interval.

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### J.B. SMAIL. Neuropsychological Evaluation of Deaf Children's Executive Functions.

**Objective:** Impulsivity, considered by some to be the cardinal characteristic of both ADHD and executive dysfunction, has received extensive attention in the research literature over the years by experts in the field of deafness. Poor impulse control and its correlates are the most frequently noted behavioral characteristics of deaf children in the literature today.

Despite the paucity of research on the executive functions (EF) in deaf children, findings from existent studies suggest that physiological differences in brain development lead to differences in executive functioning. Deaf children appear to present with a greater degree of impulsivity and disorganization than their hearing peers, with neurologically at-risk deaf children, or those children whose deafness is acquired through non-hereditary means, demonstrating greater differentiation than genetically deaf children. Another principal finding from these studies is that delays and deficits in language development appear to impact the development of the EF of deaf children.

The purpose of this poster session is to provide clinicians with information regarding the evaluation of the EF of deaf children.

**Participants and Methods:** A review and discussion of the current literature as it pertains to the development of EF in deaf children.

**Results:** A discussion of the factors that may impact test selection, administration, performance and interpretation, along with examples of commonly used instruments and measures will be presented. Recommendations for intervention will be offered and discussed.

**Conclusions:** Clinicians working with this heterogeneous population should be familiar with the multiple factors that impact the development of deaf children in order to appropriately select, administer and interpret neuropsychological measures of EF.

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#### **S.R. THORGUSEN, J.M. WATSON & P.G. WILLIAMS. Working Memory Span Predicts Neuroticism.**

**Objective:** Numerous cognitive-affective studies have demonstrated relationships between executive function and personality, but few have focused on working memory (WM). These few studies suggest WM is negatively related to anxious personality characteristics (e.g. Hayes, Hirsch, & Mathews, 2008; Shackman et al., 2006) and positively related to extraversion (Gray & Braver, 2002; Lieberman, 2000). However, these results have not been reliably reproduced (Gray et al., 2005; Lieberman & Rosenthal, 2001), perhaps due to inadequate operationalization of WM. The present study employed the automated operation span task (AOspan; Unsworth, Heitz, Schrock, & Engle, 2005)—a more rigorous test of WM—to examine the relationship between WM and NEO Five Factor Inventory (NEO-FFI) scales of Neuroticism and Extraversion.

**Participants and Methods:** Undergraduate participants (N=246) completed the NEO-FFI and AOspan, a measure of WM capacity in which participants solve simple arithmetic problems while memorizing strings of letters. Participants were divided into three approximately equal groups based on WM span (low, medium and high). Analyses of variance (ANOVAs) were run for each extraversion and neuroticism by WM span group.

**Results:** The results showed a main effect of Neuroticism ( $F[2,244]=4.847, p=.009$ ) wherein participants with lower WM capacity exhibited higher levels of neuroticism. Post-hoc t-tests showed that the effect resulted from differences between the low and high WM span groups ( $p=.008$ ).

**Conclusions:** We were unable to replicate the previous finding that WM correlates positively with extraversion. Our finding regarding neuroticism is consistent with other reports that neuroticism is associated with poorer executive function.

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#### **E.R. TUMINELLO, J.M. WINGO & S. HAN. Discrepancies between IQ and Executive Functioning are associated with Socioeconomic Status and Substance Abuse.**

**Objective:** Despite the recent surge in research on executive functioning (EF) and its relation to IQ, few studies have examined discrepancies between IQ and EF within an individual. The purpose of this study was to explore differences in grade point average (GPA), parental SES and college adjustment among groups whose IQ was higher than EF (IQ>EF), whose EF was higher than IQ (EF>IQ), and whose IQ and EF were equivalent.

**Participants and Methods:** 105 college students were recruited for this study. Intelligence was assessed using the FSIQ from the WASI; EF was assessed using four subtests from the D-KEFS. College adjustment outcomes were measured with the College Adjustment System (CAS). Discrepancy groups were defined as a performance difference of more than one standard deviation between IQ and EF measures. Discrepancy groups were compared on GPA, college adjustment, and parental SES using one-way Analysis of Variance.

**Results:** In three cases (Trail Making Switching,  $p=.003$ ; Color Word Switching-Inhibition,  $p=.005$ ; Design Fluency Switching,  $p=.01$ ), the

IQ>EF group had higher parental SES scores than the IQ=EF group. The IQ>EF group also had a higher SES than the EF>IQ group (Color Word,  $p=.03$ ). When comparing IQ with Design Fluency, the EF>IQ group had higher reported substance abuse than the IQ=EF group ( $p=.01$ ). No significant differences were found for GPA.

**Conclusions:** Consistent with previous research finding a positive relationship between SES and IQ, those having higher IQ than EF had higher parental SES than those whose EF was equal to or higher than IQ. Having higher EF than IQ was also associated with more reported substance abuse. Future research should examine causal explanations for the relationship between SES, substance abuse, and IQ-EF discrepancies.

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### **Imaging (Functional)**

#### **A.M. BUTTS, S. DURGERIAN, K. NIELSON, N. HANTKE, M. LANCASTER, L. GUIDOTTI, J. WOODARD, M. SEIDENBERG, P. ANTUONO & S. RAO. Resting State Functional Connectivity: Influence of Risk Factors for AD.**

**Objective:** Mild Cognitive Impairment (MCI) patients as well as cognitively intact older individuals at-risk for Alzheimer's Disease (AD) demonstrate hyperactivation in the posterior cingulate (PC) and bilateral hippocampi (HIPP) during a semantic memory fame discrimination task. At rest, these regions may be disrupted in early AD and MCI, but how healthy individuals at risk are affected has remained elusive.

**Participants and Methods:** Fifty-seven participants were balanced for age, education, and gender (n = 19 each): amnesic MCI patients; cognitively intact elders at-risk for AD (APOE  $\epsilon 4$  allele and a positive family history, At-Risk); and participants without AD risk factors (Control). fMRI was conducted on a 3T MR scanner using an echo-planar run involving a famous name discrimination task followed by a six-minute resting run. Seeds were selected based on the activation task of the PC ROI and hippocampi anatomical tracings. Averaged PC and HIPP ROI time-courses were cross correlated and converted to z-scores for parametric statistical comparisons.

**Results:** MCI patients and those at risk had the highest levels of activation, but the MCI patients had the lowest connectivity between the PC and bilateral HIPP. The connectivity between the PC and left HIPP was higher in those at risk than controls.

**Conclusions:** For those who are asymptomatic (At-Risk), the combination of increased connectivity and hyperactivation is likely adaptive and necessary for successful performance, while for those who are symptomatic (MCI), the combination of reduced connectivity and hyperactivation is likely maladaptive, as reflected in poorer memory and a diagnosis of MCI. Correspondence: *Alissa M. Butts, B.A., Psychology, Marquette University, 1570 N. Prospect Ave, Apt. 308, Milwaukee, WI 53202, United States. E-mail: Alissa.m.butts@gmail.com*

#### **E.M. CASTILLO, K.M. HASAN, C. BOAKE, D. MEN, Z. LI & A.C. PAPANICOLAOU. Integrity of the Corticospinal Tract and Perirolandic Slowing after Stroke.**

**Objective:** Although it is accepted that the structural integrity of white matter tracts is crucial for the functionality of cortical networks little evidences are available on the precise relationship between white matter connectivity and cortical functionality.

**Participants and Methods:** Combining Magnetoencephalography (MEG) and Diffusion Tensor Imaging (DTI) we studied a group of stroke patients to test whether there was a relationship between the integrity of the corticospinal tract (CST) and the presence of low-frequency oscillatory activity in perirolandic regions. MEG recordings of spontaneous activity were conducted in a group of 17 postacute stroke patients presenting with different degrees of sensorimotor impairment. Measurements of fractional anisotropy at multiple levels of the CST were extracted from the DTI sequences and crosscorrelated with behavioral and profiles of delta dipole density (DDD).

**Results:** 13 out of the 17 patients (76%) showed lateralized DDD towards the affected hemisphere (AHP). Grip strength in the affected hand showed a significant correlation with values of fractional anisotropy of the affected CST ( $r = 0.73$ ;  $p < 0.01$ ) and with DDD of the affected hemisphere ( $r = 0.66$ ;  $p < 0.01$ ). Fractional anisotropy in the affected CST showed a significant correlation with perirolandic delta dipole density in the affected hemisphere ( $r = 0.72$ ;  $p < 0.01$ ).

**Conclusions:** These results indicate a close relationship between neurophysiological pattern of slow oscillatory activity and the degree of structural integrity of the corticospinal tracts, as demonstrated by DTI tractographies. These two techniques complement each other by evaluating the functional and structural integrity of corticospinal tracts after stroke.

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### J. KÁLLAI, A. FELDMANN, F. KOCSOR, Z. KERÉKES, I. HARTUNG & K. KARÁDI. Self-recognition and self-allocation in egocentric and allocentric reference frames: an fMRI study.

**Objective:** Both the egocentric and allocentric reference frames serve as a context to plan and execute self directed actions. These spatial reference frames interact each other. Their rate in involvement to carried out a proposed action depend on instruction effect, task demand and utilized coping strategy, that manner who the self is allocates oneself in egocentric – allocentric (first person – second person view) working frames. Our aim was to examine the cortical mechanisms of the self-referentiality in different spatial context, when the subject was confronted with an ambiguous spatial task and was asked to identify him/herself as a navigation reference point in egocentric or allocentric space.

**Participants and Methods:** Forty-two, right handed volunteers (29 female; 13 male) were recruited and event-related fMRI was used. In the pre-selection phase, each participant has been taken an entire figure photo in front-wise position. To support anchoring the self involved photo into the autobiographic memory, he/she wear work-clothes and informed “this is a photo of you that will be utilized in a task that will be exhibited while you will be lying into the MRI scanner.

**Results:** Significant difference were found between “self-presented vs. self-not presented” contrast in the areas of left primary motor cortex, left superior parietal cortex (7Pc), left inferior parietal cortex (PGa), and the right angular gyrus. (hIP3).

**Conclusions:** The detailed analysis of the results allows an exact interpretation upon the role of posterior parietal cortex in the self representation and the mechanism of self allocation in egocentric and allocentric spaces.

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### A. FELDMANN, J. KÁLLAI, K. KARÁDI, F. KOCSOR, Z. KERÉKES, I. HARTUNG & F. KÖVÉR. Neurocognitive pathways of high impulsivity and conflicted risk perception: An fMRI study measuring response inhibition in a Go/No-go task on a non-clinical sample.

**Objective:** This study focused on the role of different neuro-psychological networks of healthy participants with elevated impulsivity scores solving a response inhibition (Go/No-go) task under functional magnetic resonance imaging (fMRI).

**Participants and Methods:** A total of 42 right-handed participants were selected using Barratt's Impulsivity Scale (BIS-11) and Sensitivity to Punishment and Sensitivity to Reward (SPSRQ) questionnaires. A Go/NoGo event-related fMRI task was used.

**Results:** The highest BOLD activity during the Go/No-go task was detected in the right contralateral prefrontal and right dorsolateral prefrontal cortices. Highly impulsive participants showed increased activation in the left postcentral, left inferior frontal, right medial frontal gyri, left hippocampus and bilaterally in the insula.

**Conclusions:** A compensatory mechanism is also described that allocates available attentional resources according to the task demands to control omission error and increase the expected reinforcement sensitivity. Sensitivity to Punishment (SP) are in impulsive participants was found as a good indicator of inhibitory system functions. Increased SP reflects elevated activity in the left lateralized fronto-striatal circuitry that signals higher sensitivity in risk assessment and risk aversion in conflicting situations.

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### H.M. GENOVA, J.F. SUMOWSKI, G. WYLIE, J. DELUCA & N. CHIARAVALLOTI. Throwing the Baby Out with the Movement Artifact: Movement as a Source of Systematic Error in fMRI.

**Objective:** In functional MRI it is assumed that changes in BOLD signal vary with experimental manipulation: an assumption that is violated when subjects move because motion causes signal change. Only a certain amount of movement can be corrected, and data associated with severe movement is frequently discarded. If movement is a source of random error, then such data can be discarded without biasing one's sample. However, if head movement is related to task difficulty and cognitive impairment, then discarding such data biases the sample. This was tested among persons with Multiple Sclerosis (MS).

**Participants and Methods:** Thirty-five persons with MS underwent functional MRI during three N-back trials. Maximum movement was recorded for each trial. Cognitive status was assessed using the SDMT and PASAT. We performed a 3 (task difficulty: 0-, 1-, 2-Back) X 2 (cognitive status: non-impaired, impaired) repeated measures ANOVA on head movement.

**Results:** There was a linear effect of task difficulty: movement increased with task difficulty ( $F(1,33) = 15.79$ ,  $p < .001$ ). Also impaired subjects moved more than non-impaired subjects ( $F(1,33) = 5.05$ ,  $p < .05$ ). Importantly, there was an interaction such that the linear effect of difficulty on movement was most pronounced among impaired subjects ( $F(1,33) = 7.28$ ,  $p = .01$ ).

**Conclusions:** Movement during fMRI experiments appears to increase with task difficulty, particularly for cognitively-impaired MS patients. As such, discarding data with severe movement artifact may bias MS samples such that only those with less severe cognitive impairment are included in the analyses.

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### M. GONZALES, R. REED, F. BINEY, S. STAUTBERG, T. SWANN-STERNBERG, K. GOUDARZI & A.P. HALEY. Impact of Obesity and Hypertension on Working Memory: an fMRI Study.

**Objective:** Obesity is a growing epidemic that is associated with cerebrovascular disease and dementia in later life. Traditionally obesity's impact on the brain has been attributed to its comorbidity with cardiovascular disorders such as hypertension. However, obesity's physical and endocrine effects may independently contribute. The aim of the current study was to use neuroimaging to assess the cognitive and cerebral hemodynamic impact of obesity alone and in combination with hypertension in a middle-aged population.

**Participants and Methods:** Fourteen obese adults with and without hypertension and ten healthy controls (ages 40 to 60 years) completed a 2-back verbal working memory (VWM) task during fMRI. Task-related activation was averaged in empirically-defined regions of interest. Group differences in 2-back-related activity were examined using Univariate Analysis of Variance (ANOVA) tests corrected for multiple-comparisons (two-tailed  $p < .02$ ).

**Results:** Obese individuals with and without hypertension displayed lower brain activation than healthy controls in the right middle frontal gyrus ( $p = .017$ ) and left inferior temporal gyrus ( $p = .002$ ). Obese individuals with hypertension also had lower brain activation than healthy controls in the right inferior parietal lobe ( $p = .019$ ) and right middle frontal gyrus ( $p = .016$ ).

**Conclusions:** Our results suggest that obesity during middle age may be independently associated with sub-clinical alterations in brain functioning during working memory and that comorbid hypertension may exacerbate these effects. Given the prevalence of obesity and its preventive nature, a better understanding of the mechanisms by which obesity affects brain function is of great public health importance.

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**W.R. HARRELL, P.F. ICARD, J. BIZZELL, R. KITSON, S.R. HOOPER, D.S. GIPSON & A. BELGER. Functional MRI and Working Memory in Children with Chronic Kidney Disease.**

**Objective:** Pediatric chronic kidney disease (CKD) has been associated with neurocognitive deficits, particularly deficits in memory. Previous studies have focused primarily on patients with severe CKD. This study examines working memory performance and activation of relevant brain regions in pediatric patients with moderate to severe CKD.

**Participants and Methods:** 21 participants with CKD (eGFR <90 ml/min/1.73m<sup>2</sup> for >3 months; mean age 14 years) were compared with 11 controls. Mean age and adaptive functioning were similar across groups. During a visual-spatial working memory task, functional images were acquired using gradient-echo MPI (24 oblique slices; TE 30 ms; TR 1500 ms; flip angle 80). Whole-brain and region of interest analyses were conducted using eventstats and FSL.

**Results:** In both encode and retrieve phases of the task, CKD patients showed significantly less change in activation from baseline in brain regions involved in visual-spatial processing and attention, including the superior parietal lobe and posterior cingulate gyrus. Patients showed increased left hemisphere activation compared with controls. Differences from controls were more significant in patients with severe CKD (eGFR <30 ml/min/1.73m<sup>2</sup>; n=11) than those with moderate CKD (90 > eGFR >30; n=10). CKD patients also responded less accurately to the memory task (55% correct vs. 63% for controls; p=0.03).

**Conclusions:** Pediatric CKD patients appear subject to difficulties with visual-spatial working memory, and these performance differences appear to correlate with reduced activity in expected brain areas. A larger sample size will be needed to confirm these results and explore possible moderators and mediators, such as CKD severity.

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**G. XU, M. DOWLING, A. LA RUE, B. HERMANN, H. ROWLEY, M. SAGER & S. JOHNSON. Early cerebral blood flow change in cognitively normal middle-age subjects who have high risk for Alzheimer's disease.**

**Objective:** There is growing evidence that healthy middle-aged adults at risk for Alzheimer's Disease (AD) experience preclinical brain changes, but the relationship between cognitive status and brain function is still poorly characterized because these subjects are generally cognitively normal. Regional cerebral blood flow (CBF) has been shown to be sensitive to MCI and AD, but whether CBF will be sensitive to subtle cognitive differences in people at risk is not known.

**Participants and Methods:** Arterial Spin labeling (ASL) MRI scans were performed in 50 subjects (45 with parental history of AD; Age 56.9 ± 5.4), recruited from the Wisconsin Registry for Alzheimer's Prevention (WRAP; n=1300). Subjects were classified into 3 groups: high functioning, average functioning, memory impaired. Cognitive status was expressed as a continuous probability score based on a latent class model using comprehensive neuropsychological data from the entire cohort and based on factor weightings of three content domains: episodic learning and memory, executive function and processing speed.

**Results:** A significant association was found such that subjects who had a high probability of belonging to the memory impaired cognitive group had the lowest CBF. The region of greatest difference was the posterior cingulate.

**Conclusions:** These results confer neurobiological support for the latent class solution and suggest that middle aged adults at risk for AD who are in the lower memory group also exhibit lower cerebral blood flow in a key memory region. Whether these findings are predictive of future cognitive decline still needs to be determined with continued study.

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**W.D. KILLGORE & D.A. YURGELUN-TODD. Self-Reported Insomnia is Associated with Increased Activation within the Default-Mode Network During a Simple Attention Task.**

**Objective:** During normal waking, insomnia patients show reduced activation of prefrontal cortical regions compared to healthy subjects. Recent studies in healthy individuals have described a network of medial cortical structures that appear to be activated in the absence of cognitive demands—the default mode network (DMN). No studies have yet examined the relationship between self-reported sleep problems and waking functional status of the DMN.

**Participants and Methods:** Sixteen healthy adults (8 male; 8 female; Mean age = 47.3, SD = 5.4) were asked about sleep problems and subsequently scanned using fMRI (3T) during a low-level simple attention task (i.e., viewing alternating blocks of color images of flowers, rocks, and trees with slightly more interesting pictures of colorful decorative plates, dinnerware, and table place-settings). Sleep quality was rated on a 10-point scale from “fall asleep easily” to “difficulty falling asleep or can't sleep at all.” Using SPM99, scores on this scale were entered into a linear regression analysis to predict cerebral responses during the visual task.

**Results:** Greater activation within regions of the “default mode network,” including the precuneus and lingual gyrus, was positively correlated with difficulty falling asleep (p<.005, uncorrected). In contrast, activation within the inferior frontal gyrus bilaterally and right inferior operculum was negatively correlated with difficulty falling asleep (p<.01, FDR corrected).

**Conclusions:** During a simple visual attention task, greater self-reported difficulty falling asleep was associated with greater activation within the DMN and lower activation within bilateral regions of the inferior dorsolateral prefrontal cortex, suggesting reduced waking neurocognitive engagement in those complaining of insomnia.

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**L. KRIVITZKY, K. BLACKSTONE, T. ROEBUCK-SPENSER, R. ROTH & G. GIOIA. A novel task of working memory and inhibitory control for fMRI: Pilot study in mTBI and healthy children.**

**Objective:** Previous functional neuroimaging research has observed regions of greater activation in mTBI than healthy controls at lower working memory loads. This study aims to explore activation patterns for measures of working memory in children with mTBI vs controls, particularly when there is a component requiring inhibitory control.

**Participants and Methods:** Thirteen children with symptomatic mTBI were matched on age and gender to 13 typically developing children (15M, ages: 7-18, mean: 12.3, FSIQ: 111). Average time between injury and testing ranged from 8 to 82 days (median: 20 days). 11 (85%) of the patients' mechanism of injury was sports-related; 31% lost consciousness during their injury. The Tasks of Executive Control (TEC, in press) was developed as a standardized computer-administered measure of working memory (WM) and inhibitory control by utilizing a picture n-back paradigm with increasing load crossed with a go/no-go task (scanner adapted task is 20 minutes with 7 conditions). All children underwent neuropsychological testing, out of scanner TEC practice, and EPIBOLD fMRI (3T) with the TEC. Data were analyzed using SPM5 and the threshold was uncorrected at p>.001.

**Results:** On the TEC, children with mTBI showed greater activation than controls in bilateral frontal and midfrontal areas with greater working memory demand. With the addition of an inhibitory control demand, children with mTBI showed increased activation in bilateral anterior and posterior cerebellum. Unlike findings with the out-of-scanner TEC, overall accuracy levels were low in both patients and controls.

**Conclusions:** Children with mTBI recruited more areas of the brain that have been associated with executive control thus illustrating greater cognitive effort on both the WM and inhibitory control tasks within the TEC than controls. The TEC has potential to illustrate a concurrent pattern of activation for WM and inhibitory control in other pediatric populations.

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**V.R. LALUZ, K.L. POSSIN, M. WIDMEYER, A. BIRD, H.J. ROSEN & J.H. KRAMER. Frontotemporal Dementia Patients Show Increased Dorsolateral Prefrontal Cortex Activation on a Cognitive Control Task Relative to Healthy Controls.**

**Objective:** Research in young controls indicates that a dorsolateral and medial prefrontal network mediates cognitive control. However, little is known about the underlying structural and functional neuroanatomy of cognitive control in aging and neurodegenerative disease. This study aims to examine functional differences in cognitive control in patients with neurodegenerative disease.

**Participants and Methods:** Seven adults with behavioral-variant frontotemporal dementia (bvFTD) and 13 age-matched controls (mean age: 63 +/- 5) underwent structural and functional MRI on a 3T Siemens scanner. A computerized task of cognitive control (Flanker) required individuals to indicate an arrow's direction (left or right) during fMRI. The direction of the arrow was either congruent with distracting arrows surrounding the target arrow, or incongruent. fMRI activation in the frontal lobes was analyzed on the incongruent condition relative to the congruent condition using SPM5.

**Results:** fMRI indicated that both bvFTD and controls showed activation in the middle frontal gyrus and the right anterior cingulate. When comparing bvFTD activation to normals, however, bvFTDs showed significantly more right caudal middle frontal gyrus activation ( $p=0.001$ ) than in the anterior cingulate. Structural neuroimaging using voxel-based morphometry showed that bvFTDs had prominent atrophy in the anterior cingulate cortex ( $p<0.01$  FDR corrected) that was more widespread than their DLPFC atrophy.

**Conclusions:** fMRI showed that medial prefrontal and dorsolateral regions play an important role in cognitive control in bvFTD patients and healthy controls. Importantly, bvFTD patients show greater recruitment of the dorsolateral prefrontal cortex than controls. This increased recruitment may serve as a compensatory mechanism to offset their prominent medial prefrontal atrophy.

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**B. MCKENNA, G.G. BROWN & S.P. DRUMMOND. Isolating Component Processes of Verbal Working Memory using fMRI**

**Objective:** Working memory (WM) is a temporary storage system for the maintenance and manipulation of information. Although fMRI studies have advanced the identification of neural systems underlying WM, results do not directly map onto component processes postulated by cognitive theories. We aimed to develop task-based, fMRI cognitive theory that are capable of isolating systems underlying different components of verbal WM.

**Participants and Methods:** Sixteen (age = 25 ± 5.9 yrs) subjects performed two separate WM tasks during a task event-related fMRI design. Activation during learning and rehearsal periods was examined in a priori regions implicated in WM. The rehearsal component of WM was manipulated by increasing the number of syllabi in the verbal stimuli. Attentional and encoding demands were manipulated by visually degrading the stimuli.

**Results:** Manipulation of the storage component yielded clusters of activation in Brodmann's Areas (BA) 6,9,10,40 during the rehearsal period, but no clusters were found during the learning period. Manipulation of the attentional and encoding demands yielded clusters of activation in BA 18,37 during the learning period, but no clusters during the rehearsal period.

**Conclusions:** Results demonstrate a double dissociation where discrete activations related to specific components of WM were isolated. Rehearsal processes were related to activation of prefrontal cortices implicated in organization of information. Visuo-attentional processes were related to visual processing regions. This paradigm provides a method to examine the neural systems related to specific WM components. These methods can provide insight in how WM components change in different neurological and psychiatric populations.

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**T. MCQUEENY, K. MEDINA, B. NAGEL, A. SCHWEINSBURG & S. TAPERT. Functional Connectivity and Age-Related Gender Differences in Inhibitory Processing Across Adolescence.**

**Objective:** In order to investigate frontal-striatal neurodevelopment, we used fMRI to investigate brain response to a cognitive inhibition task among adolescents.

**Participants and Methods:** Teens included 31 girls and 43 boys ages 12-18. Exclusions included psychiatric and neurological disorders. During fMRI, participants performed a Go/No-Go response inhibition task.

**Results:** Behaviorally, boys and girls did not differ on the task. Significant age by gender interactions were found ( $p's<.05$ ); in general, boys showed increased No-Go activation with age in the right inferior frontal gyrus (IFG), anterior cingulate, caudate, left motor cortices, as well as areas in the temporal and parietal lobes. In contrast, girls showed a mixture of increased (left IFG, parahippocampal gyrus) and decreased (right insula, superior/medial frontal gyri) activation with age. As a follow-up functional connectivity analysis utilizing the right-IFC as a seed-region, it was found that adolescents with increased right-IFC activation to No-Go stimuli also demonstrated increased motor cortex, thalamus and caudate response ( $p's<.001$ ), confirming significant frontal-striatal connectivity during adolescence. Visual inspection revealed that boys demonstrated a more diffuse connectivity pattern compared to girls.

**Conclusions:** Consistent with previous studies, these findings indicate that the frontal-striatal network is activated during response inhibition in adolescents, although substantial gender differences in maturation of this network were found. Whereas boys showed a more diffuse pattern of increased activation with age, girls showed a mixed pattern of increased and decreased activation. This suggests that adolescent girls and boys may use separate cognitive approaches to response inhibition or have differential frontal-striatal neurodevelopmental trajectories. Future longitudinal studies need to confirm these findings.

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**D. MECHANIC-HAMILTON, L.H. SWEET, B.A. JERSKEY & M.S. ALOIA. Default Network Response to a Working Memory Challenge after Withdrawal of CPAP Treatment for Obstructive Sleep Apnea.**

**Objective:** Decreased working memory (WM) performance and changes in brain activity have been reported in studies of obstructive sleep apnea (OSA); however, the brain response to continuous positive airway pressure (CPAP) treatment and withdrawal, in particular default network processing, has not yet been reported.

**Participants and Methods:** Ten OSA patients performed a 2-Back WM fMRI paradigm following verified CPAP use and after two consecutive nights of CPAP withdrawal. Participants were trained to 80% accuracy on the 2-Back and accuracy did not differ between treatment conditions. A 0-Back control task was also presented. Two six-minute fMRI scans included eight 0-Back/2-Back cycles.

**Results:** Eleven regions were identified as significantly deactivating during the 2-Back compared to the 0-Back condition. Five of the 11 regions, showed further deactivation in the off, compared to the on treatment condition, including right posterior cingulate, right inferior parietal lobule, left middle temporal gyrus (BA20), left parahippocampal gyrus and right paracentral lobule. The left middle temporal gyrus (BA21) showed less deactivation off treatment. Task performance and reported sleepiness levels showed significant relationships with brain response, but only in the off treatment condition. Greater deactivation in the left posterior cingulate ( $r=-0.66$ ,  $p=0.04$ ) and right postcentral gyrus ( $r=-0.73$ ,  $p=0.02$ ) was significantly related to better 2-Back performance. Greater deactivation in the left ( $r=-0.71$ ,  $p=0.02$ ) and right ( $r=-0.64$ ,  $p=0.05$ ) medial frontal gyrus was significantly associated with sleepiness off treatment.

**Conclusions:** These findings indicate that the default network is responsive to CPAP withdrawal, and involved in compensatory change during high cognitive demand during withdrawal states in patients with OSA. Correspondence: Dawn Mechanic-Hamilton, MS, Clinical Psychology Training Consortium, Alpert Medical School of Brown University, Box G-S121-4, Providence, RI RI, United States. E-mail: dawn\_mechanic@yahoo.com

**K.J. MILLER, C. GEIST, M. BAUER, P. SIDDARTH, G.W. SMALL & D. SILVERMAN. Brain metabolism using FDG-PET among individuals classified with Overt Primary and Subclinical Hypothyroidism.**

**Objective:** Recent studies suggest regional cerebral hypometabolism and cognitive deficits among individuals with overt primary hypothyroidism (CH) (Bauer et al., 2009; Miller et al., 2006, 2007). "Subclinical hypothyroidism" (SCH) is also associated with mild cognitive deficits (Miller et al., 2009; Lowe et al., 2007). This present study examined regional metabolism in CH and SCH subjects.

**Participants and Methods:** 38 subjects underwent FDG-PET, 7 SCH and 7 age-matched controls (X age=62, 60, respectively) as well as 14 CH and 10 controls (X age=43, 41). Scores from neuropsychological battery and thyroid lab values were collected. Standardized volume of interest and statistical parametric mapping methods were used to analyze PET data.

**Results:** TSH levels were elevated in CH and SCH subjects ( $\pm$ SEM;  $31.3\pm 15.1$ ,  $5.3\pm 0.6$ , respectively) relative to their age-matched controls ( $1.5\pm 0.2$ ,  $1.8\pm 0.4$ ); they also demonstrated hypometabolism in the anterior cingulate (SCH:  $t=4.74$ ,  $p<0.0005$ , CH:  $t=5.03$ ,  $p<0.0005$  at voxels of peak significance, normalized to whole brain activity) and hypermetabolism in the cerebellum (SCH:  $t=4.22$ ,  $p=0.001$ ; CH:  $t=2.84$ ,  $p=0.005$ ), compared to their respective age-matched controls. Hypometabolism was uniquely demonstrated in CH in posterior cingulate, as well as Broca's area and its contralateral counterpart ( $p\leq 0.001$ ) and in SCH in the right middle frontal gyrus of the dorsolateral prefrontal cortex ( $t=4.14$ ,  $p=0.001$ ) and the right parietotemporal cortex ( $t=4.94$ ,  $p<0.0005$ ) compared to age-matched controls.

**Conclusions:** Having elevated TSH was associated with reduced brain metabolism in addition to cognitive deficits even without overt primary hypothyroidism. Future implications include consideration of screening for subclinical hypothyroidism, with treatment goals directed towards restoring cerebral function

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**R.C. MULLIGAN, L.H. SWEET, C.E. FINNERTY, B.A. JERSKEY, S.P. DAVID, R.A. COHEN & R.S. NIAURA. An FMRI Study of Smokers Performing an Inhibitory Control Task: Neural Correlates of Early Life Stress.**

**Objective:** Withdrawal from nicotine negatively affects inhibitory control in dependent smokers, but deficits in inhibitory control may also

be the pre-existing consequence of exposure to early life stress. To dissociate the neural effects of withdrawal from those associated with early life stress, functional neuroimaging was performed while smokers with and without history of early life stress performed an inhibitory control task while on and off nicotine.

**Participants and Methods:** A Go/No-Go challenge was administered to 13 dependent smokers (mean cigarettes per day = 18.5) during two fMRI assessments. Participants abstained from smoking prior to both sessions, but they were administered a nicotine patch before one fMRI session and a placebo patch prior to the other. A questionnaire that inquired about the number of adverse childhood events (ACE) experienced was completed to assess early life stress.

**Results:** Withdrawal was associated with significantly greater activation of right inferior parietal regions, whereas administration of nicotine was associated with greater activation of a right fronto-cerebellar network. Activation of right inferior parietal lobe (IFP) during correct inhibition was inversely related to number of ACEs endorsed on the questionnaire ( $r=-0.65$ ;  $p<.05$ ) such that individuals with greater exposure to early life stress deactivated IFP, a region otherwise activated by individuals with low exposure to early life stress.

**Conclusions:** Results suggest that fronto-cerebellar function is disturbed in chronic smokers, but this deficit is transiently enhanced by administration of nicotine. By contrast, differences in brain response associated with exposure to early life stress are notable in posterior brain regions.

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**C.B. PADULA, R.M. ANTHENELLI, J.C. ELIASSEN, Z. GRAHAM, J.L. HEFFNER & K.L. MEDINA. The Influence of Gender and Trauma on Brain Activation to Emotion Processing in Alcoholism.**

**Objective:** Research suggests women are more susceptible to alcohol's damaging effects. Also, trauma has been linked to aberrant stress response. However gender and trauma together have not been investigated in alcohol dependent samples. The aim of this study was to examine the effects of gender, trauma, and their interaction on brain activation to an emotion-processing task.

**Participants and Methods:** Alcohol dependent ( $n=8$  women,  $n=6$  men) individuals completed the Trauma Symptom Checklist and other mood and stress questionnaires. Functional magnetic resonance imaging data were collected while participants performed an emotion-processing task.

**Results:** The fearful face condition was contrasted to a neutral face condition. Linear regressions revealed main effects for gender and trauma, and gender by trauma interactions. Women activated more to fearful faces in frontal and temporal areas ( $t=2.11$  to  $2.51$ ,  $p<0.05$ ), while men activated more in cerebellar regions ( $t=-2.58$ ,  $p<0.05$ ). Furthermore, we found a negative association between trauma and activation in the left frontal area ( $p<0.05$ ). Lastly, we found gender by trauma interactions in right frontal regions ( $t=-2.87$  to  $-3.86$ ,  $p<0.05$ ). Right middle/inferior frontal areas showed increased trauma related to increased activation in females, not males. In another inferior frontal area, trauma in females related to decreased activation, and in males related to increased activation.

**Conclusions:** Preliminary results suggest gender differences in activation to an emotion-processing task in abstinent alcohol dependent individuals. Recent trauma was associated with reduced neural activation. Females and males seem to have different brain response patterns based on trauma history. Results suggest that gender and trauma should be addressed in future studies.

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**K. PATEL, L. JACOLA, K. EATON, K. SZALEWSKI, J. RAS-MUSSEN, M. SCHAPIRO & J. VANNEST. An fMRI Investigation of Syntactic Verb Processing in Down Syndrome.**

**Objective:** Individuals with Down syndrome (DS) exhibit difficulties with aspects of language including grammar and syntax. Through fMRI we investigated the neural basis of these mechanisms in DS individuals. A word/nonword decision paradigm was used to examine syntactic processing of regular (walk → walked) and irregular (take → took) past tense verbs.

**Participants and Methods:** Six Down syndrome patients (5M, 1F, age 15-26yo) and 6 typically developing (TD) controls (2M, 4F, age 6-26yo) participated. Audiovisual stimuli of 20 regular -ed past tense verbs, 20 irregular, 20 over-regularized (taked), 20 present tense, and 40 non-word foils were presented in an fMRI scan. Participants responded via button press for “silly” or “real” word indication.

**Results:** With a GLM analysis, we compared over-regularized past tenses (taked) in reference to regular -ed past tense verbs. DS participants performed with 28% response accuracy in rejecting over-regularized past tenses, similar to the 4 youngest TD with 26% accuracy, while older TD participants were 86% accurate. DS participants displayed significant activation in the right inferior/middle frontal cortex and the bilateral posterior superior temporal cortex extending into parietal regions, in comparison to the TD group [ $p < 0.01$ ].

**Conclusions:** Activation reflects engagement of attentional and working memory resources, suggesting that the discrimination of over-regularized verbs as “silly” is more taxing in DS participants. Similarities in response accuracy between DS and young TD participants may also represent developmental delays of regions involved in syntactic processing. Ultimately, recruitment of additional networks supporting attention and syntactic processing in DS participants may underlie language difficulties observed in this group.

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**C. PENDERGRASS, K. ARMSTRONG & A. WOOLARD. Cognitive, Emotion, and Motor Inhibition in Bipolar Disorder.**

**Objective:** Impaired inhibition is common in patients with bipolar disorder. Previous studies have examined performance on cognitive, emotion, and motor inhibition tasks separately but have yet to examine the relationship between inhibition performance across different task domains (cognitive, emotion, and motor). The present study examined performance and the neural circuitry subserving cognitive, emotion, and motor inhibition in bipolar patients and healthy controls.

**Participants and Methods:** Euthymic bipolar I patients and matched health control participants performed a stop-signal task and color-word and emotional Stroop tasks while undergoing fMRI. We calculated between-group differences and within-group correlations for performance and neural response for all three tasks.

**Results:** Bipolar patients (BP) performed significantly slower across all three tasks and exhibited significantly lower performance accuracy on the color-word and emotional Stroop tasks. Performance on the stop-signal task was not related to performance on either Stroop task; however, performance on the color-word and emotional Stroop tasks were positively correlated for BP and controls. Across all three tasks, controls demonstrated greater dorsolateral and ventrolateral prefrontal cortical and bilateral anterior cingulate activation compared to BP.

**Conclusions:** Results from the present study are consistent with previous research suggesting that bipolar patients exhibit greater impairment on tasks requiring automatic inhibition, such as the Stroop tasks, compared to tasks requiring voluntary inhibition, such as the stop-signal task. The current study also provides additional evidence for disrupted recruitment of neural regions known to support successful inhibition in patients with bipolar disorder. Further studies are needed to examine the impact of impaired inhibition and neural dysfunction in bipolar disorder.

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**L.H. SWEET, R.C. MULLIGAN, C.E. FINNERTY, B.A. JERSKEY, S.P. DAVID, R.A. COHEN & R.S. NIAURA. Effects of Nicotine Withdrawal on Verbal Working Memory and Associated Brain Response.**

**Objective:** Previous literature has reported the negative impact of nicotine withdrawal on brain function during cognitive tasks such as verbal working memory (VWM). Mechanisms of these withdrawal effects have not been clearly identified. Functional neuroimaging offers an objective method to examine brain mechanisms responsible for observable behavior and subjective reports.

**Participants and Methods:** To investigate these mechanisms, 12 dependent smokers (7 women; mean age = 38.67; mean cigarettes per day = 13.42) were administered a 2-Back VWM challenge during two fMRI assessments. Participants abstained from smoking prior to both sessions; however, they applied a nicotine patch before one fMRI session and a placebo patch and prior to the other.

**Results:** Nineteen regions exhibited a significant (two-tailed  $p < .001$ ) response to the 2-Back during either condition. In three out of five regions that exhibited deactivation, withdrawal was associated with significantly greater deactivation in left ( $p = .013$ ) and right ( $p = .004$ ) temporal pole and left medial frontal gyrus ( $p = .009$ ). Differences in activation and deactivation between nicotine conditions were significantly ( $p < .05$ ) related to craving in the majority of regions that responded to the task. Variance in individual brain responses was significantly ( $p < .05$ ) greater during the withdrawal condition in these regions.

**Conclusions:** Results suggest that differences in brain response to a working memory challenge in a state of withdrawal may be attributed, at least in part, to increased craving. Further deactivation of relatively deactivated regions also suggests further suspension of default network processing, possibly to compensate for more inefficient processing.

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**I. SZATKOWSKA, T. WOLAK, P. SOLUCH & A. MARCHEL. Functional MRI of Recognition Memory in the Hippocampus. A Preliminary Study.**

**Objective:** Previous neuropsychological and neuroimaging findings reveal that the hippocampus is important for recognition memory. However, it is unclear whether the hippocampus contributes particularly to recognition of previously studied (old) stimuli, or to recognition of novel (new) stimuli or, rather, contributes to a general processing that is necessary for recognition of both types of information. To address this issue, we examined hippocampal activity during recognition of old and new visual stimuli using fMRI.

**Participants and Methods:** An fMRI study was carried out in 12 healthy subjects using a 1.5 T clinical MRI scanner. A complex visual scene recognition tasks known to activate medial temporal lobe structures was used during scanning. Analysis of an fMRI data was directed at brain regions exhibiting old/new effects. These effects were identified with bidirectional contrasts of the activity elicited by old pictures and that elicited by new pictures.

**Results:** No areas within the hippocampus were identified where activity was greater for old than for new stimuli (old > new effect). However, reversed (new > old) effect was evident in several areas in the right hippocampus, including both anterior and more posterior areas. The study showed hippocampal activation for new compared to old stimuli.

**Conclusions:** The results suggest that the hippocampus is particularly sensitive to stimulus novelty. Given the importance of anterior hippocampal pathology in temporal lobe epilepsy, an approach emphasizing novelty processing may be particularly useful for clinical fMRI in epilepsy presurgical evaluation.

This work was supported by grant 1354/P01/2007/32 from the Polish Ministry of Science and Higher Education.

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**J. VANNEST, B.K. SCHEFFT, K.P. EATON, R.K. TSEVAT & J.P. SZAFIARSKI. fMRI of Self-generated versus Passive Memory Encoding.**

**Objective:** Behavioral studies have shown that verbal information is better retained when it is self-generated rather than read (learned passively). We used fMRI and a paired associates task to examine brain networks underlying self-generated memory encoding.

**Participants and Methods:** Participants were 15 healthy English speakers ages 19-62, (5F). In the fMRI task, related word pairs were presented in a "read" condition, where participants viewed both words and read the second word aloud, or a "generate" condition, where the second word was presented with only the first letter; with the subject required to generate the word (e.g. red - l\*\*\*). 30 word pairs were presented in each condition, with pairs arranged in blocks of 5. After the fMRI scan, words that were read or generated were presented, each with two foils, in a forced-choice recognition task.

**Results:** Recognition performance was 63% accurate for words in the "read" condition and 77% in the "generate" condition [ $t(14)=3.48$ ,  $p<.05$ ], consistent with previous behavioral results. fMRI revealed increased activation for generate>read in inferior/middle frontal gyri bilaterally (L>R), anterior cingulate, and caudate nucleus and the temporo-parietal junction bilaterally. Furthermore, a region in the left insula showed increased activation associated with better memory performance on the "generate" condition across individual participants.

**Conclusions:** These results suggest enhanced cortical activation accompanies self-generated encoding; a specific network of brain regions is recruited during self-generated encoding. Improved encoding is associated with increased participation of the left insula. The findings have implications for the development of procedures to enhance memory performance.

Supported by R01NS048281 (JPS)

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## ADHD/Attentional Functions

**R. CZARNECKI, A. BÉDARD, J. FAN, J.M. HALPERIN & K. SCHULZ. The Role of the Frontal Operculum in the Implementation of Response Sets.**

**Objective:** The anterior insula/frontal operculum and the dorsal anterior cingulate cortex are core regions in a cognitive control network that has been implicated in the stable maintenance of task sets. These regions show both transient activity at control initiation and sustained activity that reflects the cross-trial implementation of response sets in sensorimotor areas. This study tested the role of this cinguloopercular network in the trial-by-trial control of responses sets.

**Participants and Methods:** Sixteen healthy young adults were scanned with functional magnetic resonance imaging while performing a cued go/no-go task that required the maintenance of response sets over the cue-target interval.

**Results:** Cues signaling trial initiation produced transient activity in frontal opercular and premotor regions that partially overlapped target-related activations, as well as in downstream inferior temporal, parietal, and occipital sensorimotor areas. In contrast, the maintenance of response sets over the cue-target interval generated sustained activation in the ventromedial prefrontal cortex, motor cortex, putamen, and the anterior temporal and inferior parietal cortices. Further, the transient and sustained cue-related activity was similar whether the response was eventually executed or inhibited. Surprisingly, the anterior insula cortex showed only target-related activity.

**Conclusions:** These results suggest that different frontal regions are involved in the initiation of cognitive control and the maintenance of response sets over short delay periods. The same frontal opercular regions that have been implicated in the maintenance of task sets over extended periods may also operate on a different time scale to initiate cognitive control and response execution on a trial-by-trial basis.

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## Emotional Processes

**B. TELLEZ-ALANIS, V.M. PATIÑO-TORREALVA & G. DELAHANTY-MATUK. Impulsivity and Decision-Making: Gender Differences in the Iowa Gambling Task.**

**Objective:** Bechara et al. (1999; 2000) proposed the Iowa Gambling Task (IGT) to study decision-making under risky conditions. Recently, Zermatten et al. (2005) and Franken et al. (2008) reported a relationship between impulsivity, as a personality trait, and decision-making using this same task. Nonetheless, these and other studies have provided overall results from group performance. In this study, we reveal gender differences in IGT performance by healthy participants arising from a deck-by-deck and period-by-period analysis.

**Participants and Methods:** 51 healthy subjects (age 18-30; years of education 12.5-17; 27 men) participated in the study. The Eysenck Personality Inventory (Eysenck & Eysenck, 1994), The Functional/Dysfunctional Impulsivity Scale (Dickman, 1990), The BIS/BAS Scale (Carver & White, 1994) and the UPPS (Whiteside & Lynam, 2001) were used to assess impulsivity, whereas the IGT was used to explore decision-making.

**Results:** A gender difference was found only in the UPPS Urgence Subscale (Mann-Whitney  $U=204$ ,  $p=.02$ ), being superior in men. Regarding decision-making, an ANOVA evidenced effects by deck ( $F_{3,147}=23$ ,  $<.001$ ,  $\epsilon=.7$ ), an interaction between deck and period of execution ( $F_{12,588}=8.1$ ,  $<.001$ ,  $\epsilon=.5$ ), and among deck, period and gender ( $F_{12,588}=3$ ,  $=.009$ ,  $\epsilon=.5$ ). Finally, Spearman correlations between scores from the impulsivity scales and IGT responses evidenced gender differences in specific dimensions of impulsivity.

**Conclusions:** Our results indicate that gender profiles in decision-making using the IGT are different, suggesting that more fine grained analysis of performance is necessary to account for this processes.

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## Learning Disabilities/Academic Skills

**P.T. CIRINO. Kindergarten Precursors of First Grade Academic Skills.**

**Objective:** Precursors of early reading skills are well known, but math precursors are less well studied and potentially more varied. The present study assessed precursors of math and reading in Kindergarten to predict Grade 1 outcomes in both math (computation and problem solving) and reading (decoding and fluency, comprehension). Both within domain and cross-domain prediction was expected.

**Participants and Methods:** Students ( $n=194$ ) from a diverse school district were assessed in both K and G1. Math precursors included number sense (math naming, rote counting, quantity comparison) and executive function (working memory or WM, processing speed, behavioral inattention); reading precursors included phonological awareness (PA) and rapid naming (RAN). Outcomes were composite measures of math computations, problem solving, decoding, and reading fluency/comprehension. Multiple regression was used to identify salient precursors of each outcome within and across domain.

**Results:** Kindergarten precursors predicted math computations, final model  $F(6,168)=37.72$ ,  $p<.0001$ ,  $R^2=57\%$ , and problem solving,

$F(7,167) = 51.41, p < .0001, R^2 = 68\%$ , with unique contributions for math naming, oral counting, quantity comparison, WM, and PA (all for both outcomes), and age for computations (all  $p < .05$ ). Precursors were also predictive of reading decoding,  $F(6,167) = 67.56, p < .0001, R^2 = 70\%$ , and of reading fluency/comprehension,  $F(5,169) = 61.23, p < .0001, R^2 = 64\%$ , with unique contributions for math naming (both), oral counting (decoding), WM (both), PA (both), RAN (both), and age (decoding) (all  $p < .05$ ).

**Conclusions:** Kindergarten precursors were strongly related to academic outcomes one year later. Both within domain and cross-domain prediction was evidenced. Phonological awareness and math naming were predictive of both math and reading composite outcomes, as was working memory (though the type of working memory differed by outcome). Quantity comparison was specific to math outcomes, and rapid naming was specific to reading outcomes.

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## Symposium 7: Cognitive Enhancement: From Physiologic to Behavioural and Virtual Tools.

**Chair: Sophie Blanchet**

**Discussant: Shirley Fecteau**

**9:45–11:15 a.m.**

**S. BLANCHET, P. PIOLINO, G. GAGNON, S. FECTEAU, S. BLANCHET & S. FECTEAU. Cognitive enhancement: from physiologic to behavioural and virtual tools.**

**Symposium Description:** Episodic memory is one of the cognitive functions most affected by brain damage. Impairments in attention and executive control processes, which play an important role in memory, are also frequent. Although cognitive rehabilitation tends to be neglected in clinical practice, different approaches exist for enhancing cognitive performance. The earliest behavioural approaches in the memory field consist of teaching mnemonic strategies that promote rich encoding or that facilitate retrieval. Following this trend, Dr. Blanchet will expose the gains related to a cognitive rehabilitation program that emphasizes the learning of memory and attention control strategies in patients with memory disorders after a stroke. How to generalize these strategies to daily life was also emphasized. The development of virtual reality offers a new tool with a strong potential to aid in the transfer of training toward life activities. Dr. Piolino will expose how a virtual environment can be exploited to alleviate memory deficits in patients with traumatic brain injury. Depending on both the timing and intensity of the stimulation, transcranial magnetic stimulation (TMS) also provides a new avenue for enhancing cognitive performance. Ms. Gagnon will expose how TMS, applied over prefrontal areas during encoding or retrieval of a memory paradigm, increases the memory performance in young and healthy individuals. Finally, Dr. Fecteau will demonstrate how neuro-modulation effects induced by TMS can enhance cognitive control in patients with control disorders. Interestingly, the symposium will address the complementariness of these different approaches and their potential application in clinical practice to improve the care and quality of life of patients with cognitive disorders.

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**G. GAGNON, C. SCHNEIDER, S. GRONDIN & S. BLANCHET. Enhancing memory performance in young and healthy adults: A study with paired-pulse transcranial magnetic stimulation.**

**Objective:** Applying strategies in encoding and retrieval can increase memory efficiency. Interestingly, transcranial magnetic stimulation (TMS) is a neurophysiological tool that can also improve cognitive performance (Pascual-Leone et al., 1994). The facilitation effects of high frequency (>1 Hz) TMS on memory functions have been showed in a few studies in young and healthy participants (Pascual-Leone et al., 1993) and in elder individuals with memory complaints (Solé-Padullés et al., 2006). However, in these studies, TMS did not target regions specifically involved in either encoding or retrieval, such as left and right prefrontal cortex, respectively (Tulving et al., 1994). In our study, we investigated the facilitation effects of TMS applied during encoding or retrieval over these regions.

**Participants and Methods:** Eleven right-handed individuals ( $21.33 \pm 2.27$  years old) performed a recognition task. Paired-pulse TMS (15 ms spaced) were applied over the left or right dorsolateral PFC (DLPFC) either during encoding or retrieval of verbal or non-verbal material.

**Results:** Results showed that ppTMS applied over the left DLPFC during encoding induced shorter response time compared to stimulation over the right DLPFC or the sham condition [ $t(10) = 2.77, p = .020$  and  $t(10) = 2.89, p = .016$ , respectively]. In addition, ppTMS applied over the right DLPFC during retrieval was associated with shorter response time compared to stimulation over the left DLPFC [ $t(10) = 2.52, p = .031$ ].

**Conclusions:** Overall, our data suggest that ppTMS of DLPFC can facilitate memory performance, thus is capable of transient influence on brain cognitive function in young and healthy individuals.

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**P. PIOLINO. Cognitive enhancement on components of episodic memory and feature binding via virtual reality: new insight in traumatic brain injury.**

**Objective:** Neuropsychological tests are often far removed from patients' daily life experiences and subjects' complaints of everyday memory problems. Moreover, rehabilitation programs generally fail in transferring forms of memory enhancement targeted by rehabilitation techniques and memory for general life experiences. Virtual reality (VR) is gaining popularity as a tool in neuropsychology because it enables researchers and clinicians to create situations that are close to daily life with perfect experimental control of multimodal environments. In the past decade, VR techniques have been developed essentially to investigate and rehabilitate spatial memory and navigation rather than memory for complex episodes elements as well as their contextual features (associated details, location and temporal order) and binding.

**Participants and Methods:** We conducted a series of studies using new VR tools assessing the main aspects of episodic memory and feature binding in aging and diverse neurological pathologies. Moreover, we worked out a VR program focused on cognitive enhancement of episodic memory.

**Results:** We conducted a series of studies using new VR tools assessing the main aspects of episodic memory and feature binding in aging and diverse neurological pathologies. Moreover, we worked out a VR program focused on cognitive enhancement of episodic memory.

**Conclusions:** Our findings confirm that RV tools open up a large field of memory evaluation, and the promise of new and powerful tools for memory rehabilitation.

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**S. FECTEAU. Modulating decision-making and executive functions with brain stimulation in addiction.**

**Objective:** The notion of enhancing executive functions and decision-making processes with the use of neuromodulation has received compelling support. Decision-making behaviors can be accounted for by a dual-process model, in which reflective and reflexive systems continuously cooperate and compete. From this model, impaired decision-making are conceptualized as a result of an imbalance between these systems. Hyperactivity in reflexive areas, such as the orbitofrontal cortex, and lack of regulatory influence from lateral prefrontal, reflective circuits may lead to a cognitive pattern reminiscent with addictive behaviors (e.g., excessive reward seeking, impulsivity). The objective is to test whether neuromodulation can change the balance between these two systems and improve decision-making behaviors.

**Participants and Methods:** A series of experiments using repetitive transcranial magnetic stimulation and transcranial direct current stimulation over the dorsolateral prefrontal cortex (DLPFC) have been conducted in healthy volunteers and patients with addiction to nicotine.

**Results:** Overall results revealed that neuromodulation can modify various decision-making behaviors such as suppressing risk-taking, reward seeking, impulsivity and self-interest in healthy subjects and patients with addiction.

**Conclusions:** Neuromodulation is a novel method of addressing cognitive control and translational studies to date report promising clinical effects. Neuromodulation promoting cognitive control can indeed reduce substance intake and craving for nicotine, alcohol, cocaine, and food. We are also investigating whether such clinical benefits can be found in patients with severe traumatic brain injury whose decision-making abilities often remain impaired despite an otherwise good cognitive amelioration.

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**S. BLANCHET, S. BELLEVILLE, L. NOREAU & P. FOUCEYROL-LAS. Rehabilitation of cognitive disorders in relation to activities of daily living in individuals with vascular cognitive impairment.**

**Objective:** After a stroke, up to 65 % of individuals suffer from different degrees of cognitive disorders that interfere with daily life functioning. This cognitive impairment is especially evident in episodic memory. In addition to memory deficits, persons with stroke frequently show impairments in attention and executive processes related to frontal network dysfunction. In some persons with stroke, impairment of this cognitive function is severe enough to reduce their autonomy in daily life. We assessed, in patients with vascular cognitive impairment (VCI) after a stroke, the impact of a cognitive rehabilitation program that specifically targets episodic memory and memory-involved processes (i.e., attention and executive control processes). We also assessed the impact of this cognitive rehabilitation on life habits.

**Participants and Methods:** Six persons with VCI participated in a rehabilitation program that emphasized the learning of encoding and retrieval strategies, as well as the training of attentional and executive processes. In addition, cognitive and life-habit outcomes were administered to two control groups with no treatment, one of healthy individuals and another one of individuals with VCI.

**Results:** After cognitive rehabilitation, in comparison to both untreated individuals with VCI and healthy control participants, treated individuals with VCI improved their learning abilities in episodic memory. Treated persons with VCI also improved their working memory abilities when compared to untreated individuals with VCI. Finally, cognitive rehabilitation induced an increased understanding of financial responsibilities in treated patients.

**Conclusions:** Thus, persons with VCI seem to benefit from cognitive rehabilitation efforts and these benefits also transfer to some complex life habits.

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**Symposium 8:  
The Non-Mexican Neuropsychologist's Guide to Mexico and Mexicans**

**Chair: Tedd Judd**

**Chair: Laura Renteria**

**Discussant: Feggy Ostrosky-Solis**

**10:15–11:45 a.m.**

**T. JUDD, L. RENTERIA, R. DIAZ-LOVING, T. VILLASENOR, L. RENTERIA, J. KUCERA-THOMPSON & F. OSTROSKY-SOLIS. The Non-Mexican Neuropsychologist's Guide to Mexico and Mexicans.**

**Symposium Description:** Mexico is a country of 110 million people. In the U.S., 9% of the population or 28 million are Mexican in origin. There are about 95,000 Mexicans in Canada. Mexican-origin populations in other countries are much smaller. North American neuropsychologists are increasingly encountering Mexican-origin clients in their practices. This symposium is intended to introduce non-Mexican neuropsychologists to Mexico and Mexicans to facilitate their work with this population. It will cover: aspects of Mexican populations, epidemiology, languages, cultures, migration patterns, education, health care, and justice systems most pertinent to neuropsychology; the state of Mexican neuropsychology; and working with Mexicans in the U.S. from the perspectives of the Spanish-speaking and the non-Spanish-speaking neuropsychologist. It will review neuropsychological research on Mexican and Mexican-American populations, best practices in neuropsychological evaluation and treatment of Mexicans and Mexican-Americans in the U.S., and an overview of available tests. Potential for cross-border collaboration will also be explored.

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**R. DIAZ-LOVING. Mexican Cultures, Languages, Institutions, and Migrations Pertinent to Neuropsychology.**

**Objective:** Psychology has witnessed recurring crisis within and criticism without to the Euro-Meso-North-American scientific tradition, traceable to the lack of cultural and eco-systemic sensitivity and an attempt to indiscriminately generalize findings across behavioral settings. Culture plays a leading role in the determination of the human way of life, by insuring the transmission and understanding of thoughts and feelings. It further provides the theoretical framework for explaining how groups of individuals arrive at shared yet distinctive sets of values, attributes, attitudes and social behaviors. Human interaction requires decoding, interpreting, storing and retrieving verbal physical and contextual stimuli, which in turn is used to behave according to socio-cultural norms of a specific group. The complexity of the process requires heuristics to navigate through stimuli, creating expectancies, beliefs, norms, roles, status, traits, values and attitudes about self and others, which provide stability and predictability to our worlds.

This presentation reviews the socio-culture norms of Mexico, including domains that are important to neuropsychology, such as language, migration patterns, education, health care and the justice system. This presentation also investigates the potential contribution that emic studies have in the understanding of human behavior. Mexican ethnopsychology in particular will be offered as an attempt at correcting assumptions about the universal applicability of currently popular perspectives. Specifically, Indigenous studies conducted on the personality functioning of Mexican subjects will be offered as a standard in the interpretation of psychological phenomena.

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#### **L. RENTERIA. Working with Mexican-Origin Clients in the U.S. from the Perspective of a Mexican-American Neuropsychologist.**

**Objective:** As the population in the United States becomes increasingly multicultural, neuropsychologists must understand the importance of culture in clinical practice. For most, the approach to working with Mexican-Origin clients is relatively unsystematic.

It not uncommon for a non-Spanish speaking neuropsychologist to rely strongly or solely on nonverbal measures, despite that these measures have been demonstrated to be culturally biased (Ardila & Moreno, 2001; Ardila, 2007).

**Participants and Methods:** This paper reviews the approach that a Mexican-American neuropsychologist has taken to increase the validity of neuropsychological assessment with a Mexican-Origin population. It will include a discussion of cultural issues that impact neuropsychological assessment including acculturation, bilingualism and educational attainment. Recommendations for non-Spanish speaking neuropsychologists working with Mexican-Origin Clients are provided. Guidelines to determine whether one should refer out a client or seek a consult are reviewed. Preliminary results from an anonymous online survey conducted in the U.S. are presented to gain a better understanding of the approach most commonly used by Spanish speaking neuropsychologists in the assessment of Spanish speakers.

**Conclusions:** The field of neuropsychology is still lacking in attending to the needs of culturally diverse clientele. Implications are discussed. The practical considerations and general guidelines offered will assist neuropsychologists in improving services for clients of Mexican-Origin.

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#### **J. KUCERA-THOMPSON. Working with Mexican-Origin Clients in the U.S. as a Monolingual English Solo-Practice Neuropsychologist.**

**Objective:** The monolingual English neuropsychologist confronts a dilemma when faced with a large Mexican-origin monolingual Spanish and bilingual Spanish-English population. This presentation is a personal account of how one such neuropsychologist has adapted her practice, presented as a possible model for others. Yakima, Washington and its surroundings is about 45% Hispanic, mostly Mexican origin, with Spanish spoken at home for over 30% of the population. The presenter is the only neuropsychologist. She has adapted to this setting by learning about this population, its background, and needs; making connections with the community and the professionals who serve it; seeking out information, training, and consultation for working with this population; working with one interpreter consistently in a process of mutual education; seeking out appropriate tests and norms; developing test adaptations and informal tests to cover areas of need for which formal tests are not available or adequate; careful consideration of the specific purposes of evaluation and testing; cultural adaptations of recommendations; and maintaining an attitude of continuous learning.

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#### **T. VILLASENOR. The State of Neuropsychology in Mexico.**

**Objective:** Neuropsychology has a proud history in Mexico. A landmark event was the meeting of INS in Mexico City in 1983. Today it has grown to have representation in most of the major universities, with a number of different active research programs. Neuropsychological services are available in most cities. An array of regional, national, and international societies encompassing a variety of allied professions has contributed to the development of the field. Mexico has made substantial contributions to the neuropsychological body of research. This presentation will highlight the nature of neuropsychological practice in Mexico, and those aspects of research that contribute distinctively to clinical work with Mexican-origin populations.

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### **Paper Session 7: Cognitive Intervention/Rehabilitation**

**10:45 a.m.–12:15 p.m.**

#### **L. CLARE, D. LINDEN, R. WOODS, R. WHITAKER, S. EVANS, C. PARKINSON, J. VAN PAASSCHEN, S. NELIS, Z. HOARE, K. YUEN & M. RUGG. Goal-oriented Cognitive Rehabilitation for People with Early-stage Alzheimer's Disease: a Randomized Controlled Trial of Clinical Efficacy.**

**Objective:** This single-blind randomized controlled trial aimed to provide evidence regarding the clinical efficacy of cognitive rehabilitation (CR) in early-stage Alzheimer's disease (AD).

**Participants and Methods:** Participants were 69 individuals (41 female, 28 male; mean age 77.78, sd 6.32, range 56 – 89) with a diagnosis of AD or mixed AD and vascular dementia and an MMSE score of 18 or above, and receiving a stable dose of acetylcholinesterase-inhibiting medication. Forty-four family carers also contributed. Participants were randomized to either CR, relaxation therapy (RT) or no treatment (NT). The CR group received 8 weekly individual home-based sessions of CR incorporating work on personally-relevant goals supported by components addressing practical aids and strategies, techniques for learning new information, practice in maintaining attention and concentration, and techniques for stress management. The primary outcomes were goal performance and satisfaction, assessed using the Canadian Occupational Performance Measure. Questionnaires assessing mood, quality of life and carer strain, and a brief neuropsychological test battery, were also administered. A subset of participants underwent functional magnetic resonance imaging (fMRI).

**Results:** CR produced significant improvement in ratings of goal performance and satisfaction, while scores in the other two groups did not change. At six-month follow-up, the CR group rated their memory performance more positively than did RT and NT. Behavioral changes in the CR group were supported by fMRI data for a sub-set of participants.

**Conclusions:** The findings support the clinical efficacy of CR in early-stage AD. The study was funded by the UK Alzheimer's Society.

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**K.R. THOMAS, R.E. WILLIAMS, M.W. BONDI, D.C. DELIS & E.W. TWAMLEY. Supported Employment Plus Cognitive Training for Veterans with Traumatic Brain Injury.**

**Objective:** Traumatic brain injury (TBI) often results in residual cognitive and functional impairments. We examined the effects of Cognitive Symptom Management and Rehabilitation Therapy (CogSMART), a 12-week compensatory cognitive training intervention, on post-concussive symptoms, cognitive performance, and work outcomes in Iraq/Afghanistan veterans receiving supported employment services. CogSMART provides a) psychoeducation, b) strategies to address sleep problems, fatigue, headaches, and stress, and c) strategies to improve prospective memory, attention, learning/memory, and executive functioning.

**Participants and Methods:** 13 unemployed veterans with mild-to-moderate TBI enrolled in a 12-month randomized controlled trial comparing supported employment plus CogSMART (SE-Cog) to enhanced supported employment (ESE). Participants were all male, 85% non-Caucasian, with a mean age of 32 and mean education of 13 years. Their TBIs occurred a mean of 4 years before study enrollment, and their mean losses of consciousness lasted 4 minutes. Sixty-nine percent met criteria for PTSD. Their mean baseline scores were average on tests of attention, processing speed, learning, delayed recall, prospective memory, and executive functioning. However, their mean performance on one processing speed task (Digit Symbol) was below average (mean  $SS=6.6$ ).

**Results:** Repeated measures ANOVA using baseline and three-month scores showed that, compared with the ESE group, SE-Cog participants reported more improvement in post-concussive symptoms ( $F=36.6$ ,  $df=1,5$ ,  $p=.002$ ); there were also trends toward improvement in verbal fluency and quality of life. Forty-four percent of SE-Cog participants and none of the ESE participants have obtained work thus far.

**Conclusions:** These results suggest that CogSMART, in the context of supported employment, may improve post-concussive symptoms, cognitive performance, and work outcomes.

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**L. FASOTTI, J. SPIKMAN & D. BOELEN. Efficacy of a Multifaceted Treatment for Executive Dysfunction after Acquired Brain Injury: A Randomized Controlled Trial.**

**Objective:** A multicenter RCT was conducted to evaluate the effects of a multifaceted treatment on daily life executive functioning.

**Participants and Methods:** 75 patients with acquired brain injury showing dysexecutive problems were randomly allocated either to the experimental multifaceted training or to a control treatment, consisting of computerized cognitive function training.

Multifaceted treatment of executive dysfunction's main objective was the improvement of several aspects of daily executive functioning. Control treatment was Cogpack, an individually administered computerized cognitive training package consisting of several repetitive exercises aimed at improving general cognitive functioning.

**Results:** The results of the study were twofold. Measures that were considered indications of daily life executive functioning showed that the multifaceted treatment led to significantly better treatment results, lasting at least six months post-treatment. In a Role Resumption List, for example, the experimental group scored significantly better in several areas of daily life. Better scores for this group were also found in an Executive Secretarial Test, a complex, newly designed test in which a job assessment procedure was simulated.

However, other measures regarding wellbeing and subjective complaints showed similar improvements for both groups, whereas conventional cognitive and executive tests showed no effects at all.

**Conclusions:** Significant treatment effects can be accomplished by a multifaceted treatment, it such a treatment is aimed at improving daily executive activities and is tailored to the individual patient. These effects last for a substantial period after ending the treatment.

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**A. ZEDLITZ, L. FASOTTI & A.C. GEURTS. Fatigue after stroke can be treated with Cognitive and Graded Activity Training (COGRAT): Preliminary results of a RCT.**

**Objective:** Poststroke Fatigue (PSF) is a common and debilitating complaint, which has only recently received attention (DeLuca, 2005). Up to date no evidence-based treatments are available and clinicians generally have little to offer in terms of a remedy or treatment (McGeough et al, 2009). Following the positive results of a pilot study, a more elaborate program of Cognitive Behavioural Therapy and three compensation strategies combined with a Graded Activity Training (COGRAT, Fasotti, 2006; Romani, 2008) has been developed and is currently being evaluated in a randomised controlled trial in 7 rehabilitation centres in the Netherlands.

**Participants and Methods:** Ninety-eight chronic stroke patients were randomly assigned to either the cognitive therapy alone, or to cognitive and graded activity training after having been in a waiting list condition for three months. Subjective fatigue (CIS20 and FSS), cognitive disturbances (e.g. ANT,15-WLT), physical activity (registration and Stepwatch), and psychosocial functioning (e.g. HADS, SCL-90, CISS and SA-SIP) were measured at inclusion, before and after the treatment, and at six months follow up.

**Results:** Preliminary results of the 50 patients who already completed treatment show that in both groups, fatigue scores after treatment were significantly lower. As for objective cognitive disturbances and differential effects between groups, no sound conclusions can as yet be drawn. Further analysis revealed improvement in subjective cognitive and psychosocial functioning.

**Conclusions:** The developed cognitive therapy protocol seems to be an effective treatment for reducing fatigue after stroke. The additional value of graded activity training needs to be established when all patients have completed the study.

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**A. ELLIS, C. BEEVERS & T. WELLS. To See or Not to See: The Effects of Attention Allocation on Recall of Positive Information in Dysphoria.**

**Objective:** Cognitive models of depression posit that biased emotional processing contributes to depression maintenance. Particularly, cognitive dysfunctions in memory, attention and problem solving, which are highly dependent on executive functioning, have been implicated in depression. Specifically, depression has been associated with biased attention and memory for emotional information; however, few studies have examined relations between these processes. Study goals were to: 1) determine whether dysphoric and non-dysphoric individuals differed in amount of time they viewed word stimuli; 2) determine whether dysphoric groups differed in incidental recall of study stimuli; and 3) conduct mediation analyses testing whether attentional processes mediated the association between dysphoria status and word recognition.

**Participants and Methods:** Stably dysphoric ( $n = 23$ ,  $BDI-II = 26.6$ ) and non-dysphoric ( $n = 40$ ,  $BDI-II = 5.9$ ) participants' line of visual gaze was assessed using eye-tracking methodology while viewing emotionally valenced words (e.g., dysphoric, positive, aversive, neutral). They then completed an incidental recognition task to assess memory for study stimuli.

**Results:** Results indicated that non-dysphoric individuals demonstrated an attentional bias for positive words, while dysphoric individuals lacked this bias ( $F(1, 51) = 8.03$ ,  $p < .008$ , partial  $\eta^2 = .14$ ). Further, fixation duration and time spent viewing positive stimuli mediated the association between dysphoria status and incidental recognition of positive words.

**Conclusions:** Results suggest that a “protective bias” to attend to positive stimuli, typically observed among non-dysphoric individuals is absent in dysphoria. Additionally, the results suggest that this lack of attention for positive information may be affecting the encoding processes necessary for enhanced memory of this information.

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**Poster Session 6:  
ADHD/Attentional Functions,  
Assessment/Psychometrics/Methods (Child),  
Autism Spectrum Disorders, Learning  
Disabilities/Academic Skills, Multiple  
Sclerosis/ALS/Demyelinating Disorders**

**11:30 a.m.–1:00 p.m.**

**ADHD/Attentional Functions**

**E. ANDRESEN, A. ROZMARYNOWSKI, A. ORVIS & D. OSMON.**  
**Connor's Continuous Performance Test in Simulated ADHD.**

**Objective:** Incentives to feign ADHD in psychoeducational assessments have been well documented (Sullivan, May, Galbally, 2007) and the ability of simulators to fake ADHD performance on a continuous performance test was evaluated in the present study.

**Participants and Methods:** 56 undergraduate students took Conner's CPT-II as part of a larger study. Students were randomly assigned to a high incentive control or ADHD simulator group. The results from these students were compared to the CPT-II results of 11 students who had been tested through our LD Clinic, who reported attention concerns ( $T > 65$ ) on at least one scale of the Conners' Adult ADHD Rating Scale (CAARS).

**Results:** Simulators differed from Controls and Attention Complaint Clients on the Omissions, Confidence rating, Reaction Time, Reaction Time Standard Error, Variability, Detectability, Reaction Time ISI, and Standard Error ISI. Simulators differed from Controls but not Attention Complaint Clients on Commissions and Perseverations. On Detectability only Attention Complaint Clients differed from Controls.

Using only the experimental data, stepwise logistic regression achieved 93% specificity and 86% sensitivity using Commissions and Variability. Comparing Simulators with Attention Complaint groups, ROC analysis revealed sensitivity of 71% at a specificity of 90% using Variability

**Conclusions:** Present results are consistent with past literature suggesting that continuous performance tasks may be useful in identifying ADHD and differentiating the disorder from those attempting to feign the disorder (Booksh et al., 2009). Simulator's performance on a number of scores from the CPT-II differentiated their performance from normal controls and from students with clinical attention referrals.

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**O. BARRIOS & E. MATUTE.** **Execution Time in a Planning and Organization Task Differentiates Children with and without ADHD.**

**Objective:** Deficits in executive function (EF) such as low performance on planning and organization tasks, have been reported as fundamental in ADHD. Solving this type of task requires not only correct strategies but also control of time. The aim of this study was to determine whether the time of the performance of a planning and organization task could differentiate subjects with and without ADHD.

**Participants and Methods:** 38 children aged 9–13 (11 girls, 24 boys) whose parents and teachers identified symptoms of ADHD made up the ADHD Group; while 38 children (10 girls, 28 boys) were included in

the Control Group (CG). All were from public schools. Performance of the Pyramid of Mexico task from the ENI (Matute, Rosselli, Ardila and Ostrosky, 2007) was analyzed using five measures: number of correct designs (CD), number of movements (NM), time invested in correct designs (TCD), number of correct designs with the minimum number of movements (CDMM), and time invested in correct designs with the minimum number of movements (TCDMM).

**Results:** We found that for both time measures, the ADHD Group had a slower performance than the Control Group [TCD,  $F(9.440) MS=17.053 p=.003$ ; TCDMM,  $(4.476) MS=2190.316 p=.038$ ]; whereas the number of correct designs achieved with the minimum number of movements, and the number of movements used, were comparable. Contrary to expectations, the Control Group had a lower number of correct designs than the ADHD Group [ $F(4.787) MS=17.053 p=.032$ ].

**Conclusions:** Our results suggest that run time is useful in differentiating between subjects with and without ADHD when performing a planning and organization task.

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**A. BEDARD, J.W. TRAMPUSH, J.H. NEWCORN & J.M. HALPERIN.**  
**Perceptual and Motor Inhibition in Adolescents/Young Adults with Childhood-Diagnosed ADHD.**

**Objective:** This study examined perceptual and motor inhibition in a longitudinal sample of adolescents/young adults who were diagnosed with ADHD in childhood, and as a function of the relative persistence of ADHD.

**Participants and Methods:** Ninety-eight participants diagnosed with ADHD in childhood were re-evaluated approximately 10 years later. Eighty-five never-ADHD controls similar in age, IQ, sociodemographic background, and gender distribution served as a comparison group. Participants were administered a psychiatric interview and the Stimulus and Response Conflict Tasks (Nassauer & Halperin, 2003).

**Results:** Participants with childhood ADHD demonstrated slower, more variable and less accurate responses to both control and conflict conditions relative to the comparison group; there was no specific effect of childhood ADHD on perceptual or motor inhibition. ADHD persisters and partial remitters did not differ in overall accuracy, speed or variability in responding, but relative to partial remitters, persisters demonstrated greater slowing in response to perceptual conflict.

**Conclusions:** These findings are consistent with theories positing state regulation, but not inhibitory control deficits in the etiology of ADHD, and suggest that improved perceptual inhibition may be associated with better outcome for ADHD.

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**G.B. CHRISTOPHER & N.L. NUSSBAUM.** **Gender Differences in Executive Functioning for Children with ADHD, Predominantly Inattentive Type.**

**Objective:** Little research exists directly comparing ADHD males and females on executive functioning task performance. The research that does exist has found conflicting results with some studies finding females to perform better than males (Rucklidge, 2006; Rucklidge & Tannock, 2002) while others have found no gender differences (Arcia & Connors, 1998; Rucklidge, 2006; Rucklidge & Tannock, 2002; Seidman et al., 2005). The purpose of this research was to evaluate gender differences on a number of different executive functioning domains.

**Participants and Methods:** Scores were obtained for 51 children aged 7 to 13 with diagnoses of Attention-Deficit/Hyperactivity Disorder – Predominantly Inattentive type (ADHD-PI). They all completed executive functioning measures of working memory, response inhibition, and vigilance. The sample consisted of 31 males and 20 females. All children had an IQ above 80 and achievement within expectations of their ability.

**Results:** Data was analyzed using simple regression analysis. Four separate simple regressions were run for the four executive functioning scores examined. The results showed that gender accounted for 9.8% ( $p=0.025$ ) of the variance in working memory scores, and 14.5% ( $p=0.006$ ) of the variance in response inhibition scores, with females outperforming males in both cases. No significant results were found for vigilance.

**Conclusions:** These findings suggest that gender differences do exist in executive functioning for children with ADHD-PI. These results are consistent with previous literature and suggest the need for future research to include both female only and mixed gender samples in order to best address how ADHD manifests in children.

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#### L.C. ENINGER, G. BOHLIN & C. WAHLSTEDT. An Investigation of Risk Profiles of Early Temperament in Relation to Behavioral Problems.

**Objective:** In order to better understand the heterogeneity among individuals exhibiting various behavior problems, it has been advocated that research should focus more on creating risk profiles based on individual patterning of behavioral dispositions or risk factors, rather than looking at mean levels of specific variables. Temperament has traditionally been of interest when predicting behavioral problems, however the most common approach has been predictions at the variable level. Certainly it may be of interest to find that high levels of early activity and negative emotionality is a risk factor for conduct problems, for instance; however, one often needs to know more about the individual child in clinical settings.

**Participants and Methods:** The present study was conducted on 800 children between the ages of 3;11 and 4;2 years. Based on parent-reported temperament (activity, impulsivity, emotionality, socialbility, and shyness) as well as effortful control, risk profiles were created using cluster analysis and studied in relation to later behavioral problems and competencies.

**Results:** Several relatively robust profiles emerged showing differing relations to hyperactivity and conduct problems, internalizing behaviors, and peer relations. Interestingly, a closer look at these profiles found slightly different profiles to be related to problem behavior in girls compared to boys.

**Conclusions:** This study is the first part of a longitudinal study that will be examining early temperament as well as cognitive and emotional functioning in relation to later behavioral problems. Clinical implications of these findings will be discussed.

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#### A.L. FLORES. Emotional Dysregulation in Preschoolers Predicts Later ODD but not ADHD

Adrienne L. Flores, Anne-Claude V. Bedard, Ph.D, David J. Marks Ph.D., Jeffrey M. Halperin Ph.D. Department of Psychology, Queens College, CUNY, 65-30 Kissena Blvd, Flushing, NY 11367.

**Objective:** Attention-Deficit/Hyperactivity Disorder (ADHD) is an early-emerging neurodevelopmental disorder defined by symptoms of inattention, impulsivity and hyperactivity. Yet among preschoolers with the disorder, inattention is less prominent and high levels of emotional dysregulation are frequently reported. This study examined the prognostic significance of emotional dysregulation as a diagnostic indicator of later ADHD and Oppositional-Defiant Disorder (ODD).

**Participants and Methods:** A large sample of 3-4 year-old children, who were identified as "at-risk" for ADHD, were rated by parents and teachers on the BASC-2. The analyses focused on subscales assessing "Hyperactivity," "Attention Problems" and "Emotional Self-Control." Parents were subsequently interviewed annually for two years to determine the presence of ADHD and ODD according to DSM-IV criteria.

**Results:** Logistic regression analyses, using teacher BASC-2 ratings, indicated that Hyperactivity, but not Attention Problems and Emotional Self-Control, significantly predicted an ADHD diagnosis both 12 and 24 months later. Parent ratings indicated that Hyperactivity predicted an ADHD diagnosis at 12 month follow-up, whereas both Hyperactivity and Attention Problems predicted an ADHD diagnosis 24 months later. Notably, teacher ratings of Emotional Self-Control, but not Hyperactivity and Attention Problems, predicted an ODD diagnosis at 12 months, but not 24 months. In contrast, early parent ratings of Emotional Self-Control predicted an ODD diagnosis at both 12 and 24 month follow-up.

**Conclusions:** These results suggest that Hyperactivity, and to a lesser extent Attention Problems, predict ADHD, while ODD is selectively predicted by levels of Emotional Self-Control. These data indicate a clear dissociation between ADHD and ODD that is evident during the preschool years.

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#### R. GEVA. Attention Regulation Deficits in Infants with Brainstem Dysfunction.

**Objective:** A recent theoretical model implicated neonatal brainstem integrity as a mechanism for later emerging self-regulation deficits, however direct effects of neonatal brainstem dysfunction on attention regulation were not yet studied.

**Participants and Methods:** The aim of the present study was to examine attention functions of premature infants ( $N=65$ ) whose neonatal brainstem functions were evaluated within 2 weeks post birth. Infants were recruited to a prospective study and their focused attention was tested at 18 months of age. Infants were tested using a 4 trials' procedure (1 simple toy, 3 complex toys) under 4 conditions (lack of distraction, unimodal visual, unimodal auditory and bimodal distracters). It was expected that in this complex paradigm, infants with brainstem dysfunction will have difficulty making the required shifts to attend the relevant stimuli and will have a difficulty inhibiting reactivity to distracters, once the stimulation would become familiar.

**Results:** Repeated measures analysis with birth weight and length of neonatal hospitalization as covariates was indicative of a significant interaction between the number of attention shifts and optimality of neonatal brainstem functions (Wilks' Lambda  $F = 3.183$ ,  $p < 0.003$ ).

**Conclusions:** These data seem to present the first support to the notion that neonatal brainstem compromise is related to later emerging attention regulation deficits. Clinical implications will be discussed.

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#### L. GLASS, J.J. RYAN & S.T. GONTKOVSKY. Comparing WISC-IV Performance in an ADHD Sample.

**Objective:** The WISC-IV profile for ADHD reported in the Technical Manual may be misleading because it is based on a sample that combined ADHD subtypes, girls and boys, and participants who were taking medication with those who were not. This investigation compares WISC-IV performance of children taking ADHD medication and those who are not and also reports score differences between girls and boys.

**Participants and Methods:** Participants were 80 boys and 36 girls with ADHD combined type. Means for age and FSIQ were 9.51 years ( $SD = 2.83$ ) and 88.80 ( $SD = 8.79$ ). Seventy-two were taking medication and 44 were not. The WISC-IV composites and subtests were compared for Medicated and Not Medicated and for girls and boys.

**Results:** Table 1 reports means for composite and subtest scores of the Medicated and Not Medicated groups. There was a significant difference on PRI, with a greater mean for the Medicated group,  $t(1, 114) = 2.96$ ,  $p = .004$ . No other significant differences emerged. The only subtest differences were on BD,  $t(1, 114) = 2.76$ ,  $p = .007$ , and MR,  $t(1, 114) = 2.37$ ,  $p = .02$ , with significantly greater scores for the Medicated group.

Mean composite and subtest scores of boys and girls appear in Table 2. There were no significant composite differences. The only subtest difference was on CD, with girls performing better than boys,  $t(1, 114) = 2.12, p = .04$ .

**Conclusions:** The present study suggests that taking ADHD medication at the time of an exam may significantly influence performance. Correspondence: *Laura Glass, M.S., Roosevelt University, 2600 W Logan Blvd, Apt 3i, Chicago, IL 60647, United States. E-mail: laura.glass@mymail.roosevelt.edu*

**A. MARGOLIS, B. BEEBE, A.A. HANE, S. MARKESE, J. JAFFE, K. BUCK, H. CHEN & P. COHEN. Infant Self-Regulation of Affect vs. Attention Differs with Mother vs. Novel Partner.**

**Objective:** The details of infant self-regulation on a moment-to-moment basis are little understood. We examine the role of affect level (positive/negative) and of partner novelty (mother/stranger) in infant self-regulation of affect (facial/vocal) vs. attention (gaze on/off partner's face).

**Participants and Methods:** Split-screen videotape of 4-month mother-infant (MI) and stranger-infant (SI) face-to-face communication was coded on a 1s timebase. Infant self-regulation was measured by auto-correlation (multi-level time-series analysis). 122 MI and 122 SI dyads were studied. Positive affect level variables were infant and adult mean facial affect, infant mean vocal affect, infant positive vocal affect. Negative affect level variables were infant and adult negative facial affect, adult negative facial affect/woe face, infant negative vocal affect.

**Results:** Infant affect self-regulation (facial/vocal) operates similarly in MI and SI dyads: with positive affect level (self or partner), infant affect self-regulation is lowered, more variable ("relaxed"); with negative affect level (self or partner), infant affect self-regulation is heightened, more stable ("wariness").

In contrast, infant attention self-regulation differs in MI vs. SI dyads. With familiar partner (MI), infant attention self-regulation becomes uncoupled from affect level and is thus more available for attention functions. With novel partner (SI), infant attention self-regulation, just like infant affect self-regulation, is constrained by affect level.

**Conclusions:** Thus, the MI vs. SI comparison identifies a dissociation between self-regulation of affect vs. self-regulation of attention, but with familiar partner (MI) only. Future research may show that with development, as the child becomes more familiar with handling novelty, this dissociation of self-regulation of attention vs. affect may emerge with the novel partner as well.

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**A.S. MARKS, D.J. MARKS, O.G. BERWID & J.M. HALPERIN. Familial Aggregation of Inhibitory Control and State Regulation Deficits in Preschool Children with ADHD.**

**Objective:** To evaluate whether inhibitory control and state regulation serve as candidate endophenotypes for Attention-Deficit/Hyperactivity Disorder (ADHD) by administering process-specific measures to parents of hyperactive-inattentive (HI) and typically-developing (TD) preschoolers. It was hypothesized that inhibitory control and state regulation deficits would be significantly more prevalent in parents of HI vs. TD children.

**Participants and Methods:** Parents' group status [HI-Fathers ( $n=41$ ), HI-Mothers ( $n=71$ ), TD-Fathers ( $n=31$ ), and TD-Mothers ( $n=47$ )] was determined based on parent and teacher behavioral ratings on the ADHD-Rating-Scale-IV of their child. Inhibitory control was examined using reaction time (RT) changes across conditions on the Stimulus and Response Conflict Tasks (SCT and RCT); each of which includes conflict and non-conflict conditions to isolate unique inhibition processes. RT differences were assessed via two-way (Group X Task Condition) ANOVAs. Independent samples  $t$ -tests were conducted to examine group differences in RT variability (RTSD), which served as the primary measure of state regulation.

**Results:** Significant Group x Condition interactions were observed on the SCT and RCT; HI-Fathers had significantly longer RTs than TD-Fathers on the conflict vs. non-conflict conditions. HI-Fathers also displayed significantly greater RTSD vs. TD-Fathers on the RCT (conflict condition); a trend was also observed for the SCT. Contrary to fathers, TD-Mothers demonstrated significantly longer SCT RTs than HI-Mothers on the conflict vs. non-conflict condition.

**Conclusions:** Inhibitory control and state regulation deficits appear more prevalent among fathers of HI preschoolers. This supports familial aggregation of inhibitory control and state regulation, and implicates them as candidate endophenotypes of ADHD.

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**D.J. MARKS, A. MLODNICKA, A.V. BEDARD, A.S. MARKS & J.M. HALPERIN. Bang for the Buck? The Impact of Early Remedial Interventions on Subsequent Neurocognitive Functioning in Children with ADHD.**

**Objective:** Relative to controls, preschoolers with ADHD receive more speech therapy (ST), occupational therapy (OT), and physical therapy (PT) services. However, little is known regarding the impact of these interventions on subsequent neurocognitive functioning.

**Participants and Methods:** Ninety-five preschoolers with ADHD [Mean (SD) age = 4.32 (0.49) years] were administered a neuropsychological assessment battery (NEPSY) during their initial (baseline) evaluation and again approximately two years later [Mean (SD) age = 6.40 (0.49) years]. Receipt of ST, OT, and PT (at or before baseline) was each coded dichotomously (Received vs. Not Received). Time (Baseline vs. Follow-up) x Service (Received vs. Not Received) mixed ANOVAs were conducted to examine the impact of ST on NEPSY Language scores, and the influence of OT and PT on NEPSY Sensorimotor abilities.

**Results:** Examining the impact of ST on Language revealed no significant main effects or interactions. Analyses involving OT and PT revealed significant main effects for Time (Follow-up > Baseline) and Service (Received < Not Received) on Sensorimotor abilities; there was no interaction of Time x Service for either OT or PT.

**Conclusions:** Early remedial interventions, in the form of ST, OT and PT may be of limited utility vis-à-vis later neurocognitive functioning in youth with ADHD. Those who did and did not receive services made strides in neurocognitive functioning at a similar rate. The fact that the same gap was present longitudinally, supports a deficit rather than a developmental lag model for neurocognitive functioning in ADHD.

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**J. BROOME, C. GOPIN, R. CZARNECKI, D. MARKS, A. BEDARD & J. HALPERIN. Relationship of early IQ and parenting to subsequent academic achievement.**

**Objective:** Parent-child relationships play a significant role in child development, including general cognitive functioning and perhaps subsequent academic achievement. This study examined the extent to which parent - child relationships measured during the preschool period affect later academic achievement.

**Participants and Methods:** We hypothesized that parenting would significantly influence academic achievement primarily in children with weaker overall cognitive abilities. Preschool children, ages 3-4 year [mean (SD) = 4.30 (.47);  $n = 216$ ], were administered the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III) and participated in a videotaped parent-child interaction (PCI). The PCI yielded information regarding Parent behavior (e.g. level of emotional support, amount of encouragement parent gives the child), Child behavior (e.g., child's compliance toward the task, his/her enthusiasm), and Dyadic interactions (e.g., mutual affection, enjoyment of the parent and child together). Read-

ing achievement was subsequently evaluated at age 6 using the Wide Range Achievement Test-Fourth Edition. The sample was divided into three groups (low, medium, high) based upon their preschool Full Scale IQ from the WPPSI-III. Pearson product-moment correlations were used to examine the relationship of preschool Parent, Child, and Dyadic PCI scores to 6-year-old measures of reading in each group.

**Results:** Associations between Parent, Child, and Dyadic PCI scores and later reading scores were strongest for individuals in the low IQ group. In contrast, only child PCI scores were associated with later reading for individuals in the two higher IQ groups.

**Conclusions:** These findings suggest that parental involvement may be particularly important to later reading ability in children with comparatively lower IQ scores.

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#### **A. MLODNICKA, D.J. MARKS & J.M. HALPERIN. The Impact of Early Service Utilization on Later Attention Deficit/Hyperactivity Disorder Symptom Severity.**

**Objective:** To examine the extent to which early use of occupational therapy (OT), physical therapy (PT), speech therapy (ST), and/or special education (SPED) services by preschool children with Attention Deficit/Hyperactivity Disorder impacts the severity of ADHD symptoms at a two year follow-up.

**Participants and Methods:** Current or prior ST, OT, PT, and SPED services was dichotomously assessed in a sample of preschool children with ADHD [ $n=102$ ; Mean (SD) age = 4.36 (0.46) years]. Frequency and severity of ADHD symptoms was assessed dimensionally by aggregating item scores from the K-SADS during their baseline assessment and again two years later [Mean (SD) age = 6.59 (0.30) years]. Separate Time (baseline vs. follow-up) x Service (received vs. not received) analyses of variance were conducted for each intervention to examine the relationship of service receipt to changes in ADHD severity.

**Results:** Significant main effects for Time emerged indicating reductions in ADHD severity over time. Significant Time x Service interactions were observed for analyses involving PT and SPED such that the reduction in ADHD severity over time was most robust for those who received the interventions. In contrast, no Time x Service interaction was observed for OT or ST.

**Conclusions:** Although the primary focus of PT is on gross motor difficulties the benefit of physical training appears to contribute to a decrease in ADHD symptom severity. The individualized learning environment, smaller classroom size and increased supervision in Special Education classrooms may also have a lasting and protective effect on reducing ADHD symptoms.

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#### **M.C. PARDEY, J. HOMEWOOD, N. KUMAR, A. GOODCHILD & J.L. CORNISH. Long-term Effects on Cognitive and Neural Development Following Chronic Ritalin Treatment to Non-ADHD Adolescent Rats.**

**Objective:** Attention Deficit Hyperactivity Disorder (ADHD) diagnosis often results in chronic treatment with psychostimulants such as Methylphenidate (MPH, Ritalin). With increases in misdiagnosis of ADHD, children may be mistakenly exposed to chronic psychostimulant treatment during development. The aim of this study was to assess the effect of chronic Ritalin treatment on cognitive and neural development in non-ADHD (WKY) and ADHD (SHR) rats.

**Participants and Methods:** Animals were chronically treated with either Ritalin (2 mg/kg oral, WKY-MPH,  $n = 20$ ; SHR-MPH,  $n = 19$ ) or water (WKY-NO,  $n = 20$ ; SHR-NO,  $n = 20$ ) to model clinical dosing in children. Immunostaining for Tyrosine Hydroxylase (TH) positive neu-

rons was performed at 3 stages. Group 1 ( $n = 16$ ) and Group 2 ( $n = 16$ ) were euthanized 1 week and 12 weeks, respectively, after cessation of treatment for neural tissue analysis. Group 3 ( $n = 47$ ) were euthanized upon completion of cognitive-behavioural testing for neural tissue analysis (12 weeks post treatment).

**Results:** Behavioural testing revealed that during treatment, WKY-MPH initially showed significantly higher locomotor activity in the first week with no differences observed in the following weeks of treatment compared to WKY-NO. This pattern was not reflected in SHRs, with treatment significantly increasing locomotor activity every week. During a cognitive task assessing delay sensitivity (impulsivity) conducted two weeks after treatment had ceased, WKY-MPH chose the delayed reinforcer significantly less than WKY-NO, with no effect on either SHR group. Measures of TH densitometry at each of the 3 stages are currently in progress.

**Conclusions:** These results show different motor stimulant effects with repeated administration of oral Ritalin between the two rat strains. These results also suggest that non-ADHD (misdiagnosed) animals chronically treated with Ritalin throughout adolescence show cognitive deficits in adulthood. Effects of chronic treatment on TH positive neural development will be discussed.

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#### **N.G. RIOJAS, A.G. LOPEZ, M.G. GONZALEZ & S.M. CAVAZOS. Analysis and comparison to the copy of the Rey Osterrieth Complex Figure in students between 12 and 15 with features of ADHD and controls in the state of Nuevo Leon.**

**Objective:** ADHD afflicts a significant percentage of students between 12 and 15 in secondary state of Nuevo Leon, is useful to analyze the impact that this disorder has on academic performance, personal and social development of students who exhibit characteristics such as inattention, impulsivity hyperactivity, behavioral and cognitive disorganization, difficulty in generating alternatives quickly without considering consequences and strategies so you leave the task. The objective of this study is to analyze and compare the results in the kind of performance between students selected and controls.

**Participants and Methods:** The sample comprised 50 men and 50 women between 12 and 15 years of secondary state of Nuevo Leon. To determine to use a list of selected DSM-IV and answering teachers Conner test could detect ADHD likely subsequently applies to Rey complex figure copying.

**Results:** We found that the selected students was more common type of execution without detail, step by step following the contour or separate segments, while controls performed the rectangle and then the details.

**Conclusions:** This study helps to understand the skills used by students with ADHD and support in developing and improving these, contributing to more effective learning and improving their school and family relationships.

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#### **L. SHANK, J. KAUFMAN, L. O'BRIEN & S. WARSCHAUSKY. Sleep Disturbance and Inspection Time in Children with Cerebral Palsy.**

**Objective:** Sleep disorders are associated with neuropsychological impairments. Children with cerebral palsy (CP) are four times more likely than typically developing (TD) children to exhibit sleep disorders. This study examined the relations between parental reports of sleep disturbance and visual inspection time (IT) in both children with CP and TD peers. Greater sleep disturbance was hypothesized to be associated with longer IT. IT measures components of cognitive processing speed, relatively independent of motor speed.

**Participants and Methods:** Participants were 46 children with CP and 76 TD peers, ages 8-16, mean 11.5 (2.5) years, 62% male. In the CP

group, 27 were at a Gross Motor Function Classification System (GM-FCS) level I, 3 at a GMFCS II, 16 at a GMFCS III, 7 at a GMFCS IV, and 4 at a GMFCS V. The IT task consisted of a Pi stimulus presented on a computer screen for brief experimenter controlled durations. Examinees were asked to make a simple decision regarding visual properties of the stimuli using arrow keys to indicate choice. Parents completed the Pediatric Sleep Questionnaire (PSQ-16).

**Results:** There was a significant correlation between PSQ-16 and IT in the CP group only, with greater sleep disturbance associated with higher IT threshold. In the CP group, medical variables and motor functioning were not significant predictors of PSQ-16 scores.

**Conclusions:** For children with CP, greater reported sleep disturbance is associated with longer IT durations, likely reflecting slowed processing speed. Findings are discussed in terms of the attentional and sleep disorder risks associated with CP.

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#### J. TALAMANTES, J. CORTEZ, A. GARCIA, C. RAMIREZ & P. VALDEZ. Analysis of indices of sustained attention on a continuous performance task.

**Objective:** Sustained attention is the capability to respond efficiently during prolonged periods. It is necessary to assess three indices of this cognitive process: general stability (standard deviation of speed and accuracy), time on task stability (linear regression on speed and accuracy) and short term stability (hit runs and error runs). The objective of this study was to analyze these indices of sustained attention using a continuous performance task.

**Participants and Methods:** Participants were 86 healthy undergraduate students, age:  $17.97 \pm 1.13$  yr, 36 male and 60 female. All participants responded a Continuous Performance Task (CPT). This task required the participant to press 1 to any number (except "9") appearing at the center of the computer screen, to press 2 when a "9" appeared, and to press 3 when a "4" appeared after the "9". The CPT had 27 blocks with 20 stimuli each.

**Results:** General stability values were: accuracy =  $1.06 \pm 0.05$  standard deviations; reaction time =  $37.28 \pm 1.33$  standard deviations. Time on task values were: accuracy =  $-0.16 \pm 0.02$  linear regression; reaction time =  $-0.06 \pm 0.03$  linear regression. Short term stability values were: hit runs =  $24.93 \pm 2.79$  sequences; error runs =  $2.31 \pm 0.04$  sequences.

**Conclusions:** The analysis of these indices of sustained attention could be useful to assess patients with attention disorders.

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#### J. WASSERSTEIN, M.V. SOLANTO, D. MARKS & K. MITCHELL. Diagnosis of ADHD in Adults: What is the Appropriate DSM Symptom Threshold?

**Objective:** DSM-IV criteria for ADHD were derived from field studies with children, aged 6 to 17. These criteria require the presence of at least 6 inattentive or 6 hyperactive-impulsive symptoms. These criteria were extended to adults by default. There is evidence, however, suggesting that hyperactivity-impulsivity diminishes with maturation. Appropriate cutoffs for adults are not known. This study used dimensional data from a well-normed questionnaire to empirically identify appropriate symptom thresholds for adults.

**Participants and Methods:** Participants were 88 adults (mean age 41, 66% female), meeting formal DSM-IV criteria for ADHD, based on a structured diagnostic interview corresponding to DSM-IV (CAADID). All completed the Conners Adult ADHD Rating Scale (CAARS) which includes sub-scales for DSM-IV Inattentive and Hyperactive-Impulsive symptoms. A T-score threshold of 65 was used to identify participants with statistically elevated severity of symptoms relative to the normal adult population.

**Results:** Eighty-six of 88 adults had a T-score of at least 65 (1.5 SD) on the CAARS DSM-IV Inattentive scale. Of these, 96.5% met the criterion number of 6 Inattentive symptoms on the CAADID. On the CAARS DSM-IV Hyperactive-Impulsive scale, 48 (55%) participants met this T-score threshold. Of these, only 53.1% met the cutoff of 6 hyperactive-impulsive symptoms on the CAADID.

**Conclusions:** Mandating at least 6 inattentive symptoms allows inclusion of nearly all adults who are at least 1.5 SD above the mean relative to the general population. By contrast, mandating at least 6 hyperactive-impulsive symptoms excludes almost half of adults who exhibit the same degree of severity for this symptom cluster. These data provide a compelling basis for altering the symptom threshold of hyperactivity-impulsivity for adults in the DSM-V.

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### Assessment/Psychometrics/Methods (Child)

#### M. DÉRY, M. HENRY, L. ÉTHIER & P. NOLIN. Motor and Cognitive Inhibition in Maltreated Children.

**Objective:** To study motor and cognitive inhibition of maltreated children using the Knock and tap (NEPSY) and Inhibition (NEPSY-II) subtests.

**Participants and Methods:** Study participants included 34 maltreated children aged from five to seven years of age (mean=6.77 years; S.D. = 0.76). Knock and tap is a measure of motor inhibition whereas Inhibition (a subtest with 3 conditions: Naming, Inhibition and Switching) is a measure of cognitive inhibition. For this study, percentile scores from the Knock and Tap and only combined scaled scores (integrating the total completion time and total errors scores for Naming and Inhibition) of Inhibition were used. The participants were compared to the normative samples of the tests.

**Results:** The results of the Knock and Tap test showed that 25.00% of children performed below the average level. Most of the children performed at the normal level (43.75%) or above (31.25%). On the Naming condition of the subtest Inhibition, 44% of maltreated children scored below the average level, 16% had the mean score and 40% scored above. On the Inhibition condition, 40% were below the mean score, 52% were at the normal level, and 8% were above.

**Conclusions:** In summary, results show a wide performance range in maltreated children; some within expected range, some below average and other over average. Also, deficits are mainly observed in cognitive inhibition and less in motor inhibition. This study emphasizes that inhibition is not a global concept and that is it important to have different inhibition measures in neuropsychological studies.

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#### J.C. FLORES LÁZARO & F. OSTROSKY-SOLÍS. Presentation of a Neuropsychological Executive Functions Battery.

**Objective:** To present a neuropsychological executive functions battery, specifically designed and adapted to Mexican population, that permits to evaluate more than 16 executive functions (EF) during development, adult and elderly phases.

**Participants and Methods:** A neuropsychological approach based on Stuss & Levine (2002) proposal: clinically based, wide used tests and supported in scientific literature, with complementary functional neuroimaging studies; to construct an instrument capable to evaluate EF supported by different prefrontal cortex regions (orbital, medial, dorsolateral, and anterior prefrontal), also considering hemispherical differences and to include a wide range of EF evaluated.

**Results:** 12 Tests has been properly designed and adapted to developmental characteristics in Mexican population; some tests were not ade-

quate for this population and were eliminated (for example Trail Making Test). The battery is organized in four levels: Basics EF (orbital-medial): inhibitory control, risk detection, motor control; Working memory: verbal and visual (maintenance and mental manipulation); Executive Functions: visuospatial and sequential planning, mental flexibility, verbal fluency, productivity, inverse sequence, codification strategy and control; Metafunctions: abstraction, metacognition, and figurative meaning comprehension. The battery allows the evaluation of more than 16 EF processes with an average of 40 minutes in total application. At the moment preliminary norms includes more than 600 subjects from 6 to 70 years old. Clinical validation is in course with prefrontal cortex damage patients. Diverse and independent groups are currently using this battery in different scientific research projects.

**Conclusions:** This neuropsychological EF battery represents an instrument designed to meet evaluation and research needs in Mexican population.

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**R.M. ROTH, P.K. ISQUITH & G.A. GIOIA. Parent report of Executive Function and Performance on the Tasks of Executive Control in children with ADHD.**

**Objective:** Problems with executive function contribute to the clinical diagnosis of ADHD in children and adolescents. Deficits in inhibitory control and working memory have been reported for both performance-based tests and parent reports of executive dysfunction in daily life. We examined relationships between parent reports of everyday executive function and children's performance on a novel computer administered set of tasks that manipulate working memory load and demand for inhibitory control.

**Participants and Methods:** 69 children and adolescents (55 males, 14 females) clinically diagnosed with ADHD completed the Tasks of Executive Control (TEC) which integrates an n-back paradigm to parametrically increase working memory load (0-, 1-, and 2-back) with a go/no-go task to manipulate inhibitory control demand. Parents completed the Behavior Rating Inventory of Executive Function (BRIEF).

**Results:** Several modest but significant correlations were observed between BRIEF and TEC scores. Lower accuracy on the TEC was associated with greater problems reported on the BRIEF Inhibit, Shift, Emotional Control, Organization of Materials, and Monitor scales. Greater response variability on the TEC was related to greater reported problems with inhibitory control and organization.

**Conclusions:** The pattern of correlations provided some evidence of validity for the TEC. The novel performance tasks captured aspects of executive dysfunction that are reflected in the daily lives of children and adolescents with ADHD.

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**J. HILL, A. MORTON, J.L. CALLAHAN, R. RIDDLE, L. NASSI & M. PUNARO. Linking Alpha-Interferon and Cognitive Impairment in Pediatric Systemic Lupus Erythematosus.**

**Objective:** Systemic Lupus Erythematosus (SLE) is an immunological disease which attacks major organ systems and the central nervous system. Neuropsychological impairments have been identified within 23% – 75% of pediatric lupus patients, with 25% occurring before age 20. Children and adolescents with lupus (pSLE) usually evidence more severe disease activity than patients with adult onset. This is an understudied population, with little information on the nature of cognitive deficits.

**Participants and Methods:** Our sample includes 21 patients, ages 13-17 years, with pSLE who received neuropsychological testing and provided genetic material for analysis.

**Results:** Data indicate that 14% of patients scored below average on the FSIQ on the Wechsler Abbreviated Scales of Intelligence (WASI),

with 25% having low VIQ scores. PIQ scores were average to above-average. Data identify a potentially impactful skill deficit, as pSLE patients tended to exhibit more focal difficulty with formulating task conceptualizations. While total test errors on the Wisconsin Card Sorting Test (WCST) were within normal limits, the mean number of trials required to complete the first category was surprisingly high (19 trials), with 38% of the sample in the 6th – 10th percentile range. Almost 30% of patients performed slower than average on part A of the Trail Making Test, with 19% mild to moderately impaired, while 20% were slower on part B, with 13% severely impaired.

**Conclusions:** Relationships between cognitive functioning and cytokine alpha-interferon production along with socioeconomic status and ethnicity will be presented to test the hypothesis that alpha interferon signature is related to cognitive dysfunction.

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**E. HINOJOSA CALVO, V.L. CÁRDENAS MONCADA & N.A. CHÁVEZ PERAZA. Parent's Scale for Ecological Assessment of Executive Functions in Children.**

**Objective:** The following study presents an instrument of evaluation of the Executive Functions (EF) in children, under an ecological perspective considering the relationships among age, gender, academic achievement, parents' education and the EF.

**Participants and Methods:** We developed a scale for parents, Likert type with 72 items based on the theoretical pattern of P. Anderson (2002) and considering the main social and academic contexts of the children. It was administered to 319 parents whose children aged from 9 to 12 years old, all from public elementary schools in Mexico City. With the obtained data, the items discrimination was carried out, obtaining 68 items.

**Results:** The factorial analysis identified four components with conceptual clarity that explain 38.5% of the total variance, evaluated in 32 items: Attention ( $\alpha=.90/16$  items), Goal Setting ( $\alpha=.77/8$  items), Cognitive Flexibility ( $\alpha=.57/4$  items) and Inhibition ( $\alpha=.83/9$  items). The first three corresponded to the pattern of P. Anderson and the last one was integrated as another component due to its factorial weight. The statistical analysis showed that girls obtained significantly higher scores than boys in attention and inhibition, moderated correlation between the academic achievement and the four factors, with more weight for the attention, and parents' education determined significant differences in inhibition.

**Conclusions:** A valid and reliable instrument was created to evaluate the EF in children with ecological perspective that can complement the traditional evaluation. These findings support the notion of EF as a multidimensional construct, where the attention and inhibition have a fundamental roll.

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**J. HORVATH. Distinguishing ADHD from Disorganized Attachment Based on Performance on the Test of Variables of Attention**

**Objective:** The Test of Variables of Attention (TOVA) is a standardized neurophysiological measure used to assess attentional functions and performance. The TOVA has been widely used as a major component in evaluating for Attention Deficit Hyperactivity Disorder. Research has documented that T.O.V.A. results correlate with the diagnosis of ADHD, Inattentive Type at least 84% of the time and with ADHD, Hyperactive-Impulsive Type at least 86% of the time. In the same study, the T.O.V.A. correctly identified 80% of the non-ADHD children.

According to the TOVA manual, clinicians are advised to take into consideration the many factors other than ADHD that could affect a person's TOVA performance. One such factor affecting TOVA performance, not deserving of attention, includes attentional variations resulting from parent-child attachment disruption. While the TOVA manual has

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widely publicized norms for ADHD, there are no documented norms for a phenomenon, called Disorganized Attachment. As children with disorganized attachment live in an enduring state of traumatic stress, it makes theoretical sense to propose that their attentional performance could suffer.

**Participants and Methods:** In this study, we compared children aged 8-13 diagnosed with ADHD vs. disorganized attachment on their TOVA performance.

**Results:** While ADHD participants showed their difficulty with sustained effort demonstrated in consistent hyperactivity and/or inattention as the test progressed, children with disorganized attachment, independent of ADHD status, demonstrated even more severe deficits than ADHD children. While performance was impaired in both groups, individuals with attachment disorganization, manifested in hyperarousal and freezing, demonstrated more severe levels of impairment than those with mere hyperactivity and inattention.

**Conclusions:** This finding suggests that caregiver-induced trauma is qualitatively and quantitatively potentially more psychopathogenic than biological factors alone.

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### G.L. IVERSON & B.L. BROOKS. Identifying Cognitive Impairment in Children with Mood Disorders Using Computerized Testing.

**Objective:** To develop a psychometric criterion for identifying cognitive impairment in children and adolescents with mood disorders.

**Participants and Methods:** Participants were children and adolescents between the ages of 6 and 19, including 215 healthy control subjects ( $M=13.4$ ,  $SD=3.2$ ), 30 outpatients diagnosed with depression ( $M=14.6$ ,  $SD=2.1$  years), and 37 outpatients diagnosed with depression and suspected co-morbid attention-deficit hyperactivity disorder (ADHD) ( $M=13.2$ ,  $SD=3.1$  years). All completed the CNS Vital Signs computerized battery. This battery of seven tests yields five domain scores (Memory, Psychomotor Speed, Reaction Time, Complex Attention, and Cognitive Flexibility).

**Results:** The total clinical sample, on average, showed relatively modest deficits in most aspects of cognition (Memory= $91.4$ ,  $SD=17.8$ ; Processing Speed= $88.8$ ,  $SD=17.2$ ; Reaction Time= $95.7$ ,  $SD=26.4$ ; Complex Attention= $86.7$ ,  $SD=28.3$ ; and Cognitive Flexibility= $94.9$ ,  $SD=24.4$ ). The children with co-morbid ADHD performed more poorly than the children with depression on the Processing Speed composite (Cohen's  $d=.56$ ), and there was a nonsignificant trend toward worse performance on the Memory composite ( $d=.45$ ). When the five composite scores were considered simultaneously, 34.3% of the total clinical sample had two or more domain scores below the 5th percentile, compared to only 5.7% of the control sample [Chi Square(1)= $38.83$ ,  $p<.0001$ ; Odds Ratio= $8.8$ , 95% CI= $4.1-18.9$ ]. This low false positive rate (i.e., 3-9%) was maintained across age groups, gender, ethnicity, and frequency of computer use in the control subjects.

**Conclusions:** A minority of children with mood disorders appear to have cognitive impairment. The psychometric criterion for cognitive impairment on this computerized test battery has a very low false positive rate.

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### A. JACKSON, R. PERNA & S. ROY. ADHD Subtypes and Differential Neuropsychological Test Performance.

**Objective:** The value of neuropsychological assessment with ADHD has been questioned, and while there is some empirical support for differential test patterns between inattentive and hyperactive subtypes, study results have differed and may represent the heterogeneity of this population. Most studies compare these two groups, but few studies assess the ADHD not otherwise specified (NOS) group. This study compared ADHD combined type with ADHD NOS on common neuropsychological measures to assess differences and determine the neuropsychological group differences. The hypothesis is that the NOS group would have less neurocognitive symptoms and impaired test scores.

**Participants and Methods:** Twenty-nine school age (mean age 10.7 years) children (26 boys, 3 girls), 15 with ADHD hyperactive type, 14 with ADHD NOS were referred due to behavior or academic problems and completed neuropsychological testing. None of the participants had a neurological history, evidence of an ABI, or MR. Data included all WISC-IV, WIAT-II, WCST, and CMS scores.

**Results:** Groups were compared (anova) but no significant differences were found on any variables, even when controlling for Full Scale IQ (ancova). Both groups had similar scores on all variables even those which have been found to differentiate the hyperactive and inattentive groups, in some samples. Also notable it that neither group had any test score patterns that would be considered a deficit.

**Conclusions:** These data suggest that children with a combined subtype or NOS can have normal neuropsychological testing and may not be differentiated by neuropsychological test pattern, though combined type has more diagnostic symptoms.

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### J. KAUFMAN, M. VAN TUBBERGEN, J. DONDERS, S. ASBELL & S. WARSCHAUSKY. Visual Inspection Time and Graphomotor Processing Speed in Children With Cerebral Palsy.

**Objective:** Inspection Time (IT) is a measure of general speed of processing (PS). IT tasks are amenable to assistive technology interfaces for accessibility. Relationships were tested between modified and standard IT tasks and standard PS measures in both typically developing (TD) children and children with cerebral palsy (CP).

**Participants and Methods:** Participants were 106 TD children and 58 children with CP. Standard and modified IT tasks consisted of brief pi stimulus presentations via computer with examinees responding to a question regarding a visual property of the stimulus; visual IT was estimated using a stepwise technique. Standard administration required keyboard responding between 2 choices, and modified administration utilized autoscanning between 2 choices with pressure switch response. A subset of children (78 TD and 32 CP group) also completed Wechsler PS subtests (Coding and Symbol Search).

**Results:** IT was faster in TD than CP groups ( $F(1,160)=8.96$ ,  $p<.005$  - modified and  $F(1,160)=21.24$ ,  $p<.001$  - standard). Standard IT was faster in the TD ( $t(103)=3.27$ ,  $p<.001$ ) but not the CP group. There were significant correlations for TD ( $r=.60$ ,  $p<.001$ ) between PS measures but not between PS measures and IT tasks. There were significant correlations for the CP group ( $r=.612$ ,  $p<.001$ ) between PS measures. Significant correlations were found for the CP group between modified IT and PS ( $r=-.362$ (symbol) and  $-.388$ (coding),  $p<.05$ ) but not for standard administration.

**Conclusions:** Findings demonstrate slower performance for both PS and IT measures in CP group participants. IT tasks behaved differently between these populations depending upon response modalities, suggesting that unanticipated added cognitive demands associated with accessibility may affect performance in individuals with motor dysfunction. Implications for development of measures using accessible response modalities are discussed.

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### L. KELLY, C.R. ROACHE & G.N. HOLMBECK. The Impact of Language Processing Skills on Social and Communicative Adaptive Behavior Among Youth with Spina Bifida.

**Objective:** The purpose of this study was to investigate the language processing skills of youth with spina bifida (SB) using the Comprehensive Assessment of Spoken Language (CASL). Furthermore, this study aimed to investigate whether the CASL is a significant predictor of communicative and social adaptive behavior skills among youth with SB, based on parent-report.

**Participants and Methods:** This study was part of a larger longitudinal investigation examining neuropsychological functioning and psychosocial adjustment among youth with SB. Participants included 134 families of youth with SB (62 male, 72 female) between the ages of 8 and 16 (M age = 11.42, SD = 3.13). Youth completed the Nonliteral Language, Inference, and Pragmatic Judgment subtests of the CASL and the Vocabulary subtest of the Wechsler Abbreviated Scale of Intelligence (WASI). Caregivers completed demographic questionnaires and the Adaptive Behavior Assessment System-II (ABAS-II; Communication and Social subtests).

**Results:** Participants performed in the Low Average to Average range on the CASL: Nonliteral Language (M SS = 94.19, SD = 19.49), Inference (M SS = 85.27, SD = 21.28), and Pragmatic Judgment (M SS = 88.80, SD = 18.74). These subtests were significantly associated with the WASI Vocabulary subtest, a proxy for verbal intelligence. Regression analyses revealed that all subtests of the CASL were significantly associated with adaptive communication skills and only the Pragmatic Judgment subtest was significantly associated with adaptive social skills.

**Conclusions:** Findings suggest that the language processing skills of youth with SB are within the low average to average range. In addition, analyses reveal that performance on the CASL can predict adaptive behavior skills of youth with SB, particularly communication skills.

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**S. LEFFARD, J. KAUFMAN & S. WARSCHAUSKY. Moderators of Standard and Modified Inspection Times in Children with Cerebral Palsy.**

**Objective:** Inspection time (IT) is a component of processing speed that is amenable to accessibility modifications for children with significant motor impairments including those associated with cerebral palsy (CP). Previous findings indicate that standard and modified (via assistive technology) inspection time tasks have equivalent psychometric properties for typically developing children, but not for children with CP. The current study examined physiological, cognitive, behavioral and motor factors that potentially moderate the differences between standard and modified inspection times in children with CP.

**Participants and Methods:** Participants were 45 children with cerebral palsy, ages 8-16, 71% male. In this high functioning sample, capable of participating in both standard and modified tasks, 62% were at Gross Motor Function Classification System (GMFCS) level I and 39% were at Manual Ability Classification System (MACS) level I. Children completed standard and modified IT tasks and the PPVT-III. Parents completed demographic surveys and the Conners CPR-S.

**Results:** Regression moderation analyses using the product variable approach (Baron & Kenney, 1986; Cohen & Cohen, 1983) indicate that history of seizures ( $R^2 = .66, p < .05$ ), Conners' PRS-R DSM Inattention T-scores ( $R^2 = .53, p < .01$ ), GMFCS ( $R^2 = .52, p < .01$ ), and MACS ( $R^2 = .58, p < .01$ ) are significant moderators of the relationship between standard and modified inspection times in children with cerebral palsy. Birth weight, CPRS-R Hyperactive T-scores, and PPVT are not significant moderators.

**Conclusions:** Results indicate that several factors, including but not limited to functional motor impairment, are associated with differential performance on standard and modified IT in children with CP. Psychometric and clinical implications are discussed.

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**M. MCCABE & D. WABER. What Does the Rey-Osterrieth Complex Figure Measure? Association with Ecologically Relevant Outcomes.**

**Objective:** The Rey-Osterrieth Complex Figure (ROCF) is a widely used instrument often utilized to assess visuospatial skills. Its clinical significance, however, may extend to other functional domains, and thus be more broadly relevant. The predictive relationship between performance on the ROCF and "real world" functioning is not well established, particularly in children.

**Participants and Methods:** We examined this relationship in 77 children with a history of Acute Lymphoblastic Leukemia (ALL) and associated treatment, a group at increased risk for cognitive, academic and adaptive sequelae (Raymond-Speden et al, 2000; Anderson et al, 2000). Participants ranged in age from 6 to 22 years (M = 10 years, SD = 3.5 years) and were a minimum of 5-years post-diagnosis. Nearly 65% of participants scored at or below the 25th percentile on Organization and approximately 45% displayed "part-oriented" Styles. Dependent variables were regressed on raw scores for Organization and Style (Developmental Scoring System, Bernstein & Waber, 1996) for the Copy condition, adjusting for age. Dependent variables included: receipt of special education services, story memory (TOMAL), academic achievement (WJ-III), and parent-reported executive functioning (BRIEF).

**Results:** The Organization scores predicted (1) academic achievement, including Passage Comprehension ( $p < .01$ ), Letter-Word ID ( $p < .01$ ), and Calculation ( $p < .05$ ), and (2) BRIEF Metacognitive Index ( $p = .05$ ), with a trend ( $p = 0.12$ ) for receipt of special education services. The Style score was not significantly associated with any dependent variable.

**Conclusions:** The clinical significance of poor performance on the ROCF is not limited to visuospatial skills.

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**C. MCGILL, C. WELLS, L. MONETA, E. MCGUIRE, H. PADIA, L. GATHERCOLE, P. ALLEN, P. ISQUITH & G. GIOIA. Psychometric Analysis of a Monitoring Version of the Behavior Rating Inventory of Executive Function (BRIEF-M).**

**Objective:** We examined evidence of reliability and validity for a shortened, modified form of the BRIEF, the BRIEF-Monitor form (BRIEF-M), intended to track changes in executive function.

**Participants and Methods:** Seventy-eight children (60% male) aged 11 to 18 years (M=14.40, SD=2.09) with recent mTBI, and 96 parents, completed a retrospective pre-injury baseline and two, serial, post-injury forms of the modified BRIEF-M rating scale with a 5-point rating system. Median number of days to the first visit was 15.0 with another 14.0 days to the second visit. The self-report form included 32 items composing five non-overlapping scales (Working Memory, Emotional Control, Task Completion, Planning/ Organization, Inhibit), while the parent form included 31 items within five similar non-overlapping scales but with Initiate substituted for the Task Completion scale. Three validity items are added.

**Results:** Internal consistency for individual scales was moderate to high for both forms (self-report:  $\alpha = .77$  to  $.94$ ; parent  $\alpha = .79$  to  $.95$ ); test-retest reliability for total scores was high for the parent form ( $r = .90, n=25$ ) but less acceptable for the self-report ( $r = .55, n=22$ ). Evidence of validity was demonstrated via paired t-tests of parent and child serial ratings with scores demonstrating initial impairment at clinic visit 1 relative to pre-injury baseline and improved functioning at visit 2.

**Conclusions:** The BRIEF-M exhibits promising initial evidence of reliability and validity for serial assessment of executive dysfunction and may be helpful in tracking recovery from injury or treatment effects. Continued refinement is ongoing.

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**P. PEREZ-ARCE & B.L. MERRITT. Spanish-As-A-Second Language: Assessment Proficiency Training Model For Neuropsychologists.**

**Objective:** The objective is to develop a replicable training model for clinical psychologists with medium Spanish proficiency for testing purposes who want to expand their neuropsychology practice to Spanish speaking clients. The training program addresses the challenges that seasoned native Spanish-speaking neuropsychologists face in training, supervising, and mentoring licensed clinical psychologists with limited Spanish proficiency and identifying and managing the individual challenges to the professionals-in-training.

**Participants and Methods:** The developers and presentors of this training program are licensed clinical psychologists. An instructive pediatric clinical case will be presented to illustrate the training process with a discussion of selection of appropriate neuropsychological tests, effective use of available Spanish language resources, issues of differential diagnosis taking acculturation and differences between primary and preferred language into account, the ethical use of established norms and the added complexities in interpreting results.

**Results:** To succeed essential resiliency and learning characteristics have been identified: motivation to speak only in Spanish during work hours, a willingness and ability to receive and integrate immediate corrective feedback on language use, self-correcting monitoring skills, off-work study and practice efforts, and effective use of supervision. An evolving step-wise plan to assess the trainee's improvement and the supervisor's effectiveness will be presented. The supervisor's resiliency and teaching characteristics will also be discussed.

**Conclusions:** Success in training neuropsychologists with Spanish-language conversational skills is contingent on setting standards for performance and the commitment of supervisor to mentor, actively support and guide the trainee's consistent and disciplined efforts to reach a proficient competency level for conducting neuropsychological evaluations in Spanish.

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**M.A. PETHERICK, J.E. CASEY, P. RICCIARDI & C.R. HALE. Patterns of Cognitive Functioning in a Combined Normative and Clinical Sample: A Cluster Analytic Study of the WISC-IV.**

**Objective:** To produce a reliable typology of childhood intellectual functioning in a combined sample based on patterns of performance on the WISC-IV core subtests.

**Participants and Methods:** The 970 participants between the ages of 8 and 16 selected for this study were drawn from two sources: (1) a population of children referred for assessment due to persistent academic difficulties; (2) the WISC-IV standardization sample. Participants from each source were matched on age and Full Scale IQ. Participants' WISC-IV scaled subtest scores were subjected to two-stage (hierarchical and iterative partitioning) cluster analysis. The reliability of the final cluster solution was established using both split-half and multiple-method reliability techniques.

**Results:** The five-cluster solution chosen was well replicated across four clustering methods (Ward's, Complete Linkage, Average Linkage Between Groups, Average Linkage Within Groups), across hierarchical and iterative methods, and in split-half samples. The five subtypes (labeled based on their salient characteristics) were: (1) Low Block Design and Coding, (2) Low Ability, (3) Average with higher average Perceptual Reasoning, (3) High Average, and (5) Low Verbal Comprehension. Four of the derived clusters were consistent with previous research conducted on referred or normative samples.

**Conclusions:** Reliable patterns of WISC-IV core subtest scores can be identified in a combined sample comprising referred and normative groups using cluster analysis. Future research is needed to replicate the derived typology with varied methodology (e.g., Q-factor analysis), to evaluate the external validity of the solution, and to explore the nature of cluster membership by comparing the types of individuals that are grouped together. Correspondence: *Michelle A. Petherick, M.A., Psychology, University of Windsor, 1787 St. Clair Rd. RR#1, Stoney Point, ON N0R 1N0, Canada. E-mail: mpeth@uwindsor.ca*

**M. PÉPIN, A. OTERO, M. LAVALLÉE, P. LAPORTE & M. LORANGER. The Development of Attention among 6 to 15 Year-Old Children from Four Different Cultural Backgrounds.**

**Objective:** This study examines developmental changes, as well as cultural and gender differences, in performances on tasks assessing the components of a dynamic attention system model among boys and girls aged 6 to 15 years.

**Participants and Methods:** In a first study, the Computerized Attentional Performance Test (CAPT, Pépin, Laporte, & Loranger, 2006) tasks assessing phasic alertness, sustained attention, selective attention, divided attention, and attentional control, presented in visual and/or auditory modes, were first completed by 1302 children aged 6 to 12 years from four cultural backgrounds (French-Canadian, English-Canadian, French and Mexican).

**Results:** Analyses reveal that performance significantly increases with age, but does not discriminate between sex and cultural background. Furthermore, findings suggest that the development of simple and low demand attentional functions is largely achieved before or at the age of 12, while performance on complex and highly demanding attentional tasks appear to continue developing after the age of 12 (no ceiling effect observed for certain tasks). To verify this last hypothesis in a second study, the CAPT was administered to 400 children aged 13 to 15 years from Quebec and Mexico. Results show that the development of all attentional functions seems to be largely achieved at the age of 15 years old, while, once again, cultural background and sex have no effects on the performance.

**Conclusions:** Those results will be discussed in the general context of normal development of attention and their eventual applications for evaluation of children with attention deficit disorders (ADHD).

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**R. VAURIO, L. DOWELL, R. MARTIN, E. MAHONE, M.B. DENCKLA & S.H. MOSTOFSKY. A Comparison of Patterns of Performance on Measures of Cognitive and Motor Ability in Children with HFA and ADHD.**

**Objective:** Profile analysis (i.e., identification of particular patterns of strengths and weaknesses on neuropsychological measures) has been proposed as a useful method for identification of diagnostic groups in children with developmental disabilities.

**Participants and Methods:** To investigate this, 146 children with ADHD ( $n = 89$ ) and high functioning autism (HFA) ( $n = 57$ ) were identified through structured parent interview and structured behavioral observation. All participants completed a neuropsychological battery including 1) Wechsler Intelligence Scale for Children-Fourth Edition; 2) Physical and Neurological Examination for Subtle Signs (PANESS; Denckla, 1985) and 3) Motor control measures [Motor Inhibition (Conflicting Motor Response Task and Contralateral Motor Response Task) and Motor Persistence (Lateral Gaze Fixation and NEPSY Statue)] as part of a larger neuropsychological evaluation. Data were evaluated with Step-Wise Discriminant Analysis to classify children into diagnostic categories based on task performance.

**Results:** A solution including 5 motor and IQ variables was moderately predictive of diagnostic status ( $r^2 = 0.59$ ;  $p < 0.001$ ). HFA status was negatively correlated with gaze persistence and performance on Symbol Search, with stronger performance on tasks assessing motor inhibition and Block Design. Predictive power of the model is stronger for HFA than for ADHD (77.9% of originally grouped cases correctly classified). One-way ANOVA evaluating differences in test performance for each variable entered into the Discriminant Analysis indicated significant differences only for Gaze Persistence, Symbol Search and PANESS Overflow performance, but not other variables.

**Conclusions:** The results suggest that profile analysis may be more useful in differentiating ADHD from HFA than comparison of individual test performance.

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**F. VAN DER FLUIT, E.C. BENNATON & B.P. KLEIN-TASMAN. Socio-Communicative Behaviors and Autism Spectrum Classification in Young Children with Williams Syndrome.**

**Objective:** Examine the utility of the Social Communication Questionnaire (SCQ) as a screener for sociocommunicative difficulties in WS.

**Participants and Methods:** Parents of children with WS completed the SCQ. Children were also assessed using the Autism Diagnostic Observation Schedule (ADOS), a semi-structured play observation. Comparisons of the classifications yielded by the 2 measures were conducted to evaluate the usefulness of the SCQ as a screening tool for a possible ASD diagnosis in WS.

**Results:** Participants included 48 children with WS (29 males, 19 females) with a mean age of 72.48 months ( $SD=39.093$ ). Approximately 1/3 of the sample exceeded the SCQ cutoff score (18/48, 37.5%). Similarly, 1/3 of the sample was classified as ASD using the ADOS (17/48, 35.4%). Classifications on the two measures were related,  $\chi^2(1, n=48)=5.107, p<.05$ . While Receiver Operating Curve analyses indicated that the SCQ distinguishes significantly between those classified ASD and those classified nonspectrum on the ADOS, ( $D=.702, p<.05$ ), sensitivity was low for capturing socio-communicative difficulties seen on the ADOS ( $Se=.588, Sp=.774$ ).

**Conclusions:** A proportion of WS individuals do experience social difficulties as reported by parent questionnaire and clinician observation. While use of the SCQ may aid in identifying children requiring further evaluation, additional information, such as language level, may provide a better indication of the need for further assessment than the SCQ.

This work was supported by NIH R03 MH 69400

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## Autism Spectrum Disorders

**C.R. AINSWORTH, A. KING, K. O'BRIEN, M. STEPANSKY, L. FELIX, J. DORFLINGER & A.V. DAVIS. Behavioral Profiles in Early versus Late Age of Diagnosis in Aspergers Syndrome.**

**Objective:** Age at first diagnosis varies across the autism spectrum disorders with research indicating the mean age of diagnosis for Autism ranging from 3.1-5.49 years, Pervasive Developmental Disorder-NOS from 3.9- 4.8 years, and Aspergers syndrome (AS) from 7.1- 11.13 years. The later age of AS diagnosis is a detriment for early intervention services. The current study examined differences in behavioral profiles for children who received an AS diagnosis at an "early" versus "late" age.

**Participants and Methods:** Participants were 40 children between the ages of 4.2-18.4 years who underwent diagnostic assessment at a medical center including administration of the Autism Diagnostic Observation Schedule (ADOS) and parent rating on the Behavior Rating Inventory of Executive Function (BRIEF) and Behavior Assessment for Children – Second Edition (BASC-2). The sample was dichotomized by a median split with a cutoff of 11.29 years for age at diagnosis.

**Results:** Multivariate analyses followed by post hoc tests revealed significant between group differences [ $F(1,38)=8.05, p < .05$ ] on the ADOS, with the "early" group demonstrating increased Stereotyped Behavior/Restricted Interests. Multivariate analyses did not indicate significant group differences on the BRIEF. Significant between group differences ( $p < .05$ ) were revealed on the BASC-2, with the "late" group exhibiting decreased adaptive skills.

**Conclusions:** Thus, behavioral profiles between the "early" and "late" groups differed significantly, as children with relative impairment in adaptive skills, but without the more obvious symptoms of stereotyped behavior/restricted interests, were diagnosed with AS at a later age. Awareness by clinicians of these differences in symptom presentation would allow for earlier AS diagnosis and subsequent benefit from early intervention services.

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**J. SOUTHWICK, K. TUMBLIN, J. PETRIE, T. WU, A. CRAMOND, T. MERKLEY, M.B. DUBRAY, A. FROEHLICH, E.D. BIGLER, N. LANGE, A.L. ALEXANDER & J.E. LAINHART. The Profile of Memory Impairment in Autism.**

**Objective:** Memory impairment in autism is a well-established finding. Less well-characterized, however, is the profile of memory functioning in autism using a clinical test battery. The Test of Memory and Learning (TOMAL) was used to assess memory in autism vs typically developing controls.

**Participants and Methods:** Participants included 46 children and adolescents with autism, ages 5 to 19, and 29 typically developing controls matched for age, performance IQ, handedness, and head circumference with the Test of Memory and Learning (TOMAL). Analyses of covariance were conducted using handedness and head circumference as covariates.

**Results:** Significant group differences were found for all index memory scores, including overall (mean score: control, 104.48; autism, 84.74), verbal (control, 103.31; autism, 82.26), and nonverbal memory (control, 104.93; autism, 88.24). Significant differences were found for all TOMAL subtests, except Manual Imitation, a measure of simple motor sequential recall.

**Conclusions:** These results portray a broader profile of impairment in autism, with less sparing of ability domains, than has been previously reported. To determine influence of verbal reasoning ability on group differences, groups were matched on verbal IQ ( $p = .083$ ). In this more conservative analysis, t-tests revealed that differences remained significant for all but a few TOMAL subtests, including Paired Recall ( $p = .064$ ) and Visual Selective Reminding ( $p = .097$ ), and selective reminding delayed (SRD) tasks: Word SRD ( $p = .193$ ) and Visual SRD ( $p = .059$ ). These findings indicate the multifaceted nature of memory impairment in autism, and provide additional support for previous findings of spared recall on tasks that require processing of less complex information in autism.

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**K. TUMBLIN, J. SOUTHWICK, J. PETRIE, T. WU, A. CRAMOND, T. MERKLEY, M.B. DUBRAY, A. FROEHLICH, E.D. BIGLER, N. LANGE, A.L. ALEXANDER & J.E. LAINHART. Prominent Recency Effect in a List-Learning Task in Autism.**

**Objective:** In typically developing individuals performing a list-learning task for the first time, retention advantage for the first (primacy effect) and last (recency effect) few words is a well-established feature of this type of short-term learning. However, some studies have suggested that in individuals with autism, just a recency effect may dominate retention of list-learning activities, which may indicate differences in how information is processed in autism.

**Participants and Methods:** The current investigation examined recency and primacy effects of list-learning on the first trial of the Verbal Selective Reminding Test from the Test of Memory and Learning (TOMAL) in 32 children and adolescents with autism and 22 typically developing, age-matched controls.

**Results:** Controlling for total number correct on the first trial, no significant differences were found between groups with regards to primacy effects. However, a significant ( $p < .01$ ) recency effect was observed for retention of the last three words in the autism group. In the autism group, 30.8% of words recalled on Trial 1 were obtained from the last three words in the list (1.56 of 5.06 words recalled), as compared with 18.4% for controls (1.18 of 6.41 words).

**Conclusions:** Various speculations have been made regarding why memory impairments occur in autism, including encoding and clustering of information, and the relationship between autism and other disorders that show a similarly pronounced recency effect. Results are discussed in terms of potential frontotemporal neural systems that mediate memory and their potential underlying aberrant connectivity in autism.

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#### N. CRUZ & M.C. GIBBS. Executive Function and Adaptive Functioning in Children with Autistic Spectrum Disorders.

**Objective:** Executive dysfunction is associated with the neurobehavioral profile of children with Autism Spectrum Disorders (ASD). Research also identifies adaptive functioning deficits. Little research has evaluated the relation between executive functions and adaptive functioning in children with ASD. This study explored this relation.

**Participants and Methods:** Participants included 20 children (ages 7-14; 3 females, 17 boys) diagnosed with ASD (including high functioning autism, Asperger's disorder, and PDD-NOS) who completed the Test of Everyday Attention for Children: Creature Counting subtest, Wechsler Intelligence Scale for Children- IV: Working Memory Index (WMI), Tower of London-Drexel version (TOL-Dx), Behavior Rating Inventory of Executive Function (BRIEF), and the Adaptive Behavior Assessment System- II (ABAS-II). Full Scale IQ standard scores ranged from 81-136. Bivariate correlations were conducted.

**Results:** Lower performance-based flexibility using the Creature Counting Total score was significantly associated with lower ABAS-II Conceptual Composite scores and, using the Creature Counting Timing score, was marginally associated with lower ABAS-II Social Composite scores. Likewise, poorer parent-rated flexibility (BRIEF) was significantly associated with lower Social Composite scores. Lower performance-based working memory using the WMI was associated with lower Conceptual Composite scores. However, parent-rated working memory (BRIEF) was not associated with the ABAS-II. There was no significant association between performance-based planning, using the TOL-Dx, and ABAS-II. However, poorer parent-rated planning (BRIEF) was significantly associated with lower Conceptual Composite scores.

**Conclusions:** Executive functions are important components of the neurobehavioral profile of children with ASD and relate to the adaptive functioning weaknesses commonly reported. However, future research is required to clarify these relations.

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#### J. HOLDNACK & L. DROZDICK. Social Perception Deficits in Adolescent and Adult Autism Spectrum Disorders.

**Objective:** This study evaluates the sensitivity of the Advanced Clinical Solutions for the WAIS-IV and WMS-IV social perception subtest to Autism spectrum disorders.

**Participants and Methods:** Samples of individuals diagnosed with Autism (n=16) or Asperger's syndrome (n=27), completed the social perception subtest. The Social Perception subtest measures abilities related to perceiving emotional expression. Affect naming requires the ability to recognize and correctly name facial expressions related to emotion. The prosody score indicates the ability of the examinee to understand how tone of voice conveys affect or sarcasm and can change the meaning of a statement. The pairs items measure the ability of the examinee to identify how facial expressions and body language convey information about a social interaction.

**Results:** The Autistic group performed in the borderline to low average range: total social perception (SS=4.4), affect naming (SS=6.4), prosody (SS=4.9), and pairs (SS=4.9). Compared to matched controls, the Autistic sample performed significantly lower on all measures ( $p < .01$ ) except affect naming, with effect sizes ranging from 1.71 (total score) to .57 (affect naming). The Asperger's group performed in the low average to average range: total social perception (SS=8.2), affect naming (SS=7.9), prosody (SS=9.0), and pairs (SS=8.3). The total score and affect naming were significantly lower than matched controls.

**Conclusions:** Adolescents and adults with Autism show general deficits in social perception while those with Asperger's syndrome had specific difficulties with affect naming. These results validate the use of the social perception subtest in these clinical samples.

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#### C. CASNAR, S.J. HUNTER & L. FELIX. Utility of the BASC-2 and BRIEF in Discriminating Autism Spectrum Disorder (ASD), Attention Deficit Hyperactivity Disorder (ADHD), and Comorbid ASD/ADHD.

**Objective:** Autism is a developmental disorder characterized by social and communication impairments, as well as difficulties in executive function, attention, and sensory abilities. It is often difficult to distinguish children with autism spectrum and those with ASD and ADHD. The current study explores the use of parent report measures, the BASC-2 and BRIEF, to help facilitate diagnostic discrimination.

**Participants and Methods:** 75 patients, age 5-17, presented for comprehensive neuropsychological assessment regarding ASD. Participants with a FSIQ below 70 were excluded. Components from the assessment battery pertinent to this study included an IQ measure, the BASC-2 Parent Report Form, and the BRIEF. Analyses addressed the validity and discriminant utility of the BASC-2 and BRIEF in classifying children with ASD, ADHD, and co-morbid ASD and ADHD

**Results:** The BASC-2 revealed significant differences across all three groups on measures of Atypicality, Withdrawal, and Attention Problems, while the BRIEF indicated differences only on the Behavioral Regulation Index. A discriminant analysis was conducted to evaluate the utility of the two measures in regard to classification and diagnosis. The BASC-2 successfully supported diagnosis in 87% of children with ASD, 96% with ADHD and 75% children with ASD & ADHD. In contrast, the BRIEF only supported classification in 70% of the ADHD cases.

**Conclusions:** While parent-report measures can help provide diagnostic clarification in children with Autism Spectrum Disorder and ADHD, the BASC-2 proved to be most helpful with diagnostic classification. The BRIEF proved less discriminating and as a result, less helpful in diagnosis of ASD, but remained useful in regard to ADHD symptom identification.

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#### A.M. LYONS, M.A. SHANAHAN, H.M. BARNARD & L.D. STANFORD. Patterns of Performance in Children with ASD and Clinical Controls on the Test of Everyday Attention for Children (TEA-Ch).

**Objective:** The aim of this study was to explore the utility of the TEA-Ch as a measure of the associated attentional impairments displayed by children with Autism Spectrum Disorders (ASD). Although this measure has been examined in other clinical populations (e.g., ADHD), no studies to date have investigated the performance pattern of attention in children with ASD despite executive dysfunction as having been identified in this population.

**Participants and Methods:** Participants included 39 children ranging in age from 6 to 16 with ASD and 18 non-ASD clinical control (i.e., anxiety disorders) children. The groups did not differ significantly in cognitive ability. Subjects were compared on subtests of the TEA-Ch reflecting three attentional domains: sustained, selective, and attentional control/switching.

**Results:** Results demonstrated that children with ASD performed significantly worse than clinical controls on subtests of sustained attention (e.g., Score, Sky Search DT, Score DT). The groups did not differ, however, on subtests of selective attention (i.e., Sky Search, Map Mission) and attentional control (i.e., Creature Counting, Opposite Worlds). Further post hoc analyses were conducted to address potential differences in performance pattern across ASD subtype (Autistic Disorder, Asperger's Disorder, PDD-NOS), and results indicated a significant difference on a test of sustained auditory attention, with children with Autistic Disorder performing significantly worse than those with Asperger's Disorder.

**Conclusions:** These findings are consistent with previous studies indicating executive dysfunction in children with ASD. However, the lack of significant differences on subtests measuring set switching abilities is surprising given the rigidity and cognitive inflexibility that are characteristic of ASD. As in the ADHD population, the high sensitivity but low specificity of the TEA-Ch highlights the variability in the expression of fluctuating attention and executive dysfunction in ASD.

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**L. PAWLUK & R. LAJINESS-O'NEILL. Parental Psychopathological and Child Cognitive Correlates of Social Functioning in Children with Autism Spectrum Disorders.**

**Objective:** Due to the genetic liability that exists within autism spectrum disorders (ASD), this study examined child cognitive and parental psychopathological correlates of social functioning in ASD. Based on recent literature, it was hypothesized that visuospatial functioning would be correlated with social functioning, and higher rates of parental psychopathology would be associated with increased social dysfunction in children with ASD. In order to differentiate variables unique to ASD, SLI and ADHD comparison groups were used.

**Participants and Methods:** Subjects included 204 children with ASD ( $n = 72$ ), SLI ( $n = 42$ ), and ADHD ( $n = 90$ ). Child participants underwent neuropsychological testing. Social functioning was assessed by parent report (CBCL). Parental psychological diagnoses were included only if rendered before proband conception. A correlation matrix assessed associations between cognitive/psychological variables and social functioning. ANOVAs and chi-squares were used to elucidate differences between ASD and comparison groups.

**Results:** Scores on Block Design (WISC-IV) were positively correlated,  $r(24) = .48, p = .019$ , with Social Competency on the CBCL in ASD exclusively. ANOVA results indicated no significant differences on Block Design scores between groups. While parental psychopathology was not associated with social functioning, chi-square analysis revealed higher rates of maternal anxiety in the ASD group, and lower rates of maternal/paternal depression in the ADHD group.

**Conclusions:** Results indicated that better Block Design performance is associated with improved social functioning. This finding was unique to ASD, possibly suggesting that visuomotor skills are a social neuroprotective factor. Identifying such factors along with parental characteristics are critical in helping to elucidate ASD endophenotypes.

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**S.R. PAZIENZA, W.S. BROWN, R. ADOLPHS & L.K. PAUL. Social Responsiveness in Agenesis of the Corpus Callosum and High Functioning Autism.**

**Objective:** Individuals with agenesis of the corpus callosum (ACC), even when their FSIQ is in the normal range, tend to exhibit deficits in social interaction and communication that are consistent with the diagnostic criteria for autism spectrum disorder. However, the similarities and differences in social cognition between ACC and high functioning autism (HFA) are not yet clear.

**Participants and Methods:** This study compared social cognition in 8 adults with complete ACC and FSIQ  $> 80$  (mean age=34; FSIQ=107), and 9 age- and IQ-matched individuals with HFA (mean age=28; FSIQ=115) using the Social Responsiveness Scale (SRS).

**Results:** Overall scores on the SRS did not differ significantly between the ACC group and the HFA group ( $p > .05$ ), nor did the subscale scores for Social Cognition, Social Communication, and Social Motivation ( $p > .05$  in all cases). However, individuals with ACC were significantly less impaired than HFA in Social Awareness ( $t=2.30, p<.05$ ; means ACC=7.5; HFA=11.3) and Autistic Mannerisms ( $t=2.39, p<.05$ ; means ACC =11.9; HFA=19.4).

**Conclusions:** This study supports prior findings of symptom overlap between ACC and HFA, particularly in the domains of social communication and social cognition. New findings herein suggest that, while social motivation may be similar, individuals with ACC exhibit more typical social awareness and have fewer autistic mannerisms than adults with HFA.

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**M. STEPANSKY, L. FELIX, C.R. AINSWORTH, K. O'BRIEN, A. KING, A.V. DAVIS & J. DORFLINGER. Attention Difficulties in Children with Autism Spectrum Disorders.**

**Objective:** Although the DSM-IV-TR states that attention deficit/hyperactivity disorder (ADHD) should not be diagnosed in children with an autism spectrum disorder (ASD), there is inconsistency in the application of this rule. The current study explored the prevalence of attention difficulties in children diagnosed with an ASD (i.e., autistic disorder, Asperger's disorder, and pervasive developmental disorder-not otherwise specified).

**Participants and Methods:** Participants were 48 children (ages 6 to 18). Descriptive statistics were used to examine impairments for different measures of attention. Specifically, auditory attention span, auditory divided attention, and sustained auditory attention were measured using the Test of Everyday Attention for Children (TEA-Ch); sustained visual attention was measured using the Conners' Continuous Performance Test-Second Edition (CPT-2) and parent-, teacher- and self-reports of attention problems were measured using the Behavior Assessment Scale for Children-Second Edition (BASC-2).

**Results:** There were no statistically significant differences in performances or ratings among the ASD groups. Nearly three-quarters of the children showed impairments in auditory attention span (73%), and half showed impairments in auditory divided attention (63%), sustained auditory attention (56%), and sustained visual attention (47%). Finally, parents were most likely to report attentional impairment (74%), followed by teachers (65%), and then self-report (25%). Correlations between objective data and ratings were not significant.

**Conclusions:** Impairments in various areas of attention were found for children with ASD, consistent with research literature. These findings suggest that deficits in attention are a component of autism spectrum disorders and that a separate diagnosis of ADHD may not add to clinical utility.

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**K.K. TURECK & C. ANDERSON-HANLEY. Exergaming and Autism: Effects on Self-stimulatory Behaviors and Cognition.**

**Objective:** Aerobic exercise has been shown to decrease repetitive behaviors in autistic children (Kern et al., 1982; Celiberti et al., 1997). Additionally, research has shown significant effects of aerobic exercise on cognitive function across the life-span (Tomporowski, 2003; Colcombe and Kramer, 2003). Exergames, which utilize video game components, combine physical and mental exercise. This quasi-experimental study explored the potential benefits of a single bout of exergaming using Dance Dance Revolution.

**Participants and Methods:** Twelve participants with autistic spectrum disorders (ASD) served as their own controls. Participants were evaluated on subsequent days before and after either watching a 20 minute video or 20 minutes of exergaming. Participants' interactions with the principal investigator were videotaped pre and post. Videotapes were coded for repetitive behaviors using an operationalization of the GARS-2 (Gilliam, 2006). A brief neuropsychological battery assessing executive function was also administered before and after each condition.

**Results:** Repeated measures ANOVAs revealed significant interactions for time x condition. As hypothesized, repetitive behaviors decreased significantly after exergaming, while the control task led to an increase in these behaviors ( $p < .001$ ). Also, as hypothesized, performance on Digit Span Backwards improved after the exergaming condition and declined after the control condition ( $p = .03$ ).

**Conclusions:** Findings suggest that a single bout of exergaming can lead to a significant decrease in repetitive behaviors and improvement in some aspects of executive function. Implications include possible clinical and academic benefits of prescribing exergaming for children with ASD. Additional research is needed to clarify the mechanism behind these benefits and evaluate the long-term effects.

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**A.D. VERBALIS, S. HODGSON, T. DUMONT-MATHIEU, M. BARTON, J. GREEN & D. FEIN. Cognitive and Adaptive Stability in Male and Female Children with ASD.**

**Objective:** Studies of sex differences in children with autism spectrum disorders (ASD) suggest varying results depending on the age of the children. No longitudinal studies have yet attempted to clarify these discrepancies. As this is an important area of study, the current study examined changes in cognitive and adaptive skills from 2 to 4 years of age in a group of children diagnosed with ASD.

**Participants and Methods:** The participants in this study included young children who were evaluated twice after screening positive on the Modified Checklist for Autism in Toddlers (M-CHAT). Comparisons of cognitive (Mullen Scales of Early Learning) and adaptive (Vineland Adaptive Behavior Scales) scores were completed on 128 boys and 28 girls who exhibited a stable ASD diagnosis across both time points.

**Results:** Broad diagnostic stability was similar for boys and girls (85% maintained diagnosis in both groups). Repeated measures ANOVAs with test administration as a within-subjects factor and sex as a between-subjects factor showed no significant interaction effects for any of the subtests. However, a trend on the Vineland Daily Living Skills subtest suggested that girls decreased less over time than boys ( $p = .07$ ). Main effects for time point suggested that Mullen scores in both groups increased and Vineland scores in both groups decreased. The only main effect for sex was a trend on the Mullen Fine Motor score, suggesting that female children scored lower than male children ( $p = .07$ ).

**Conclusions:** These data indicate that female children with ASD exhibit a similar profile of change in cognitive and adaptive abilities as male children with ASD at young ages. This may suggest that increased recognition of the symptoms of ASD has allowed higher functioning girls to be correctly diagnosed more often.

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**C. WONG, E. TROYB, K. TYSON, M. ROSENTHAL, K. MRAZ & D. FEIN. Head and Body Growth in Infants Later Diagnosed with Autism Spectrum Disorders: A Comparative Study of Optimal Outcome Children.**

**Objective:** Accelerated head circumference (HC) and body growth rate from birth to two years of age are two of the most consistent biological findings in children who are later diagnosed with Autism Spectrum Disorders (ASD). The purpose of the present study was to identify brain and body growth differences between children who maintain their ASD diagnoses over time and Optimal Outcome children who were once diagnosed with ASD but no longer meet criteria for a diagnosis of ASD. Identifying such differences could lead to further understanding of what drives positive outcomes in some children.

**Participants and Methods:** The present study obtained growth charts and measurements from birth to two years of age from pediatricians' offices. The data was combined with the data from a previous study by Mraz et al. (in press) resulting in a sample of 26 children with current ASD diagnoses (ASD group), 19 Optimal Outcome children (OO group), and 48 typically developing children.

**Results:** Results show that Optimal Outcome children do not differ significantly in head and body growth from children who maintain their ASD diagnoses or from typically developing children.

**Conclusions:** While the ASD group showed a trend of having the largest mean z scores for HC, body length and weight of the 3 groups at most age intervals, the OO group had the largest mean HC z scores from 10-25 months. This finding may indicate a trend towards accelerated HC growth rate in Optimal Outcome children compared to children with ASD.

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**Learning Disabilities/Academic Skills**

**M. ALTAMIRANO-RIOS, F.R. GÓMEZ-VELÁZQUEZ, A.A. GONZÁLEZ-GARRIDO, J. ORTIZ & A.L. LÓPEZ-FRANCO. Numerical Distance Effect in Mental Arithmetic Operations.**

**Objective:** Previous research on numerical cognition have proposed that when solving simple arithmetic problems, educated adults used to automatically retrieve the responses from complex previously stored associations. In addition, a "distance effect" had been described, which seems to be related to mathematics achievement. We investigated if there is a numerical distance effect during processing of incongruent solutions of simple arithmetic operation.

**Participants and Methods:** Nineteen young healthy, right-handed university students were studied while evaluating the correctness of single digit arithmetic operations (addition, subtraction and multiplication). Incorrect solutions were closer by +/-2 or distant by +/-9 from the correct answer.

**Results:** A lower amount of correct responses were obtained for both addition and subtraction with respect to multiplication. More distant incorrect solutions were significantly better detected than the closer ones. In addition, incorrect solutions associated with prolonged reaction times, particularly those closer to the correct solution.

**Conclusions:** Results show that there is a distance effect during retrieval of arithmetic facts of addition, subtraction as well as multiplication operations. The present results suggest that individuals could set up different cognitive strategies to manipulate dissimilar arithmetic operations. Furthermore, automaticity of arithmetic-fact retrieval could not be limited to simple addition, but seems to depend upon cognitive resources demand and individual skills.

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**C.G. ARMENGOL & E. MOES. Neuropsychological Correlates of Reading Proficiency in Elementary School Mexican Children from Two Socioeconomic Strata.**

**Objective:** To assess cognitive and linguistic predictors of reading proficiency in Spanish-speaking Mexican schoolchildren, and the relative contribution and importance of each.

**Participants and Methods:** Three hundred and sixty schoolchildren were recruited from two schools: one private school serving high socioeconomic families, and one public school serving low socioeconomic families in Mexico City. Thirty children from grades 1 through 6 (15 boys and 15 girls per grade) were recruited from each school. Parents provided signed consent and completed a demographic questionnaire to determine SES. Each child read two stories out loud from the Brigrance test and answered comprehension questions to provide measures of reading proficiency. Linguistic predictors included the Word Attack and

Auditory Discrimination subtests of the Bateria Psicoeducativa Woodcock-Munoz, the Test de Vocabulario en Imágenes Peabody (TVIP) to measure receptive vocabulary, and subtests of a Spanish version of the Stroop test (Armengol, 2002) to assess speed of color naming and word reading. Cognitive predictors included a story recall test (immediate and delayed recall of two age-appropriate stories read to them), the Matrices from the Kaufman Brief Intelligence Test (K-BIT), and time and errors on the Stroop to assess inhibition.

**Results:** All variables were significantly influenced by parental education. Regression analyses and correlations indicating the specific contribution of predictors and their relationships to each other will be presented.

**Conclusions:** This study reinforces the importance of considering and assessing socioeconomic and cognitive contributions, such as story memory, to reading, over and above linguistic predictors per se. Results will be compared to English readers.

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### **E. MATUTE, M. BOLAÑOS, R. HERRERA & M. ROSSELLI. Neuropsychological Profile Subtypes in Mexican Children with School Failure.**

**Objective:** The purpose of this study was to determine if definable neuropsychological subtypes exist within a diverse population of children and adolescents with school failure.

**Participants and Methods:** To achieve this objective we analyzed a sample of twenty five school aged children (age range = 5-14 years), 15 boys and 10 girls, who were referred for neuropsychological assessment because they showed school failure. Among the school referrals were attention deficits, learning disabilities and emotional disorders.

Cluster analysis was performed, using the hierarchical agglomerative method. Eleven tasks from the Evaluación Neuropsicológica Infantil - ENI (Child Neuropsychological Assessment) (Matute, Roselli, Ardila y Ostrosky, 2007) were used: letter cancellation, digits-forward, digits-backward, non-words reading, non-words writing, arithmetic problems, mental calculation, verbal-fluency (animals), non-verbal fluency (non-semantic), perseveratives responses and correct designs built with the minimum of movements. Wechsler FSIQ, VIQ and PIQ were examined as external criteria. Finally the measures from each group were compared using the statistical Kruskal Wallis test.

**Results:** We found three interpretable clusters. Cluster 1 (C1) (N = 11) showed lower performance on non-words reading task ( $p=.006$ ) together with a VIQ < PIQ discrepancy. Cluster 2 (C2) (N = 7) showed a lower performance on letter cancellation ( $p=.002$ ), digits-backward ( $p=.013$ ) and non-words writing tasks ( $p=.016$ ); IQ was at the average level. Cluster 3 (C3) (N=7) showed an average cognitive profile.

**Conclusions:** These results suggest that school failure is related to reading disorders (C1) and attention and working memory problems (C2). For (C3), it could be suspected an emotional-behavioral problem that cognitive assessment could not reveal.

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### **J.E. CASEY. The Efficacy of an Advocacy Training Program for Parents of Children with Learning Disabilities.**

**Objective:** To evaluate the efficacy of an educational program (Parents Advocating-Children Excelling) designed to help parents of a child with a learning disability to become better advocates for their child's education needs. PACE is a 6-session (12-hour) course aimed at improving parents' knowledge in three content areas: the nature of learning disabilities; legislation governing the provision of special education services within the school system; and functional skills for effective representation (e.g., organization, communication).

**Participants and Methods:** Of the 43 parents that participated in the PACE program, 27 completed both pre- and post-course questionnaires

(63%). The pre-course questionnaire contained 10 items and the post-course questionnaire contained 12 items. Nine of the items appeared on both questionnaires, three addressing each of the specific content areas of the program. Participants rated the extent to which each item applied to them and were coded accordingly: Not at all (1); Just a little (2); Pretty much (3); and Very much (4). The complete program, presented by a psychologist and a facilitator, was offered three times at one site and twice at another site by a different psychologist and facilitator.

**Results:** Pre- and post-course rankings were compared using the Wilcoxon signed-rank test, a nonparametric test for related samples. Rankings were significantly higher on the post-course questionnaires (Mdn = 31.0) than on the pre-course questionnaire (Mdn = 21.0),  $z = -4.55$ ,  $p < .001$ ,  $r = -0.62$ .

**Conclusions:** Parents reported significant gains in their knowledge of targeted content areas aimed at improving their advocacy skills.

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### **P. CHAKRAVARTI, M.Y. KIBBY & G.W. HYND. Sulcal Variations of the Parietal Opercular Region in Relation to Dyslexia and Linguistic Abilities.**

**Objective:** Researchers suggest that sulcal variations are related to the underlying neural circuitry. Using the Steinmetz et al. (1990) classification system for the parietal opercular region, research has been disparate regarding whether dyslexia differs from controls (Leonard et al., 1993; Hiemenz & Hynd, 2000). Hence, our goal was to assess Steinmetz typologies in relation to diagnosis and linguistic measures.

**Participants and Methods:** Participants included 8- to 12-year-old children with dyslexia ( $n=20$ ), ADHD ( $n=18$ ), or controls ( $n=16$ ). All participants underwent a grant-funded project (NIH R01 HD26890 & R03 HD048752) which included neuropsychological testing and a MRI scan. The test battery included the WJ-III, CMS, CTOPP, BNT and the BASC. MRI scans were classified with the Steinmetz system where Type I refers to the 'typical' typology; Type II does not have a posterior ascending ramus (PAR); Type III has an additional sulcus between the PAR and the post-central sulcus (POCS); and Type IV has a PAR that runs continuous with the POCS.

**Results:** Chi Square revealed that groups did not differ in Steinmetz typologies. Given their lower frequency, atypical morphologies (II-IV) were combined into one group and contrasted with Type I using one-way ANOVA. For the left hemisphere, Type I was associated with better performance on Word Attack [ $F(1,52)=4.02$ ,  $p=.05$ ], Phoneme Reversals [ $F(1,52)=6.71$ ,  $p<.05$ ] and Numbers Forward, [ $F(1,50)=6.14$ ,  $p<.05$ ]. For the right hemisphere, Type I was associated with better performance on Paired Associates [ $F(1,51)=6.03$ ,  $p<.05$ ].

**Conclusions:** We found no group differences in Steinmetz types. However, atypical morphology was associated with worse linguistic and short-term memory functioning.

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### **E. MATUTE, A. GONZÁLEZ REYES, S. GUAJARDO CÁRDENAS & L. BUSTIN. Subtypes of Written Expression in Children and Adolescents.**

**Objective:** The purpose of this study was to provide a reliable and valid classification of written expression that would capture the variability present in a typical sample of elementary, junior high and high school students.

**Participants and Methods:** The sample included 280 Mexican students (50% boys, 50% girls; age range = 7-16 years; 75% of whom attended public school and 15% private school), all from the data base of the Evaluación Neuropsicológica Infantil, ENI (Child Neuropsychological Assessment, Matute, Rosselli, Ardila and Ostrosky, 2007). Participants were divided into three age groups: 1) M: 7.5 years; 2) M: 10.0

years; and 3) M: 13.9 years of age. A cluster analysis was conducted for each age group to identify subgroups of students who showed similar patterns of writing performance. This empirically derived classification model was based on the following writing skills: (a) speed; (b) length of expression; (c) rate of correctly written words; and (d) narrative coherence. Six clusters were found for groups 1 and 3, and 7 for group 2. **Results:** Results showed that most children in group 1 had an average performance on the precision task, but wrote slowly with short stories and a low level of narrative coherence. Group 2 showed high scores on most measures, whereas older children had high scores on all measures. **Conclusions:** Cluster solutions were both stable and interpretable, as the subtypes reflected variants from normal to writing disability. Different subtypes of writers were found in each age group.

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#### **C.R. HALE, J.E. CASEY, P.W. RICCIARDI & M.A. PETHERICK. Patterns of WISC-IV Performance in Children with Persistent Academic Difficulties.**

**Objective:** To identify, among a sample of children referred for psychoeducational assessment, reliable and valid subgroups based on patterns of performance on WISC IV core subtests.

**Participants and Methods:** 472 participants, ages 8 to 16, were selected from a population of children referred for assessment due to persistent academic difficulties. Participants' WISC-IV scaled subtest scores were subjected to a two-stage (hierarchical and iterative partitioning) cluster analysis. The reliability of the final solution was assessed through multiple-method and split-half comparisons using kappa and one-way random effects intraclass correlations. The derived subgroups were compared, via MANOVA, on the basis of academic achievement patterns using WIAT-II Word Reading, Spelling, and Numerical Operations subtests.

**Results:** The three cluster solution was replicated across various agglomerative clustering techniques (Ward's, Average Linkage between Groups, and Average Linkage within Groups), across hierarchical and K-means methods, and in split-half samples. Based on mean profile characteristics, the subgroups were labeled: (1) Low Ability with average Picture Concepts; (2) Low VCI; and (3) Partial ACID Pattern. Group 1 performed poorly relative to Groups 2 and 3 on all WIAT-II subtests. Numerical Operations played a particularly important role in discriminating between groups.

**Conclusions:** Reliable and valid patterns of WISC-IV core subtest scores can be identified in children with persistent academic difficulties. Future research is needed to (a) explore the effects of incorporating supplemental subtests into the analysis; (b) elucidate the cognitive processes measured by the Picture Concepts subtest; and (c) determine the extent to which Cluster 3 is comparable to the full ACID pattern consistently reported in previous research.

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#### **S.R. HOOPER, K. ANDERSON, D.C. YERBY, S.B. KNUTH, L. COSTA, A. CHILDRESS & R. KITSON. Neuropsychological Contributions to the Reading-Writing Connection: Written Language Disorder-Only Versus Written Language+Reading Disorder.**

**Objective:** This study examines the co-occurrence of reading and writing disorders, and describes similarities and differences in underlying neuropsychological functions.

**Participants and Methods:** Participants included 193 second grade students from a single, suburban-rural school district as part of a larger study examining the development of written language. Using a low achievement definition (<25th percentile on WIAT-II), the sample was

divided into 3 groups: Writing Disorder-Only ( $n = 69$ ), Writing-Reading Disorder ( $n = 35$ ), and Typical ( $n = 89$ ). Neuropsychological measures were selected based on putative cognitive contributions to both academic areas and included tasks assessing fine-motor, language, memory/working memory, and attention/executive functions. Four separate multivariate analyses examined group differences across these domains.

**Results:** The groups did not differ on age, race, gender, maternal education, teacher ratings of behavior, or student-teacher relationship ratings. Findings revealed a 33.7% co-occurrence of reading disorder in the presence of a written language disorder. Multivariate analyses revealed significant group differences for each of the neuropsychological domains. Follow-up univariate analyses showed significant differences on nearly all of the variables, with the Reading-Writing Group performing more poorly than the Writing-Only Group on all of the language measures, WISC-IV-I Digits Reversed, Story Memory (Immediate and Recognition), and WJ-III Planning and Verbal Fluency. Effect sizes for the two disordered groups ranged from medium to large.

**Conclusions:** There appears to be modest overlap of reading disorders in the presence of a writing disorder in second grade students, but the neuropsychological differences between groups indicate that there are separate underlying neurocognitive mechanisms contributing to these academic manifestations.

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#### **G.R. MESMAN & M.Y. KIBBY. Reading Components as Predictors of Different Reading Outcomes.**

**Objective:** Research suggests rapid automatic naming (RAN), orthographic functioning, phonological awareness, vocabulary knowledge, and processing speed are individually predictive of many reading tasks. However, little research has compared their predictive ability in relation to each other.

**Participants and Methods:** Participants included 158 children, ages 8 to 12 years, with ADHD ( $n = 49$ ), dyslexia ( $n = 34$ ), comorbid ADHD/dyslexia ( $n = 8$ ), other language-based impairments ( $n = 12$ ) or controls ( $n = 55$ ). Participants completed a neuropsychological evaluation as part of a larger study (R03 HD048752) which included CTOPP Rapid Object Naming (RON) and Rapid Letter Naming (RLN), Elision, Orthographic Choice and Homophone Choice, and WISC Processing Speed Index (PSI) and Vocabulary. Reading measures included WJ-III Letter Word Identification (LWI), Word Attack (WA), and Passage Comprehension (PC), and GORT-IV Rate.

**Results:** RLN and RON formed a RAN composite and Orthographic Choice and Homophone Choice formed an orthographic functioning composite (OC). Hierarchical regressions were used, one for each type of reading. While controlling for the other predictors, OC ( $p$ 's < .001), RAN ( $p$ 's < .05), Elision ( $p$ 's < .10), and Vocabulary ( $p$ 's < .10) were each individually predictive or approached significance for all types of reading. PSI was not a significant predictor ( $p$ 's > .10). OC accounted for significantly more variance than any of the predictors on LWI and PC. OC and Elision accounted for significantly more variance on WA, On Rate, OC, Elision and RAN accounted for significantly more variance.

**Conclusions:** Across reading tasks, OC appears to play a larger role than other reading components.

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#### **A. PHAM, J.C. FINE, A. SCHANTZ & R. HASSON. Inattention as a Predictor of Rapid Automated Naming and Higher-Level Reading Skills.**

**Objective:** The goal of this study is to determine how behavioral symptoms of inattention predict rapid automatized naming (RAN) performance and reading skills in typically developing children. Few studies consider the role of inattention in understanding reading outcomes. It was hypothesized that children with higher levels of inattention will exhibit poorer performance on RAN tasks and reading fluency and comprehension measures.

**Participants and Methods:** Participants included 104 third- and fourth-grade children from ages 8-11 years. Inclusion criteria included children who were not receiving special education services for a reading disability or diagnosed with ADHD. RAN performance was assessed using the four Rapid Naming subtests from the CTOPP. Oral reading fluency and comprehension were assessed using the GORT-4. Parents and teachers completed the SNAP-IV: Teacher and Parent Rating Scale to assess children's inattention at home and school.

**Results:** Hierarchical regression analyses revealed ratings of inattention predicted RAN performance ( $b = -.214$ ,  $\beta = .50$ ,  $p < .01$ ) and reading fluency ( $b = -.37$ ,  $\beta = -.19$ ,  $p < .05$ ), but not comprehension after controlling for age, gender, ethnicity, working memory and estimated IQ. However, after controlling for RAN performance, overall inattention did not significantly predict reading skills. Further analyses suggest that RAN performance mediated the relation between inattention and reading skills.

**Conclusions:** This study provides evidence that behavioral symptoms of inattention predict RAN performance and specific reading skills. Findings highlight the need to recognize the influence of assessing symptoms of inattention when understanding reading performance.

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#### **B. POLLOCK & J.E. CASEY. Distinct Memory Profiles in Children with Learning Disabilities: A Neuropsychological Perspective.**

**Objective:** To identify reliable and meaningful memory profiles in children and adolescents diagnosed with a learning disability.

**Participants and Methods:** A total of 101 children and adolescents between the ages of 9 and 16 diagnosed with learning disabilities were included in this study. Participants' scaled subtest scores on the WRAML2 core subtests and the verbal working memory subtest were subjected to two-stage hierarchical and iterative partitioning cluster analysis. Internal validity of the final cluster solution was established using multiple-method reliability techniques. ADHD co-morbidity and psychometric test findings from measures of delayed memory, intellectual functioning, and academic achievement were compared to examine the external validity of the derived cluster solutions.

**Results:** Comparison of the results obtained using several two-stage cluster analyses strongly suggested the presence of five memory subtypes. Three of the five clusters were differentiated primarily by level of performance (Average, Low Average, and Borderline scores on the majority of subtests). The other two clusters were differentiated by pattern of performance (weak visuospatial working memory and weak auditory verbal short term memory). The five subtypes exhibited distinct patterns of performance on measures of delayed memory, intellectual functioning, and academic achievement. Also, the groups differed in the rate of co-morbid ADHD, the results together suggesting that the memory profiles are valid and potentially clinically meaningful.

**Conclusions:** Reliable patterns of WRAML2 subtest scores can be identified in children and adolescents with learning disabilities. Additional research is needed to validate the current findings using an independent sample.

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#### **D. RACHES, P.T. CIRINO, J.M. FLETCHER, M.A. BARNES & L. EWING-COBBS. Complex Word Problem Solving Abilities in Children with Math and/or Reading Learning Difficulties.**

**Objective:** Children with math deficits often experience other academic difficulties, frequently in reading. This study explores how word problem solving (WPS) is affected by task demands in children with learning difficulties (LD) in math (MD), reading (RD), both math and reading LD (MDRD), or no LD (ND).

**Participants and Methods:** WPS was examined in 283 third and fourth-graders with MD, RD, MDRD or ND. Math performance was as-

essed using the Arithmetic and Complex Word Problem Solving Test (ACWPT), which examines components of word problem solving, including performing calculation and independently solving word problems with distracting information. Operation choice errors and erroneous use of distracting numeric information during WPS were also explored.

**Results:** All children were significantly less accurate on WPS than calculation ( $p < .001$ ). Word problems with extraneous numeric information were more difficult than word problems with verbal distractors,  $p < .001$ , or without distractors,  $p < .001$ , for children in all groups. Children with ND and RD were comparably accurate and made fewer errors than children with MDRD on all math measures. Children with RD were more accurate than children with MD on calculations and operation choice, though these two groups performed comparably on overall WPS and distracting number use.

**Conclusions:** Findings highlight the severity of math deficits in children with MDRD, consistent with previous literature, and reiterate the importance of both math and reading abilities to WPS accuracy. Further exploration of factors contributing to WPS deficits is warranted.

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#### **K.P. RAGHUBAR, M.A. BARNES, M. DENNIS & J.M. FLETCHER. The Construction of Spatial Situation Models during Reading in Children with Spina Bifida and Their Typically Developing Peers.**

**Objective:** To compare the construction of spatial situation models during reading in typically developing (TD) children and in good decoders/less skilled comprehenders with spina bifida (SB).

**Participants and Methods:** 69 children with SB and 36 TD children (mean age = 12.44 years) studied a market layout with objects outside the shops (e.g., hydrant and flowers outside bakeshop). Then they read a story about a protagonist at the market. Reading was periodically interrupted by the presentation of two words; children decided if these objects were from the same or different shops. Objects were from the location where the protagonist ends up (Goal); the unmentioned location he/she passed through between shops (Path); the location from which the protagonist started (Source); or another location not mentioned in the text (Other). Only children who learned the layout to 90% accuracy were included in analyses (51 with SB).

**Results:** Groups did not differ on accuracy. Both were more accurate on items from Path and Goal locations compared to the Other location. Both were faster on Path, Goal, and Source items than Other location items, paralleling findings in skilled adult comprehenders. However, children with SB had slower response times and 25% were unable to learn the layout of the market to criterion.

**Conclusions:** If children with SB have learned spatial information they use it to "see the world through the protagonist's eyes", but they are less efficient in forming spatial situation models than TD peers. Findings are interpreted with reference to comprehension models in SB.

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#### **E. RODRIGUEZ, A. GONZALEZ-GARRIDO, F. GOMEZ-VELAZQUEZ, D. ZARABOZO, F. LEAL & D. ZARABOZO-HURTADO. Orthographic Knowledge in Spanish in Young Adults.**

**Objective:** The orthographical correctness improves the written communication. In a shallow language as Spanish, some of the most frequent orthographical errors consist of write pseudohomophones, especially those involving graphemes such as b-v/ c-s-z / g-j / h / l, and ll-y that share the same phoneme.

The aim of the present work was to identify the tasks that best describe or predict the orthographic knowledge of Spanish in young adults.

**Participants and Methods:** Methods: 317 High-School students were evaluated with 5 tasks: completing words in a list, dictate of words,

dictate a text, correction of a text with homophone errors and free writing on a topic of general interest. All tasks were especially built to assess homophone errors while substituting b-v / c-s-z / g-j / h / or ll-y. Leave-one out Pearson's correlations were made between each one of task's results and the remaining behavioral outcomes.

**Results:** Correlations between each individual task and the remaining joint results showed that the dictate of words reached the highest correlation ( $r = .822$ ), and free writing task was the lowest ( $.407$ ), both were significant

**Conclusions:** The orthography knowledge can be evaluated through different tasks. Based upon present results, dictate of words seems to represent the task that more accurately describes the orthographic knowledge in High School students. However, a widespread evaluation could be recommended, due to less sensitive tasks as free writing could have the advantage of evaluate the student in a more natural context.

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### G. RODRÍGUEZ NIETO, F. OSTROSKY-SOLIS, A. LOZANO, B. BE-TANCOURT & E. AGUILERA. Relationship Between Executive Functions and Mathematical Skills in Preschool Children.

**Objective:** Math learning disability is one of the most frequent problems at elementary scholar years. Nevertheless little is known about the acquisition process of this ability and its relation with other cognitive functions. The aim of this study was to investigate the relationship between three major executive functions (inhibitory control, flexibility and working memory) and mathematical skills at preschool age.

**Participants and Methods:** 58 preschool regular children from Mexico City (mean age = 4 years 6 months, range 48-65 months; 37 girls and 21 boys).

Children were tested individually with six tasks presented in a fixed order: Bear Dragon (inhibition); Corsi Block (visuospatial working memory); Day-Night Stroop-like (inhibition); Dimensional Change Card Sort (flexibility); Backward Digit Span (verbal working memory); and Counting and Distributing from Mc Carthy Intelligence Scale (mathematical skills).

**Results:** Controlling for age in months we found that Counting and Distributing task was significantly correlated with Bear-Dragon task ( $r = -.41$ ,  $p = .002$ ), Corsi Block task ( $r = .45$ ,  $p = .000$ ), Backward Digit ( $r = .45$ ,  $p = .000$ ), without a correlation with Day-Night Stroop nor with Dimensional Change Card Sort. Bear-Dragon and Backward Digit Span scores were significant predictors and accounted for 28 % of the variance of Counting and Distribution performance.

**Conclusions:** The ability to hold information and the capability to inhibit preponderant responses seem to be relevant to the emergence of mathematical skills.

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### D.D. RODRÍGUEZ-MALDONADO & E. VILLUENDAS GONZÁLEZ. Academic procrastination in students of psychology undergraduate program in a Mexican public University.

**Objective:** "Procrastination" identifies the reasons we put off tasks—fears of failure, success, control, separation, and attachment—. Neuropsychology research relates this syndrome to a difficulty in executive functions development. The objective of this research is to assess and do a basic analysis about this executive syndrome in a particular academic population of Mexico.

**Participants and Methods:** In an academic domain of undergraduate program of psychology in Morelia, Michoacan, México, We assess a group of 50 students of each semester (1,3,5, 7 y 9):N:250. The Academic procrastination scale (a 10-item selfreport questionnaire), an interview and a questionnaire about time organization habits, and an anxiety scale were used in the assessment.

**Results:** Quantitative method. The analysis was made with a statistical software (SSPS). Correlational and descriptive studies were applied. The results showed a high level of procrastination in our students and high correlation between anxiety, motivation and procrastination.

**Conclusions:** Procrastination syndrome in academic university population is an important problem, probably related to academic successful. In a School neuropsychology assessment is important the ecological validity for interventional objectives in executive function development. This is our first attempt to explain this important executive syndrome pursuing university academic success.

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### M.A. SEDO, A.M. LUCENA & L. MALLOY-DINMIZ. EXECUTIVE FUNCTION AND THE READING-READINESS OF SCHOOLCHILDREN IN BRASIL.

**Objective:** FDT and FNT are low-verbal-load oral forms of the Stroop test and the TMT, based on measuring the speed and efficiency of conscious mental processing. Those tests aim at opening a testing window to now untestable populations. They consist of two unstressed fluent situations and two stressed conscious situations with higher cognitive pressures.

**Participants and Methods:** A pilot study of 93 school children allowed to compare the differences between low and high socio-economic schools, males and females, children at developmental levels 4-5-6-7, and particularly, their reading readiness. This was measured with the Ferreiro approach, dictation words to the student and comparing the use of syllables or sounds as mental units: X-Y-Z as in pa-ra-da (stop) or X-Y-Z as in par (pair). This approach is only valid for languages where sight-words cannot be used as early spelling cues.

**Results:** Time and error scores at FDT and FNT discriminate all four levels of ages but not at all the levels of children from public and private schools. Time scores and error scores may have different diagnostic meaning, as they may show rigidity in the handling of planned responses.

**Conclusions:** FDT and FNT are appropriate for the testing of cross-cultural and cross-linguistic populations, who can answer in their own language. FDT and FNT are appropriate for the testing of cross-cultural and cross-linguistic populations, who can answer in their own language. Stressed situations have enormous importance to detect self-control and self-mobilization of voluntary effort.

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### S.K. STERN, M.K. MORRIS, A. BLALOCK & R.D. MORRIS. The Double Deficit Hypothesis in Reading Disabled College Students.

**Objective:** Poor phonological awareness (PA) has long been associated with poor reading achievement. It has recently been proposed that visual naming speed (VNS) may constitute another impairment linked to reading disability. The Double Deficit Hypothesis proposes that four subgroups may emerge in a reading disabled (RD) group: PA-deficit, VNS-deficit, double deficit (DD), or no deficit (ND). These groups are hypothesized to differ on reading tasks based on their respective linguistic profiles (Wolf & Bowers, 1999).

**Participants and Methods:** Two hundred twenty six college students, who met regression-based discrepancy and/or low achievement criteria for RD, were selected from a larger sample of students evaluated for academic difficulties. Measures of PA, VNS, and reading achievement were collected as part of a larger assessment battery. Subgroups based on performance on PA and VNS tasks were identified and compared on reading tasks using MANOVA.

**Results:** On untimed decoding and comprehension tasks, PA and DD groups performed significantly below the VNS and ND groups. However, on measures of timed decoding and reading fluency, the VNS group

performed significantly below the ND group. The PA group also performed more poorly than the ND group on timed decoding measures, but did not differ from the VNS group. The DD group consistently performed at or below the level of the PA and VNS groups, although these differences were not always statistically significant.

**Conclusions:** Patterns of linguistic ability affect the profile of reading impairments that characterize adults with RD. These findings have implications for academic accommodations in a university setting.

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**P.J. UY & L.A. TIERSKY. Working Memory, Processing Speed, and Performance on the Paced Auditory Serial Addition Test (PASAT) in Adults with Learning Disabilities.**

**Objective:** The current study aims to determine the association between various cognitive domains (i.e., working memory and processing speed) on performance on the Paced Auditory Serial Addition Test (PASAT). Research has suggested that information-processing speed is the primary cognitive function that underlies lower scores on the PASAT (Forn, et al., 2008). Since working memory has also been identified to predict scores on the PASAT (Diehr, et al. 1998) in addition to processing speed and attention, this study attempts to determine the mediating factor of working memory on the association between processing speed and performance on the PASAT.

**Participants and Methods:** Participants were 62 adults (40 females, 20 males) diagnosed with Learning Disabilities (LD). Age ranged from 18 to 59 ( $M = 25.13$ ). Participants completed a comprehensive neuropsychological battery which included the PASAT in addition to the Wechsler Adult Intelligence Scale-III (WAIS-III) and the Conners' Continuous Performance Test-II (CPT-II).

**Results:** Regression results indicate that both processing speed (WAIS-III PSI) and working memory (WAIS-III WMI) were significant predictors of PASAT performance while controlling for attention (CPT-II Reaction Time). In addition, processing speed was also a significant predictor of working memory. Finally, results revealed that working memory partially mediated the relationship between processing speed and PASAT performance.

**Conclusions:** The results of this study suggest that working memory may have an underlying mechanism between the association of processing speed and performance on the PASAT in adults with LD.

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**Multiple Sclerosis/ALS/Demyelinating Disorders**

**T. OLIVARES, A. NIETO, M. BETANCORT, Y. PÉREZ, M. HERNÁNDEZ & J. BARROSO. The Association of Clinical Variables, Subjective Self-Reported Cognitive Impairment and Fatigue with Depression and Anxiety in Multiple Sclerosis.**

**Objective:** Depression and anxiety are common psychiatric symptoms among patients with Multiple Sclerosis (MS). However, anxiety is relatively under-studied. Few studies have evaluated how it is influenced by disease variables.

**Objective:** to explore the relationship of clinical variables, subjective cognitive impairment and fatigue with depression and anxiety in MS.

**Participants and Methods:** 35 patients were studied. Expanded Disability Status Scale scores ranged from 0 to 6.0 ( $M=1.8$ ;  $sd=1.5$ ). The patients averaged 10.1 ( $sd=7.6$ ) years from symptom onset. We used the Hospital Anxiety and Depression Scale (HADS) to assess symptoms of anxiety and depression. Subjective cognitive impairment was measured using the Multiple Sclerosis Neuropsychological Screening Questionnaire (MSNQ) and the Fatigue was assessed with the Fatigue Severity Scale (FSS).

**Results:** Multiple regression analysis using depression as the dependent variable showed that MSNQ predicted 20% of the variance ( $p<0.05$ ); years since onset and FSS predicted 18% and 16% of the variance respectively ( $p>0.05$ ). The effects of the independent variables on anxiety showed that years since onset accounted for 42% of the variance ( $p<0.01$ ); FSS predicted 20% of the variance ( $p<0.01$ ) while MSNQ predicted 16% of the variance ( $p<0.05$ ).

**Conclusions:** The findings of the study suggest that years since onset, subjective cognitive impairment and fatigue predict depression and anxiety. Years since onset was strongly associated with anxiety. Increased severity of anxiety symptoms was associated with low disease duration. These results highlight the importance of these variables in the assessment and treatment of depression and anxiety in MS, and support particular consideration of anxiety symptoms at early stage of MS.

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**L.I. BERRIGAN, L. WALKER, L. REES & M.S. FREEDMAN. An Investigation of the Contributions of Acquisition and Retrieval to Verbal Memory Impairment in Relapsing-Remitting Multiple Sclerosis.**

**Objective:** There is conflicting evidence whether memory impairment in MS is a product of acquisition or retrieval problems. To better understand memory dysfunction in MS, a task assessing both free recall (FR) and free recall combined with cued recall (FR+CR) for learning, delay, and percent retention variables was employed. Deficient acquisition was expected to result in poor FR and FR+CR scores for learning and delayed recall but adequate percent-retention. Conversely, deficient retrieval was expected to result in poor FR scores but significantly improved FR+CR scores because, with cueing on all trials, effects of retrieval difficulties should be negated.

**Participants and Methods:** Twenty-three participants with relapsing-remitting MS completed the Word List subtest from the Learning and Memory Battery (LAMB). Raw scores were converted to z-scores using normative data.

**Results:** Learning, delayed recall, and percent-retention were within normal limits. No significant differences between FR and FR+CR scores were observed. An examination of acquisition over trials revealed that approximately 20% of participants scored below cut-off (-1.5SD) for the fourth learning trial. The proportion scoring below cut-off was higher for FR+CR scores than FR scores for essentially all variables.

**Conclusions:** The decline in performance on the fourth learning trial suggests participants did not achieve the same acquisition gains as the normative sample, consistent with reports that MS patients require more learning trials to reach a specified criterion. Cueing did not improve memory performance and, furthermore, participants did not benefit from cueing to the degree expected based on normative data, suggestive of possible effects of executive dysfunction.

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**A. CHENG, L. WALKER, L. BERRIGAN, A. SMITH & M. FREEDMAN. Longitudinal evaluation of information processing speed in persons with multiple sclerosis.**

**Objective:** A decline in information processing speed (IPS) is one of the key deficits in individuals with MS and may underlie dysfunction in other cognitive domains. The Computerized Test of Information Processing (CTIP) is designed to evaluate the speed with which subjects can process information across tasks of increasing complexity and it shows promise with regard to its utility at detecting cognitive impairment in MS. The current study evaluated the performance of people with MS on the CTIP across time. We investigated the performance of individuals with MS on the CTIP longitudinally to determine if change could be detected over time.

**Participants and Methods:** Six individuals with MS pre-selected for cognitive impairment were evaluated at baseline, 6 months, 12 months, and 3 to 4 year follow-up. Results were analysed at the level of the individual using a variation of the reliable change index (RCI) including an adjustment for practice.

**Results:** No significant decline or improvement in CTIP performance was detected over time. However, subjects with MS demonstrated longer reaction times with increasing task complexity; as do healthy controls.

**Conclusions:** Methodological considerations may have accounted for the lack of change over time. Future studies should objectively confirm cognitive impairment prior to study enrolment. The fact that subjects with MS show the same pattern as healthy controls on the CTIP suggests that this measure holds promise with regard to its utility at measuring IPS in this population.

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#### Y. GOVEROVER, N.D. CHIARAVALLOTI, H. WOOD & J. DELUCA. Fatigue, Cognitive abilities, and functional performance in MS.

**Objective:** Cognitive fatigue is one of the most common symptoms reported by persons with multiple sclerosis (MS). However, there is no unitary definition of what cognitive fatigue entails and most measures of cognitive fatigue are self-report questionnaires posing questions related to cognitive abilities. This study examined the relationship between measures of cognitive fatigue, performance on tests of cognitive abilities, motor abilities and a task of IADL performance; and questionnaires assessing affective symptomatology. We hypothesized that scores obtained on the fatigue subscale of the Functional Assessment of Multiple Sclerosis (FAMS) will be significantly correlated with cognitive performance and affective symptomatology.

**Participants and Methods:** 78 participants with MS completed the FAMS fatigue subscale (a self-report measure of mental fatigue), measures of affective symptomatology; a performance-based test of everyday functional activity (Executive Function Performance Test; EFPT); and neuropsychological tests of cognitive and motor performance.

**Results:** A significant relationship was noted between fatigue and affective symptomatology, but there was no significant relationship between fatigue and measures of cognitive performance. No significant relationship was observed between fatigue and everyday functional activity.

**Conclusions:** Results are consistent with prior work showing that self-reported fatigue is correlated with affective symptoms. Self-reported fatigue was not associated with objective measures of cognitive, motor or functional performance. These results do not support the idea that cognitive capacity is related to cognitive fatigue.

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#### Y. GOVEROVER, N.D. CHIARAVALLOTI, H. WOOD & J. DELUCA. Applying Self-Generated Learning to Improve Recall of functional Tasks: The Role of Executive Functioning versus Memory Abilities.

**Objective:** Self-generation is a learning strategy found to improve learning in healthy persons, as well as persons with Multiple Sclerosis (MS). However, the degree of benefit from self-generation is negatively impacted by cognitive deficits. This study examines the relative influence of memory abilities and executive functioning on the ability to benefit from self-generated learning for functional tasks in persons with MS. We hypothesized that executive functions will have a greater impact on a person's ability to benefit from self-generation, as compared with memory abilities.

**Participants and Methods:** Participants included 28 individuals with MS. A within groups design was employed examining performance on a meal preparation tasks in two learning conditions: (1) a provided condition in which information was provided to the participant and (2) a self-generated condition in which participants self-generated the necessary information. Recall was examined immediately, 30-minutes, and 1-week after initial learning. Executive functions were tested using the D-KEFS Sorting Test, and memory was tested using the open-trial selective reminding test (OT-SRT).

**Results:** A significant correlation was noted between benefit from self-generation and executive functioning. Multiple regression analysis indicated that performance on the executive functioning task significantly predicts the degree of benefit obtained from self-generation for the long-term recall. Thus, persons with MS with better executive skills showed a greater degree of benefit from self-generation one week after learning.

**Conclusions:** Executive functioning is crucial for the ability of an individual with MS to benefit from this strategy use, particularly in regard to long term recall for the newly learned material.

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#### M.M. HOOGS, A. SMERBECK, S.A. MORROW, B. WEINSTOCK-GUTTMAN & R.H. BENEDICT. Employment Status Influences the Accuracy of Self-Reported Cognitive Impairment in Multiple Sclerosis (MS).

**Objective:** Screening tests for cognitive impairment frequently rely on self-report questionnaires. In MS, such tests have poor validity, as self-perceptions of ability are influenced by mood. Also, we hypothesize that the frequency of concrete experiences in which ability is tested is another factor. The workplace may provide such concrete experience and opportunity for error. Therefore, workplace activity might lead to an advantage in accurate self-report of cognitive ability. We tested this hypothesis to determine if vocational status influences accuracy of self-reported cognitive impairment in MS.

**Participants and Methods:** Subjects were 314 MS patients; 175 employed, and 139 subjects unemployed. Groups were roughly equivalent across demographic variables, and both groups contained subjects classified as normal and impaired on neuropsychological (NP) testing. Linear relationships were compared between subjective impairment, measured by the MS Neuropsychological Screening Questionnaire (MSNQ), and NP testing between groups.

**Results:** Using Fisher's z, there was a markedly stronger relationship ( $z = -3.10$ ) between Symbol Digit Modalities Test (SDMT) performance and MSNQ in employed ( $r = -.377, p < .01$ ) vs. unemployed patients ( $r = -.039, ns$ ). Similar relationships were found on Brief Visuospatial Memory Test - Revised (BVMTR) Total Learning ( $z = -2.29$ ), BVMTR Delay ( $z = -2.17$ ), and Delis-Kaplan Executive Function System (DKEFS) Sorting ( $z = -2.23$ ).

**Conclusions:** These findings suggest a unique opportunity for developing new screening measures. Reflecting on changes in functional ability at work provides fairly concrete and specific behaviors for consideration. In the absence of routine NP assessment, improved screening measures are necessary to identify early or mild cognitive impairment in MS.

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#### M.M. HOOGS, S.A. MORROW, A. SMERBECK & R.H. BENEDICT. Type D Personality and its Correlates in Multiple Sclerosis Patients.

**Objective:** Individual personality traits, as well as configurations of traits representing personality types, have been associated with specific mental/physical health outcomes. In the case of multiple sclerosis (MS), research has relied mainly on trait approaches, using the gold standard Five Factor Model. We aimed to identify differences in traits between a sample of MS patients and healthy controls, and further, to identify relationships among those traits.

**Participants and Methods:** Subjects included 376 MS patients and 88 healthy subjects, roughly equivalent across demographic variables. Linear relationships were compared among five personality trait domains (neuroticism, extroversion, openness, agreeableness, and conscientiousness), measured by the NEO Five-Factor Inventory (NEO-FFI) between MS and healthy subjects.

**Results:** MS patients had significantly higher mean neuroticism ( $t = -5.519, p < .0001$ ), and lower extroversion ( $t = 5.338, p < .0001$ ), and con-

scientiousness ( $t=3.607$ ,  $p<.0001$ ). Using Fisher's  $z$ , there was a significantly stronger relationship ( $z=2.77$ ) between neuroticism and extroversion in MS patients ( $r=-.478$ ,  $p<.01$ ) vs. controls ( $r=-.185$ , ns), and between neuroticism and openness ( $z=2.15$ ) in MS vs. controls. In MS patients, neuroticism, extroversion, and conscientiousness were significantly associated with higher depression and fatigue. Extroversion and conscientiousness were also significantly associated with neurological disability, measured by EDSS.

**Conclusions:** Results confirm trait differences, and also suggest type differences between MS patients and normal controls. The Type D personality configuration is supported in this sample, and is associated with depression, fatigue, and neurological disability. Further research is needed to confirm Type D personality in this population, and to determine its association with more specific, and broader health outcomes.

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**G. GIAGLIS, S. KYRIAZIDOU, E. PARASKEVOPOULOU, N. TASCOS & M.H. KOSMIDIS. Evaluating Premorbid Level: Preliminary Findings regarding the Vulnerability of Scores on Cognitive Measures in Patients with MS.**

**Objective:** To evaluate the neuropsychological measures least vulnerable to cognitive decline in young patients with multiple sclerosis (MS). **Participants and Methods:** We administered four vocabulary tests (WAIS-III Vocabulary, Greek versions of Spot-The-Word (STW), Synonyms and Accentuation tests) and two abstract thinking tests (WAIS-III Matrix Reasoning and a five-component reasoning test) to 11 hospitalized relapsing-remitting MS patients (6 men, mean age:  $31.5\pm 5.28$  years, education:  $13.7\pm 2.57$  years). Using propensity score matching, we selected 33 healthy adults matched for gender, age and education (16 men, mean age:  $31.9\pm 8.50$  years, education:  $13.1\pm 3.55$  years) from a pool of 318 research participants. Logistic regression analysis was used to estimate the ability of each test to differentiate between MS and healthy groups.

**Results:** In the healthy adults pool, the four vocabulary tests correlated highly with each other ( $r's>0.70$ ). The matched healthy sample performed better than MS patients on all tests except STW (86.7% vs. 88.8% correct) and Accentuation (77.2% vs. 76.2% correct), on which the two groups had almost identical scores. The WAIS-III Vocabulary subscale was the only measure that differentiated the two groups with statistical significance ( $p=0.045$ , 73.0% vs. 64.2%). The remaining tests (abstract thinking and synonyms) showed some group discrepancies, which did not reach statistical significance, probably due to the small sample size.

**Conclusions:** STW and Accentuation tests appear to be the best 'hold' measures for estimating premorbid cognitive ability in young, hospitalized patients with MS. The WAIS Vocabulary subscale is cognitively demanding and appears vulnerable to the cognitive decline characteristic of moderate-to-high severity MS.

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**M.A. LANGILL, C. ANDERSON & B.A. PARMENTER. Remediation Efficacy of the Memory Notebook for Patients with Memory Dysfunction in Multiple Sclerosis: Follow-Up after One Year.**

**Objective:** Multiple Sclerosis (MS) is a neurodegenerative disease of the central nervous system. Cognitive impairment is a relevant, but often overlooked contributor to disability and unemployment in MS, with memory dysfunction reported in 40-60% of MS patients (Maurelli et al., 1992; Ron, 1986). This study investigated the efficacy of an 8-week memory notebook treatment for MS patients with memory dysfunction at 1-year post-treatment. As was found immediately following the 8-week treatment (Langill & Parmenter, 2009), it was hypothesized that participants in the memory notebook training group (MNG) would continue to report improved mood compared to the control group (CG) at 1-year follow-up.

**Participants and Methods:** 12 MS outpatients with either a score indicating mild-to-moderate impairment on an objective memory test (i.e., the CVLT-II or the BVMT) or a self-report of a decline in memory, were randomly assigned to either the MNG, or the CG (for supportive psychotherapy). Both groups received 8 training sessions of 1.5 hours over 8 weeks. Data collection points included pre-study, post-study and at 1 year follow-up. The primary outcome measures were the Center for Epidemiologic Studies Depression Scale (CES-D) and Everyday Memory Questionnaire (EMQ). Secondary measures included the FAMS-2, STAI and ZAS. All investigations were between-groups comparisons of pre-post-1-year change.

**Results:** Consistent with the post-8-week treatment results (Langill & Parmenter, 2009), a greater improvement of depression symptoms was seen for the MNG than the CG ( $p=.04$ ) which was maintained after one year ( $p=.03$ ). Non-significant changes were seen for the MNG in clinically therapeutic directions on all other measures, which were also maintained after one year.

**Conclusions:** This trial supports the efficacy of memory notebook training for distress reduction in MS, with maintained findings after one year. More research is required regarding the effectiveness of this remediation tool for memory abilities.

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**V.M. LEAVITT, J.F. SUMOWSKI, N.D. CHIARAVALLOTI & J. DELUCA. Can Executive Dysfunction in Multiple Sclerosis Be Explained by Processing Speed Deficits?**

**Objective:** Individuals with multiple sclerosis (MS) demonstrate cognitive deficits on tests of executive functioning and processing speed (PS). We hypothesized that PS decrements may explain the deficits shown in executive functions.

**Participants and Methods:** 28 healthy controls (HC) were compared to 29 age- and education- matched individuals with MS on tasks of executive functioning that either incorporated a processing speed element (e.g., DKEFS Trail Making Number-Letter Switching), or made no processing speed demands (e.g., WCST total categories). Processing speed within a task was controlled for using a regression analysis with speed as a covariate (e.g., Stroop Color-Word Interference with Stroop Color Naming as a covariate).

**Results:** The MS group did significantly worse than HC on all tasks of executive function with a processing speed element. In contrast, no significant between-group differences were seen on executive tasks that made no processing speed demands. Furthermore, regression analysis determined that when speed was a covariate within a particular task, the between-group performance differences were no longer significant. **Conclusions:** While individuals with MS demonstrate deficits on tests of executive function, performance decrements do not seem to be due to impaired executive skills, but rather to PS. Thus, interpretation of performance on such tests must be done cautiously.

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**V.M. LEAVITT, J.F. SUMOWSKI, G.R. WYLIE, J. DELUCA & N.D. CHIARAVALLOTI. Activation Within the Default Network Uniquely Predicts Cognitive Status in Multiple Sclerosis Over and Above Brain Atrophy.**

**Objective:** Individuals with multiple sclerosis (MS) demonstrate deficits in processing speed and learning/memory; however, even the best estimate of MS disease progression (brain atrophy) accounts for less than half the variance in cognitive status. Functional magnetic resonance imaging (fMRI) may be used to improve prediction of cognitive dysfunction in MS: research has demonstrated abnormal activation within the brain's default network (DN) among numerous neurological populations. Here, the aim was to determine whether DN activity can uniquely predict cognitive dysfunction in MS beyond that predicted by atrophy. **Participants and Methods:** fMRI was employed to quantify total activation within the DN during a low-load task (visual monitor-

ing) in 30 individuals with MS. Brain atrophy was estimated with third ventricle width. Correlations were calculated between brain atrophy and behavioral measures of processing speed (SDMT) and learning/memory (SRT: Total Learning, Delayed Recall). Correlations were also calculated between behavioral measures and DN activity.

**Results:** Atrophy was significantly negatively associated with SDMT ( $r = -0.52$ ), SRT total learning ( $r = -0.41$ ), and SRT delayed recall ( $r = -0.41$ ). Total DN activation was significantly positively associated with SDMT ( $r = 0.39$ ), SRT total learning ( $r = 0.41$ ), and SRT delayed recall ( $r = 0.42$ ). Importantly, the unique contribution of DN to cognitive performance remained after controlling for atrophy.

**Conclusions:** DN activity improves prediction of cognitive dysfunction in individuals with MS by accounting for unique variance in neuropsychological task performance over and above atrophy. DN activity may be a neurophysiological marker of cerebral efficiency in MS patients.

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#### **A. OZURA, P. ERDBERG & S. SEGA. Personality characteristics, Coping and Self-esteem; a Rorschach Investigation with Multiple Sclerosis Patients.**

**Objective:** A chronic neurological disease with an uncertain course such as multiple sclerosis (MS) brings a number of stressful experiences, while it may at the same time affect ability to cope with such problems. Personality changes and coping strategies in patients with MS have been much less studied than cognitive deficits. Our study focused on exploring personality characteristics of MS patients using the Rorschach test.

**Participants and Methods:** We included 52 patients with MS. The Rorschach Test was administered and subsequently coded by the Comprehensive System.

**Results:** Our finding show that our sample seems to largely rely on a simplifying style of coping with problems. They perceive themselves as functioning less competently than others, at some cost to their self-esteem.

**Conclusions:** The findings in our sample imply that these patients, due to their simplifying style of processing information, might have special needs in terms of communication with healthcare providers, decision making and adherence to their treatment plans. It is important to consider personality as well as cognitive changes in neurological disorders.

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#### **A.R. RABINOWITZ & P.A. ARNETT. Depression and Quality of Life in Patients with MS: Unique and Shared Mechanisms.**

**Objective:** Research suggests that depression in MS patients is related to both disease-related disability and psychosocial protective factors. However, less is known about quality of life (QOL), an important psychological outcome to patients and their families. The present study used path-analysis to evaluate factors related to depression and QOL in MS patients.

**Participants and Methods:** Eighty-nine MS patients were administered a battery of self-report questionnaires including the Chicago Multiscale Depression Inventory (CMDI) and the Functional Assessment of MS (FAMS), along with measures of social-support, pain-interference, coping-style, MS-related attitudes, sickness-impact, fatigue, and the EDSS. Using Mplus, four nested path models simultaneously predicting CMDI mood and evaluative score (depression) and FAMS general contentment score (QOL) were evaluated for overall and comparative fit.

**Results:** The best fitting most parsimonious model contained the following unique significant paths to depression: active coping and sickness-impact on sleep. QOL was uniquely predicted by venting emo-

tions coping and EDSS. MS related attitudes, number of social supports, physical fatigue, and social fatigue had significant relationships to both constructs. The retained model satisfied criteria for good model fit (CFI=.98; RMSEA=.08; SRMR=.01). R2 values for QOL and depression were .65 and .58 respectively.

**Conclusions:** These findings indicate that factors related to physical disability (e.g. ambulation and fatigue) as well as psychosocial resilience factors (e.g. social support and coping) may lead to differences in depression and QOL for MS patients. The final model suggests that these outcomes have both unique and shared mechanisms. The clinical and theoretical implications of these findings will be discussed.

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#### **K.A. RYAN, L.J. RAPPORT & K. TELMET HARPER. Driving Status and Community Integration in Multiple Sclerosis.**

**Objective:** Driving a motor vehicle is integral to independence, community participation, and activities of daily living, but research on the relationship between driving cessation and community integration among individuals with MS is sparse. Our previous research showed that a sizable portion of MS patients experience substantial difficulties in community integration, and approximately one quarter ceased driving, but the relation between those outcomes has not been addressed.

**Participants and Methods:** Seventy-eight patients with clinically-definite MS and their caregivers participated. This study examined objective (social integration, social mobility, and occupation as rated by the caregiver) and subjective (e.g., feelings of connectedness and social participation as rated by the patient) measures of community integration, disease characteristics (obtained from medical records), and social support among 57 drivers and 18 non-drivers with MS.

**Results:** Multivariate analysis of covariance (MANCOVA) indicated that drivers had more social connections and made more productive use of their time than non-drivers, even after accounting for disease severity, duration of illness, income, and perceived social support. Non-drivers used more alternative transportation than drivers, but overall use of alternative transportation was negatively associated with all community integration outcomes except social mobility.

**Conclusions:** These findings suggest that driving status has considerable influence on community integration among individuals with MS. Social support may partly buffer the adverse subjective effects of driving cessation; however, neither it nor alternative transportation can adequately compensate for the loss of independent driving on social integration and productive use of time. Interventions should be targeted to maintain community integration, especially among MS patients who cease driving.

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#### **L. LEPOW, J. VAN SWERIGAN, A.M. STRUTT, M. YORK & P. SCHULZ. Frontal and Temporal Lobe Involvement on Verbal Fluency measures in ALS.**

**Objective:** Amyotrophic Lateral Sclerosis (ALS) has been associated with changes in frontal and temporal lobe-mediated cognitive and behavioral functions. We sought to evaluate these functions in verbal fluency measures using standard scoring methods and Troyer's (1997) and Abwender's (2001) clustering and switching component processes scoring systems.

**Participants and Methods:** We examined cognition using phonemic and semantic verbal fluency tasks in 49 ALS patients and 25 healthy controls. A subset of the ALS patients was classified into ALS-intact, ALS with mild cognitive impairments (ALS-mild), and ALS with Frontotemporal dementia (ALS-FTD) based on a comprehensive neuropsychological evaluation.

**Results:** ALS patients exhibited decreased overall lexical and semantic fluency as compared to healthy controls. Troyer's scoring method sug-

gested both frontal and temporal involvement in ALS cognitive decline, with the total ALS sample generating fewer clusters and the ALS-mild and ALS-FTD patients also switching less often between clusters. Abwender's scoring system revealed predominantly temporal lobe involvement in ALS patients; however, the ALS-FTD patients also demonstrated declines in switching suggesting additional frontal lobe involvement with increased cognitive dysfunction.

**Conclusions:** These results suggest that verbal fluency measures are sensitive in identifying both frontal and temporal lobe involvement in cognitive declines associated with ALS, particularly when the component processes are evaluated.

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**J.F. SUMOWSKI, N. CHIARAVALLI, G. WYLIE & J. DELUCA. MRI Evidence for the Primary Learning Deficit hypothesis in Multiple Sclerosis.**

**Objective:** Memory impairment is prevalent among persons with Multiple Sclerosis (MS). Although memory problems were traditionally considered the result of retrieval failure, more recent evidence supports a primary deficit in learning / acquisition. To help clarify this issue, we examined the relationship between disease severity (i.e., brain atrophy) and both learning and memory.

**Participants and Methods:** Thirty-seven persons with clinically definite MS (age:  $44.3 \pm 7.4$ , disease duration =  $10.1 \pm 7.1$  years) participated. Learning and memory were assessed with the open-trial Selective Reminding Test (SRT). Brain atrophy was estimated from third ventricle width measured on high resolution MR images (MPRAGE). Partial correlations were performed between brain atrophy and SRT total learning and delayed recall controlling for age. ANOVA was used to examine the relationship between brain atrophy and recall across SRT learning trials.

**Results:** Brain atrophy was associated with lower total learning ( $r_p = -.36, p < .05$ ) and lower delayed recall ( $r_p = -.41, p < .05$ ). Importantly, atrophy was not significantly associated with delayed recall when controlling for total learning ( $r_p = -.23, p > .1$ ), suggesting little unique association between MS disease and poor retrieval independent of initial learning problems. Brain atrophy was also associated with slower learning across SRT trials, with a peak association on the fourth trial ( $r_p = -.55, p = .001$ ).

**Conclusions:** MS disease progression is associated with inefficient initial learning, with no reliable impact on retrieval independent of learning. These results indicate a primary learning deficit in MS, which secondarily leads to poor retrieval.

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**L.H. SWEET, S.D. VANDERHILL, B.A. JERSKEY, N.M. GORDON, R.H. PAUL & R.A. COHEN. Subvocal Articulatory Rehearsal during Verbal Working Memory in Multiple Sclerosis.**

**Objective:** Verbal working memory (VWM) and cognitive processing speed are frequently impaired among patients with Multiple Sclerosis (MS). This study was designed to dissociate VWM components of subvocal rehearsal and memory buffering, and to determine the influence of information processing speed on VWM. Subvocal rehearsal was expected to be more affected by MS than short-term memory buffering. Furthermore, worse subvocal rehearsal was predicted to be specifically related to slower cognitive processing.

**Participants and Methods:** Fifteen mild to moderately disabled (mean MS functional composite z-score =  $-2.11$ ) MS patients were administered a neuropsychological battery assessing VWM, processing speed, mood, fatigue, and disability. Participants performed a 2-Back VWM task with modified nested conditions designed to increase subvocal rehearsal (via inter-stimulus interval) and short-term memory buffering demands (via phonological similarity).

**Results:** Performance during these 2-Back conditions did not significantly differ and both exhibited strong positive correlations with disability. However, only scores on the subvocal rehearsal 2-Back were significantly related to performance on the remaining test battery, including processing speed (Symbol Digit Modalities Test;  $r = .61, p = .02$ ) and depressive symptoms (Chicago Multiscale Depression Inventory;  $r = -.60, p = .02$ ).

**Conclusions:** Findings suggest that VWM performance during increased subvocal rehearsal demands is specifically influenced by cognitive processing speed and depressive symptoms.

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**G.A. VARGAS & P.A. ARNETT. Performance Variability Predicts Future Disability in MS.**

**Objective:** Multiple Sclerosis (MS) has an unpredictable disease course. If methods were identified for predicting worsening disability, they could potentially improve patient treatment. Existing tests of neurocognitive functioning show weak or inconsistent relationships with current and future disability. Variability in neuropsychological test performance is rarely studied and could be a promising way of identifying patients at risk for decline.

**Participants and Methods:** 51 MS patients were tested at two time points approximately four years apart. At both time points they were given two tests of verbal fluency, two tests of memory, and three tests of processing speed. Z scores were calculated for each cognitive test and the standard deviation of these Z scores was used as a measure of performance variability. At both time points patients were given the Expanded Disability Status Scale (EDSS) and at time two they were also given the Multiple Sclerosis Functional Composite (MSFC), a newer and more comprehensive disability measure.

**Results:** In a hierarchical regression model, increased neurocognitive performance variability at time one predicted worse overall MSFC scores at time two, even after controlling for disability at time one ( $\Delta r^2 = .25, p < .01$ ). Specifically, neurocognitive variability at time one predicted the cognitive functioning score of the MSFC at time two ( $p < .001$ ), and not the upper or lower limb motor functioning scores. Disability at time one alone did not predict MSFC scores at time two.

**Conclusions:** Neurocognitive performance variability appears to be a marker for worsening disability, at least in the cognitive domain. Possible causal relationships will be discussed.

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## Forensic Neuropsychology

**J. DENBOER & S. HALL. Children's Performance on Memory for Complex Pictures©**

**Objective:** This study highlights preliminary results from children on a new symptom validity test (SVT), entitled Memory for Complex Pictures (MCP). The MCP is a computerized measure employing 50 high-resolution color photographs of complex visual scenes presented over two trials. This test has shown strong psychometric characteristics, including equivalent specificity and better sensitivity when compared to the TOMM (DenBoer & Hall, 2008) and, when compared to the WMT, equivalent specificity and sensitivity (DenBoer & Hall, 2009). The MCP has also shown excellent face validity (DenBoer & Hall, 2007).

**Participants and Methods:** In this study data was collected from child and adolescent patients (mean age = 10 years) who were referred for neuropsychological evaluation due to concerns of learning disorders and/or attention deficit hyperactivity disorder (ADHD).

**Results:** Results showed that the child/adolescent sample achieved passing scores on the MCP, obtaining an average MCP Trial 1 score of 43.63 (SD = 6.14) and an average MCP Trial 2 score of 45.50 (SD = 6.95). Notably, children achieved significantly better MCP performance than adults currently involved in litigation.

**Conclusions:** Research has begun to highlight the possibility of neuropsychological malingering in the pediatric/adolescent population (Donders, 2005). For example, Lu and Boone (2002) reported a case of suspected malingering of cognitive symptoms in a 9-year-old child involved in litigation. Further information on pediatric and adolescent malingering, respectively, can be found in Faust, Hart, and Guilmette (1988) and Faust, Hart, Guilmette, and Arkes (1988).

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## Language and Speech Functions/Aphasia

**H. TELLEZ, N.A. BALDERAS, E.S. NÚÑEZ & M. ZEPEDA. Differences in the Development of Metacognitive Strategies among School Children.**

**Objective:** The aim of this study is to observe the development of metacognitive skills in children between 4 and 12 years and analyze whether there is a gender difference in the performance of tasks that involve metacognitive linguistic analysis.

**Participants and Methods:** A population of men and women between 4 and 12 years old coursing pre-primary and primary school in the city of Monterrey, Nuevo Leon, Mexico, was chosen to be applied of a battery of tests consisting in the following: Stories Happé 1999, history of chocolate by Wimmer and Perner, embarrassing story Baron-Cohen 1999, Stone, Gregory 2002

**Results:** We found out that a significant difference in the resolution of metacognitive tasks exists between men and women, where a better performance in the girls was observed. According to the errors found, the analysis metacognitive was the most frequent type of error in men and comprehension errors in women. Additionally we observe that the greater the school degree is less possibilities to commit misconceptions in both sexes exist.

**Conclusions:** The differences found between men and women can be explained due to the earlier cognitive and language development in women than in men. Besides, the fact of having found less errors among both sexes at greater ages is due to a greater maturation development. These results establish a base for the study of the metacognition misconceptions development in both sexes.

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## FRIDAY AFTERNOON, FEBRUARY 5, 2010

### Invited Address: The Emotional Brain

Speaker: **Joseph LeDoux**

12:00–1:00 p.m.

**J. LEDOUX. The Emotional Brain.**

Given that “emotion” is hard to define, how can we pursue the neural basis of emotion. One way is to pick one emotion, such as fear, and learn as much about it as we can. In this talk, I will discuss my research on fear and the brain, and the implications for “emotion” in general as well as for understanding fear and anxiety disorders.

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### Symposium 9: Evidence-Based Management of Sport-Related Concussion

Chair: **Christopher Randolph**

Discussant: **Scott Millis**

2:00–3:30 p.m.

**C. RANDOLPH & M.W. KIRKWOOD. What are the real risks of sport-related concussion, and which are modifiable?**

**Objective:** To identify and quantify the risks associated with sport-related concussion, including the incidence of catastrophic outcome (death or permanent disability), same-season repeat concussion, “delayed” recovery, and late-life effects of concussion.

**Participants and Methods:** A retrospective review of data on catastrophic injuries from 10 years of American football at all levels of competition, as well as review of the peer-reviewed literature that bears upon this issue.

**Results:** Rates of injuries are presented, and the potential for various management strategies to modify these injuries are discussed.

**Conclusions:** Serious short-term consequences of these injuries are extremely rare, and unlikely to be modified by management strategies dependent upon “baseline” neurocognitive testing. The need for additional research into the long-term consequences of repetitive sport-related head injury is discussed.

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**W.B. BARR, C. RANDOLPH & M. MCCREA. Update on “baseline” testing and symptom checklists in managing sport-related concussion.**

**Objective:** To review the psychometric and clinical validity data for various computerized as well as pencil-and-paper batteries for the assessment of sport-related concussion, and to present an empirically-derived symptom checklist for monitoring subjective symptoms

**Participants and Methods:** A brief review of data from all published, prospective controlled studies of the application of neurocognitive test batteries will be presented. In addition, the empirical derivation of a brief symptom checklist, obtained from a study involving over 16,000 baseline assessments and 641 concussed athletes, will be presented.

**Results:** The neurocognitive impairments detected by “baseline” test batteries follow sport-related concussion are very mild and transient, typically lasting no more than a few days. In addition, the low test-retest reliability of most of these instruments undermines their utility for individual decision-making. The empirically-derived symptom checklist (CSI) proved to be as sensitive as longer checklists in tracking recovery.

**Conclusions:** To date, there is insufficient data from prospective, controlled studies to support the use of “baseline” neurocognitive testing in routine clinical management of sport-related concussion. Subjective symptoms related to concussion can be effectively monitored with a brief (12-item) scale.

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**M. MCCREA, K.M. GUSKIEWICZ, W.B. BARR, C. RANDOLPH, T.A. HAMMEKE & J.P. KELLY.** The natural history of recovery from concussion, and the effects of a symptom-free waiting period on recovery.

**Objective:** Although there are over two dozen competing guidelines for the management of sport-related concussion, they are all in agreement that players should be symptom-free before returning to competition. To date, however, the effects of observing a symptom-free waiting period on outcome have never been explored.

**Participants and Methods:** Three combined prospective, controlled studies on the recovery from sport-related concussion are presented, including 16,624 player-seasons and 635 concussions with baseline and follow-up assessments of symptoms, neurocognitive test performance, and balance.

**Results:** A review of the natural history of recovery for these 635 players is presented. In addition, it was determined that ~40% of this group was returned to play prior to becoming symptom-free. Contrary to expectations, there was no difference in outcome between these athletes and those for whom a symptom-free waiting period was observed.

**Conclusions:** The observance of a symptom-free waiting period did not appear to reduce the risk of a same-season repeat concussion or alter the natural history of recovery from concussion. The results are discussed within the context of the ongoing evolution of an evidence-based approach to the management of sport-related concussion.

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**T.A. HAMMEKE, C. RANDOLPH, M. MCCREA & W.B. BARR.** Synthesis of available data and suggested rational approach to the management of sport-related concussion.

**Objective:** To summarize the findings from the presentations on risk, natural history of recovery, effects of observing a symptom-free waiting period, and review of assessment techniques to inform a practical, rational approach to managing sport-related concussion

**Participants and Methods:** N/A

**Results:** The bulk of the evidence suggests that there is no role for routine "baseline testing in the management of these injuries, but that close observation of acute symptoms may enable rapid responding in rare cases of catastrophic outcome. Recovery from most injuries can be monitored via symptom checklist, and "atypical" recovery should prompt referral to appropriate clinician specialists (e.g., clinical neuropsychologist, neurologist).

**Conclusions:** There is insufficient evidence to support any rigid guideline for the management of sport-related concussion, and these cases are best managed on an individual basis, following the general principles detailed above.

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**C. RANDOLPH, S. MILLIS, C. RANDOLPH, M. MCCREA, W. BARR & T. HAMMEKE.** Evidence-Based Management of Sport-Related Concussion.

**Symposium Description:** Over the past decade or two, a great deal of attention has been paid in both the popular and scientific literature to the management of sport-related concussion. There has been a proliferation of competing guidelines over this period of time, as well as widespread marketing of "baseline" neurocognitive tests to aid in managing these injuries. To date, however, little attention has been paid to the nature of the risks associated with these injuries, and none of the guidelines are based upon evidence suggesting that they actually modify risk. The present symposium was designed to provide a review of the nature of the risks associated with these injuries and describe a rational, evidence-based approach to managing sport-related concussions based upon the cumulative literature to date.

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**Poster Session 7:  
Dementia (Subcortical, Specific Disorders, MCI, etc.), Emotional Processes, Imaging (Structural), TBI (Child), Visuospatial Functions/Neglect/Agnosia**

**3:45–5:15 p.m.**

**Dementia (Subcortical, Specific Disorders, MCI, etc.)**

**K.J. BANGEN, K. RESTOM, T.T. LIU, C.E. WIERENGA, A.J. JAK & M.W. BONDI.** Resting State Cerebral Blood Flow and Brain Activation during Memory Encoding in Mild Cognitive Impairment: An Arterial Spin Labeling Study.

**Objective:** Individuals with mild cognitive impairment (MCI) demonstrate changes in brain structure and function relative to cognitively normal older adults. Using arterial spin labeling (ASL), we assessed differences in resting state cerebral blood flow (CBF) as well as functional CBF and blood oxygenation level dependent (BOLD) signal response to memory encoding in the medial temporal lobes (MTL) between individuals with MCI and cognitively normal older adults.

**Participants and Methods:** T1-weighted and ASL MRI scans at rest and during picture encoding were acquired for 32 nondemented older adults, including 22 cognitively normal individuals (mean age = 74.6 years) and 10 with MCI (mean age = 78.0 years). Manually outlined regions of interest were used in the calculation of brain volume.

**Results:** Analyses showed no significant between-group differences in age or MTL volumes ( $p > .10$ ). However, individuals with MCI demonstrated a trend toward reduced resting state CBF ( $p = .08$ ). There were no statistically significant differences in functional CBF or BOLD between the two groups. Across all participants, greater percent change CBF during memory encoding was significantly associated with better performance on a memory measure administered outside of the scanner ( $r = .34, p = .04$ ).

**Conclusions:** Findings provide support for the possibility of differences in resting state physiology between individuals with MCI and their cognitively normal counterparts. Such baseline differences may influence CBF and BOLD activation and should be taken into account when interpreting findings, especially in the presence of risk factors that may alter metabolic or vascular mechanisms.

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**J. BOL, S. GROSSMAN, M. CROWDON, J. JUNG, P. POORZAND, C. STANLEY, B. MILLER & K. RANKIN.** Why do Socially Intact Neurodegenerative Disease Patients Fail Cognitive Theory of Mind Tasks?

**Objective:** Though Alzheimer's disease (AD) patients typically maintain intact social behavior early in their disease, they perform as badly as frontotemporal dementia (bvFTD) patients on cognitive theory of mind (ToM) tasks. We investigated whether neurodegenerative disease (NDG) patients fail ToM tasks due to the heavy cognitive demands of ToM, and determined which cognitive domains primarily contribute to ToM performance.

**Participants and Methods:** Seventy-three subjects (13 bvFTD, 13 AD, 5 semantic dementia [SemD], 4 progressive nonfluent aphasia [PNFA], 20 other/mixed dementia patients [MIX], 18 healthy older controls [NC]) were tested with a 12-item cognitive ToM task based on Gregory (2002) with first-order, second-order, and control task sub-scales, as well as neuropsychological measures of verbal and non-ver-

bal memory, naming, visuospatial skills, verbal fluency, set shifting, working memory, and emotion identification. Patients were mildly demented and did not differ by severity (Clinical Dementia Rating=0.7±0.6) or education (17.7±2.1 years). All cognitive variables were regressed on ToM performance, controlling for age, sex, and control task.

**Results:** All groups but SemDs failed both first- and second-order ToM tasks compared with NCs ( $p < .05$ ). Seventy-four percent of variance in first-order and 69% of second-order ToM was predicted by models ( $p < 0.0001$ ) including memory, working memory, and control task performance, with no other cognitive domains remaining significant.

**Conclusions:** This study extends previous research indicating that a domain-specific “mentalizing” deficit is not at the root of cognitive ToM deficits seen in bvFTD, and provides new evidence that domain-general cognitive failures in memory and working memory are adequate to account for ToM deficits in NDG patients.

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### J.N. COPELAND, H.R. GRIFFITH & D.C. MARSON. Qualitative Comparison of Clock Drawing Errors in Patients with Parkinson's Disease Dementia and Alzheimer's Disease.

**Objective:** This study explored clock drawing errors in Parkinson's disease dementia (PDD) patients and Alzheimer's disease patients (AD). **Participants and Methods:** 35 PDD patients, matched demographically with 35 AD patients and 35 controls, completed a clock drawing task. Command and copy conditions were scored for presence/absence of 30 errors.

**Results:** On both conditions, the PDD group made significantly more errors overall than the AD group ( $p < .001$ ). Controls made significantly fewer errors than both PDD ( $p < .001$ ) and AD ( $p < .005$ ) groups. The PDD group made significantly more errors than the AD group on “the figure does not resemble a clock”, “missing/extra numbers in the sequence,” “more/less than 2 hands present,” “lines/hands are imprecise,” “numbers are difficult to read,” and “other markings present.” In the copy condition, 3 of these items remained significant. Common errors created by all 3 groups on command include: “incorrect spatial positioning of numbers,” “not placing anchor numbers first,” “non-symmetry on the 12/6 axis,” and “incorrect placement of the hour hand.” “Incorrect spatial positioning of numbers” and “non-symmetry on the 12/6 axis” were the most common errors for all groups on copy. PDD and AD groups had high frequencies of errors on “missing/extra number” item and the “length of the minute hand” item.

**Conclusions:** Spatial clock drawing errors may not be indicative of dementia since they occurred frequently in all groups. Errors made often by dementia groups were identified. PDD clocks were characterized by messy lines/numbers, missing and/or extra features, and greater overall deviation from a clock.

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### M. GONZALEZ, G. CORTÉS TORRES & C. FLORES. Qualitative assesment of the Rey figure in patients with vascular, alzheimer and fronto-temporal dementia.

**Objective:** OBJECTIVE: To describe qualitatively (frequency and types of error) of the visoconstructive alterations in the execution of the copy of the REY OSTERRIETH in patients with Sx. Demential of three different etiologies.

**Participants and Methods:** METHOD: Descriptive- Cross-sectional. Subjects: 15 patients of INNN, 5 with Vascular Dementia, 5 more with Pb. Disease of Alzheimer and 5 with Frontotemporal of frontal predominance.

**Results:** RESULTS: the group of patients with Pb. EA were 3 men and 2 women with an average of age of 73,8 SD 12,96 the average of the score was of 15,9 SD 8,9, average schooling of 9,2 The patients with

vascular Dementia: 3 men and 2 women with an average of age of 69,4 SD 16,5 the average of score 7,8 SD 4,2. schooling 6,4 years. And the group of Frontotemporal Dementia with 3 men and 2 women with an average of age 62 SD 8,8 the average of score 10,4 SD 8,11, schooling 5,6 years.

**Conclusions:** The group that presented the lowest scores was the patients with vascular dementia, which can suggest the interrelation between the location and extension of the infarcts as well as the Co-morbidity with the changes in the affective state that are very frequent in these patients, independent of his age and schooling.

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### L. DELANO-WOOD, Y. CHANG, A. MCCAULEY, A.J. JAK, K.J. BANGEN, D. SCHIEHSER, N. STRICKER, C.E. WIERENGA, D. NATION, E. LANNI, S. SORG, N. LUC & M.W. BONDI. Entorhinal Cortex Thickness Differences by APOE Genotype in MCI and Normal Aging.

**Objective:** Studies are equivocal with regard to APOE-related volumetric changes in the hippocampus in MCI and normal aging, although recent studies suggest that possession of the  $\epsilon 4$  allele may be related to decreased thickness of the entorhinal cortex (EC), a brain area affected early in Alzheimer's disease. Since the EC may be one of the most sensitive regions in terms of preclinical AD alterations, we examined APOE genotypic differences in EC thickness across normal aging and mild cognitive impairment (MCI).

**Participants and Methods:** Forty-two nondemented participants were divided into groups based on cognitive status (MCI:  $n=21$ ; Normal Control [NC]:  $n=20$ ), and groups were comparable on age, education, gender, stroke risk, and APOE genotypes. Freesurfer-derived values of EC thickness and hippocampal volumes were compared across APOE genotype groups.

**Results:** There was no interaction of MCI status and APOE  $\epsilon 4$  genotype on EC thickness. However, relative to non- $\epsilon 4$  carriers, those with the  $\epsilon 4$  allele demonstrated significantly decreased EC thickness ( $t=3.37$ ,  $p=.002$ ) despite no group differences in hippocampal volumes ( $p=.72$ ). Further, APOE  $\epsilon 4$  status was predictive of EC thickness after adjusting for age, stroke risk, and hippocampal volumes.

**Conclusions:** Possession of the APOE  $\epsilon 4$  allele was strongly associated with EC thickness in our sample of nondemented older adults. Importantly, findings were independent of MCI status, hippocampal volumes, and stroke risk, and suggest that, even in the context of normal aging, possession of the APOE  $\epsilon 4$  allele may be associated with early alterations in brain structures implicated in the pathogenesis of AD.

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### E. LANNI, L. DELANO-WOOD, A.J. JAK, K.J. BANGEN, A. MCCAULEY, D. SCHIEHSER, Y. CHANG, N. STRICKER, D. NATION, C.E. WIERENGA, S. SORG, L. CLARK, N. LUC, D. DELIS & M.W. BONDI. Elevated Stroke Risk Predicts Lower Hippocampal Volumes in Mild Cognitive Impairment and Normal Aging.

**Objective:** Few studies have investigated associations between increased stroke risk and gray matter alterations in mild cognitive impairment (MCI). Given recent suggestions that vascular factors may modify and possibly potentiate conversion to MCI and dementia, the aim of the current study was to examine the association between stroke risk and hippocampal volumes in MCI and normal aging.

**Participants and Methods:** Participants consisted of 53 older adults divided into two demographically-comparable groups on the basis of their cognitive status (MCI:  $n=25$ ; Normal control [NC]:  $n=28$ ). The Framingham Stroke Risk Profile was used to evaluate the presence and severity of several vascular risk factors (e.g., hypertension, diabetes, coronary artery disease), and hippocampal volumes were manually-outlined on T1 images. Correlational and regression analyses were used to explore relationships between stroke risk, hippocampal volumes, and MCI status.

**Results:** Stroke risk was negatively associated with total hippocampal volumes. Results of a multiple hierarchical regression adjusting for age, gender, and whole brain volume demonstrated that elevated stroke risk was predictive of lower hippocampal volumes in both normally aging adults and those with MCI. Analyses demonstrated no stroke risk by MCI status interaction.

**Conclusions:** In our sample of nondemented older adults, results demonstrated that elevated stroke risk was associated with and predictive of lower hippocampal volumes. Findings indicate that, irrespective of diagnosis, increased vascular burden may exert a deleterious effect on hippocampal volumes, and they suggest that stroke risk may be independently linked to pathologic processes underlying hippocampal changes in MCI and normal aging.

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**E.C. EDMONDS, S.Z. RAPCSAK, J.C. BARTLETT & E.L. GLISKY. Face Memory Loss and Face Memory Distortion in Frontotemporal Dementia.**

**Objective:** Previous studies of patients with focal brain lesions have demonstrated that accurate face recognition involves an interaction between memory and executive control systems. This study examined the behavioral and neural correlates of face recognition impairment in patients with frontotemporal dementia (FTD). We hypothesized that executive dysfunction would result in memory distortions beyond what could be explained by face memory loss alone.

**Participants and Methods:** Participants included two patients with FTD. VBM revealed temporal lobe atrophy in Patient 1 and both temporal and frontal lobe atrophy in Patient 2. Participants completed a battery of anterograde face memory tests (two-alternative forced-choice and yes/no tests using a variety of lures), and a retrograde fame judgment test using both famous and unfamiliar faces.

**Results:** Participants demonstrated comparable face memory impairment on the forced-choice test and equally poor memory discrimination on anterograde yes/no tests. Patient 1 showed a pattern of responses consistent with a guessing strategy, while Patient 2 demonstrated a liberal response bias resulting in profound false recognition for category-consistent lures. Patient 2 also demonstrated high false alarm rates on the retrograde memory test, identifying unfamiliar faces as “famous.”

**Conclusions:** The presence or absence of frontal dysfunction profoundly alters the clinical manifestations of the face memory deficit in FTD, as it is associated with increased memory distortions and an overreliance on general or categorical information when making recognition decisions in both the anterograde and retrograde domains. These findings are consistent with the differential impact of frontal versus temporal lobe damage on face memory documented in patients with focal lesions.

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**J. EPPIG, D. WAMBACH, B. BETTCHER, C. PRICE, T. GIOVANNETTI, M. LAMAR & D.J. LIBON. Verbal Serial List-Learning in Mild Cognitive Impairment.**

**Objective:** Previously, we classified MCI patients into three groups – amnesic (aMCI), dysexecutive (dyMCI), and mixed impairment (mxMCI). The current research examines these MCI subgroups’ performance on a verbal serial list-learning test for differential patterns of impairment.

**Participants and Methods:** 13 aMCI, 18 dyMCI, and 44 mxMCI patients were administered the Philadelphia (repeatable) Verbal Learning Test (P[r]VLT). Z-scores were calculated using the mean and SD of the total MCI population (n= 75). Between-group and within-group performances were analyzed for immediate free recall (IFR, trials 1-5), short delay free (SDF) and cued (SDC) recall, long delay free (LDF) and cued (LDC) recall, and delay recognition (DR). Recognition foil bias (semantic, interference list B or unrelated) was compared using non-parametric, within-group analyses.

**Results:** No differences in age, MMSE, or GDS were seen between MCI subgroups, though aMCI patients were more educated ( $p < .05$ ) than the other groups. A 1-way ANOVA revealed the aMCI group scored lower than the other groups on LDF, LDC, and DR (all  $p$ 's  $< .01$ ) with no differences between the dyMCI and mxMCI groups. Paired t-tests for aMCI patients found performance decreased between IFR and all subsequent P[r]VLT test conditions. mxMCI patients showed improvement from IFR to DR ( $p < .01$ ) and LDF to DR ( $p < .07$ ). dyMCI patients remained stable across all P[r]VLT test condition. On DR, the aMCI and dyMCI patients endorsed more semantic and list b foils ( $p < .01$ ), while mxMCI patients endorsed more list b foils ( $p < .03$ ).

**Conclusions:** Patients with unique MCI subtypes display differential patterns of performance on a serial list-learning test. aMCI subjects exhibit a profile associated with an encoding impairment, a pattern similar to AD. The mxMCI group demonstrated elements of a retrieval-based deficit, a pattern associated with subcortical disease. The dyMCI demonstrates relatively stable performance across trials.

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**J. EPPIG, D. WAMBACH, C. PRICE, B. BETTCHER, T. GIOVANNETTI, M. LAMAR & D.J. LIBON. Extra-List Intrusions in Mild Cognitive Impairment.**

**Objective:** Extra-list intrusion errors on episodic memory tests are a common feature among individuals with Alzheimer’s disease (AD). Moreover, AD patients tend to produce more prototypical extra-list intrusions, particularly on cued recall trials. We examined the rate and word-frequency of intrusion errors among three distinct MCI subgroups: amnesic (aMCI), dysexecutive (dyMCI), and mixed impairment (mxMCI).

**Participants and Methods:** 13 aMCI, 18 dyMCI, and 44 mxMCI patients were administered the Philadelphia (repeatable) Verbal Learning Test, a verbal serial list-learning task. The following error variables were collected: total free recall intrusions (FRI), percent FRI, cued recall intrusions (CRI) and percent CRI. In addition, the Francis & Kucera word-frequency value was obtained for each intrusion error to assess error ‘prototypicality’. The aMCI group was also compared to 13 AD patients randomly selected from a larger database (n= 57).

**Results:** No differences in age, MMSE, or GDS were seen between MCI subgroups, though the aMCI group was more educated ( $p < .05$ ) than the other groups. A 1-way ANOVA revealed that the aMCI produced more total CRI as compared to the dyMCI and mxMCI groups ( $p < .001$ ). The aMCI group also generated CRI with higher Francis & Kucera word-frequency values in both the short-delay ( $p < .01$ ) and long-delay ( $p < .02$ ) cued recall trials than the other MCI groups. The aMCI group generated a significantly higher percentage of FRI than the dyMCI group ( $p < .02$ ). Relative to the aMCI group, AD patients had a significantly higher percent CRI.

**Conclusions:** Differential error patterns exist among patients with varying subtypes of MCI. Similar to AD, aMCI was associated with a greater number of high-frequency CRI, indicating considerable prototypicality of extra-list intrusions. This pattern was not observed among the dyMCI and mxMCI groups, suggesting that extra-list intrusions are a robust marker of episodic memory encoding deficits.

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**C.M. FUNES, A. LARCO, S. BAYAN, R. NIJJAR & J. RAZANI. Assessing Daily Living Difficulties in Patients with Mild Cognitive Impairment Using a Performance-based Measure.**

**Objective:** Mild Cognitive Impairment (MCI) is a precursor to various forms of dementia, including Alzheimer’s Disease (AD). It is typically characterized by deficit in one cognitive domain, such as memory, and

relatively well preserved activities of daily living (ADL). In the current study, we examined ADL in MCI patients with a performance-based measure. It was hypothesized that MCI patients would display mild deficits in a domain of ADL relative to AD patients, while performing significantly poorer than elderly controls.

**Participants and Methods:** Ten MCI patients, 51 AD, and 57 normal older adults were administered the Direct Assessment of Functional Status (DAFS), an observation-based daily functioning test which assesses 5 areas of ADL (orientation, communication, transportation, financial, shopping).

**Results:** One-way ANOVAs were utilized to observe performance differences between the three groups. The analysis revealed that while AD patients performed poorer than controls on all 5 DAFS subscales, MCI individuals only differed from controls on 1 out of the 5 ADL domains. However, post hoc analyses revealed that MCI individuals performed significantly poorer than controls, but better than AD patients on the DAFS shopping task (which requires learning a list of items, recall them after a delay, and select the items from among foils in a “mock” grocery store).

**Conclusions:** These preliminary data suggest that MCI patients have difficulties with tasks requiring memory skills, and that they may not be reporting problems due to the subtle nature of the ADL deficits and possible lack of awareness.

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### C. HIGGINSON, V. WHELOCK, D. LEVINE, C. PAPPAS & K. SIGVARDT. Measures of Visuoception Predict Disability in Parkinson's Disease.

**Objective:** Surprisingly little is known about the relationship between neurocognitive function and disability in Parkinson's disease (PD). Only one study has noted that MMSE scores significantly contributed to the prediction of Unified Parkinson's Disease Rating Scale (UPDRS) Activities of Daily Living (Part II) scores. Weaknesses of this study include limited neuropsychological assessment and inclusion of items assessing symptoms rather than tasks in their assessment of disability. The purpose of the current study was to address these weaknesses in determining the neurocognitive predictors of disability in a sample of individuals with PD.

**Participants and Methods:** A group of 51 non-depressed PD patients underwent neuropsychological assessment. Disability was measured using Part II of the UPDRS excluding symptom items. Motor symptom severity was measured using UPDRS motor scores. All assessment was conducted while patients were in the “on” state. A stepwise multiple regression was performed including UPDRS Part III and cognitive measures as potential predictors of disability.

**Results:** UPDRS motor scores, Similarities, Letter-Number Sequencing, Picture Completion, Digit Span, and Family Pictures I and II significantly correlated with disability. In the regression, UPDRS part III entered on the first step predicting 56% of the variance ( $F(1,49) = 61.24, p = .0001$ ). Picture Completion and Family Pictures I entered on the second and third steps predicting an additional 7% ( $F(1,48) = 8.65, p = .005$ ) and 4% ( $F(1,47) = 5.14, p = .028$ ) of the remaining variance, respectively.

**Conclusions:** Aspects of visuoception function are predictive of the difficulties that PD patients experience completing daily tasks.

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### S. HSIEH, O. PIGUET, S. SAVAGE & J.R. HODGES. Recognition of Everyday Sounds and Famous Tunes in Semantic Dementia and Alzheimer's disease.

**Objective:** Semantic dementia (SD) is a clinical syndrome characterized by progressive loss of semantic (multi-modal) knowledge. Patients

have difficulty recognizing common everyday environmental sounds but little is known whether recognition for well-known tunes is also affected. Only one case study exists which describes relative preservation of memory for famous tunes (Hailstone et al, 2009) despite profound verbal and visual semantic impairment.

**Participants and Methods:** To investigate the comprehension of environmental sounds and recognition of famous tunes, patients with SD, Alzheimer's disease (AD) and age-matched healthy controls completed a sound-picture matching task for common everyday sounds and were also asked to identify famous tunes. Other aspects of cognition, including confrontation naming and word comprehension, were also examined.

**Results:** AD and SD groups were matched for disease severity. AD patients performed at the level of controls in the recognition of common everyday sounds and famous tunes. SD patients showed profound verbal semantic deficits and were also markedly impaired in the recognition of everyday sounds. The recognition of famous tunes was variable in SD: although some patients were significantly impaired, others performed at the level of controls despite profound verbal and non-verbal semantic impairments.

**Conclusions:** Not all forms of semantic knowledge are uniformly affected in SD. Processing and recognition of famous tunes is preserved in some patients despite striking comprehension deficits for words and everyday sounds. This preservation may reflect a relative sparing of neural structures known to be involved in the processing of musical information.

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### S.D. VANDERHILL, D.F. TATE, A.M. GENTILE, N.G. CANTWELL, A. OZONOFF & A.L. JEFFERSON. Neuroimaging correlates of instrumental activities of daily living in mild cognitive impairment.

**Objective:** There has been a recent proliferation of research examining neuropsychological correlates of instrumental activities of daily living (IADLs) in mild cognitive impairment (MCI); however, few studies have examined neuroimaging correlates of IADLs in MCI. We sought to preliminarily investigate relations between brain MRI markers of cerebrovascular disease (white matter integrity) and Alzheimer's disease (total brain volume, hippocampal volume) and IADLs in MCI.

**Participants and Methods:** Participants were recruited from the Boston University Alzheimer's Disease Center and included 11 older adults with consensus-diagnosed MCI (75±7 years; 46% female). Functional measures included the informant-based Lawton & Brody IADL subscale (where higher scores reflect more independence) and the clinician-rated Functional Assessment Questionnaire (FAQ; where higher scores denote more dependence). 3T MRI measures included T1-weighted white matter hypointensities (WMH), brain volume, and hippocampal volume, and diffusion tensor imaging assessed fractional anisotropy.

**Results:** Correlations yielded medium effect sizes for statistically (or marginally) significant associations when relating FAQ ( $r=0.60, p=0.049$ ) or IADLs ( $r=-0.59, p=0.055$ ) to WMH, such that diminished white matter integrity was associated with worse functional status. Partial correlations adjusting for age did not alter effect sizes, though statistical significance was lost secondary to decreased power.

**Conclusions:** Our preliminary results provide evidence for differential associations between white matter integrity and functional status in MCI in comparison to total brain and hippocampal volumes. Findings are congruent with recent evidence that executive dysfunction, rather than memory impairment, is associated with functional decline and conversion from MCI to dementia. Funding Sources: K23-AG030962, Alzheimer's Association IIRC-08-88733, P30-AG013846, and UL-RR0025771.

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**S. JUÁREZ, F. OSTROSKY-SOLIS & L. GUTIÉRREZ-ROBLEDO. Semantic memory and the evolution of mild cognitive impairment on patients with lacunar infarction.**

**Objective:** To determine whether a decline on semantic memory is an important factor determining the evolution to dementia in patients with mild cognitive impairment due to lacunar infarction.

**Participants and Methods:** Patients with mild cognitive impairment and white matter lesions determined by magnetic resonance image and/or computed axial tomography. 30 patients who presented decline on semantic memory and 30 patients without a decline. The patients were administered the NEUROPSI (a brief neuropsychological battery that assess orientation, attention and concentration, memory, languages, writing and reading, and executive functions, and is standardized in Spanish speaking population and standardized for age and educational level). Decline on semantic memory was determined by category fluency, picture naming and similarities. Patients were followed during 3 years. Cognitive decline and dementia was determined by an independent geriatric evaluation.

**Results:** The groups did not differ significantly in sex, age and mean of education, but showed significant differences ( $p < 0.05$ ) in task of immediate memory, category memory, recognition, category fluency and reading. Regression analysis revealed that development of cognitive impairment was significantly associated to the initial score on semantic memory.

**Conclusions:** Semantic memory is an important neuropsychological factor for development of dementia in patient with mild cognitive impairment due to lacunar infarction.

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**L.E. KIRSCH-DARROW, M. MARSISKE, M.S. OKUN, K. FOOTE, H.H. FERNANDEZ & D. BOWERS. Apathy and Depression: Separate Factors in Parkinson's Disease.**

**Objective:** Apathy refers to negative symptoms such as blunted emotions, loss of interest, and lack of productivity. Previous studies have suggested that apathy can be dissociated from depression in PD. We hypothesized that apathy and depression are distinct constructs that can be separated with confirmatory factor analysis (CFA). We predicted that items from the Apathy Scale (AS) and Beck Depression Inventory-II (BDI-II) would load onto 4 factors: 1) an apathy factor representing loss of motivation, 2) a depressed mood factor representing sadness and negativity, 3) a loss of interest/pleasure factor, and 4) a somatic factor representing bodily complaints (e.g. sleep, fatigue).

**Participants and Methods:** One-hundred sixty-one non-demented PD patients (age = 64.1,  $\pm$  8.4 yrs; UPDRS motor severity = 25.13  $\pm$  8.6) completed the AS and BDI-II. Item parcels (in pairs) were created to improve normality. CFA with AMOS 17 was used to examine the fit of the item parcels to the a priori factors.

**Results:** All four factors had high factor loadings (.59-.87). There was a good fit for the overall model,  $\chi^2$  (128, N = 146) = 194.9,  $p < .01$  (NFI = .858, CFI = .945, IFI = .946, RFI = .830, TLI = .934). RMSEA was .060 ( $p = .16$ ). An alternative nested models approach indicated that the four factor model was significantly better than alternative nested models at  $p < .001$ .

**Conclusions:** Results support the concept that apathy and depression are discrete factors. Results will be discussed in terms of ideas about how apathy and depression can be parsed and implications for treatment.

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**L. LOPEZ, K. MILLER, J. KIM, S. PANOS & G. SMALL. Semantic Fluency: A Helpful Addition to the MMSE in Predicting Mild Cognitive Impairment.**

**Objective:** The Mini Mental Status Exam (MMSE) is a widely used screening tool to assess gross cognitive performance, but some studies have suggested that this test may not be sensitive enough to distinguish

patients with more subtle cognitive decline found in Mild Cognitive Impairment (MCI). Recent studies have indicated the use of a semantic fluency task as an efficient and effective screening tool for MCI. The goal of the current study is to compare the predictive value of a semantic fluency task (Animals) with the MMSE to determine whether it would be a helpful additional screening tool in distinguishing MCI from normal aging or Age-Consistent Memory Impairment (ACMI) and Alzheimer's disease (AD).

**Participants and Methods:** Our study consisted of 187 participants (80 ACMI, 69 MCI, and 38 AD), including 112 women, with the mean age of 66.58 (SD = 12.48). All participants completed a full neuropsychological evaluation, including standard memory testing, which was used for diagnosis of ACMI, MCI, and AD.

**Results:** Classification results of three Discriminant Function Analyses, all significant at  $< .05$ , revealed that MMSE and Animals individually were each able to correctly classify 46.3% of participants with MCI. The combined model (MMSE + Animals) was able to correctly classify 73.1%, which is a 59% increase from their individual predictive values.

**Conclusions:** Although these results suggest that Animals and MMSE have equal individual predictive value for MCI, combining the two significantly increases the number of correct diagnostic classifications, supporting semantic fluency's usefulness as an additional screening tool for MCI.

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**W. LYNCH, K.B. FROMING, H.J. ROSEN, B.L. MILLER & J.H. KRAMER. Emotion Processing and Disinhibition in the Behavioral Variant of Frontotemporal Dementia.**

**Objective:** To determine the diagnostic specificity and behavioral correlates of emotion processing in behavioral-variant frontotemporal dementia (bvFTD). Previous research has suggested impairments in facial affect processing in bvFTD, but sample sizes have been small, non-emotional face processing abilities have not always controlled for, and behavioral correlates have not been examined. We hypothesized that bvFTD patients would have more impaired affect processing than age and MMSE matched AD patients, even after controlling for face recognition, and that these deficits would be associated with an informant-based measure of behavioral disinhibition.

**Participants and Methods:** The three groups included: 25 patients with bvFTD (mean age=61.5; MMSE=25.8), 42 patients with AD (mean age=62.8; MMSE=23.9) and 146 normal controls (mean age=62.6; MMSE=29.5). Measures were the Comprehensive Affect Testing System (CATS) Face Matching and Affect Naming tasks. Disinhibition was measured by the Neuropsychiatric Inventory.

**Results:** An ANOVA was conducted with face matching and MMSE scores as covariates. BvFTD patients were significantly worse at affect naming (mean=9.8) compared to AD patients (mean=11.6) and normal controls (mean=13.0), ( $p < .005$ ). A correlation partialling out the effects of MMSE and face matching indicated that performance on the Affect Naming task was negatively associated with level of disinhibition within the bvFTD group ( $r = .37$ ).

**Conclusions:** BvFTD is associated with significant impairment in recognizing facial expression even after controlling for dementia severity and face processing. In addition, this emotion processing deficit is correlated with higher levels of disinhibition.

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**A. MATEVOSYAN, B.H. MILOYAN, R. NIJJAR & J. RAZANI. Relationship Between Cognitive and Daily Functional Change Over a 1-Year Period in Patients with Dementia.**

**Objective:** The literature indicates that there is a relationship between deficits in specific cognitive domains and functional abilities in patients with dementia. The aim of this study was to examine the relationship between cognitive decline and daily functional decline over a one year period in patients with dementia.

**Participants and Methods:** A heterogeneous sample of 41 dementia patients were administered the California Verbal Learning Test-II Short Form (CVLT-II SF), Rey-Osterrieth Complex Figure Test (Rey-O), and Wisconsin Card Sorting Test (WCST) to examine the domains of verbal/non verbal memory, visual-spatial memory and executive skills. The Direct Assessment of Functional Status (DAFS), a performance-based task, was used to assess actual functional abilities that included orientation, communication skills, identification of driving rules and signs, financial abilities, and shopping skills. All patients were administered the tests at baseline and 1-year follow-up.

**Results:** Change from baseline to one year follow-up for each measure was calculated as: % change =  $[(\text{Year1}-\text{Year2})/\text{Year1}] * 100$ . A series of bivariate correlation analyses were performed to examine relationships between cognitive and functional change over the 1-year period. The analyses revealed statistically significant relationships between % change in the areas of visual-spatial skills and transportation skills ( $r=.41$ ), verbal memory and financial skills ( $r=.52$ ), and verbal memory and shopping skills ( $r=.55$ ).

**Conclusions:** These findings indicate that as specific aspects of cognitive functioning declines in patients with dementia, so do various daily functional skills. These results are useful to healthcare professionals, particularly as they relate to treatment planning for patients and their families.

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**J. RAO, C. WIENEKE, S. WEINTRAUB, M. MESULAM & E. ROGALSKI. Examining the Semantic Interference Effect in Subtypes of Primary Progressive Aphasia.**

**Objective:** Primary Progressive Aphasia (PPA) is a neurodegenerative syndrome characterized by selective language disruption and relative preservation of other cognitive abilities for the first two years post-onset. Anomia is the most common manifestation. Previous research suggests that word-finding difficulties may be attributed to a blurred distinction among semantic category members ("semantic interference"). Recently, this effect was demonstrated in individuals with the semantic variant of PPA, which is characterized by explicit word comprehension deficits. This study was conducted to determine if semantic interference also contributes to the anomia present in PPA patients with the nonsemantic variants (logopenic and agrammatic) who lack explicit word comprehension deficits.

**Participants and Methods:** Twenty-three individuals with PPA were characterized as semantic, agrammatic, or logopenic based on measures of word comprehension, syntax, and naming. Using a computerized task in which a spoken word (target) was followed by two objects, patients decided as quickly as possible which object depicted the target. On 50% of the trials the foil picture was semantically related to the target; remaining trials used unrelated foils. Reaction times for related and unrelated trials were compared to assess the presence of a semantic interference effect.

**Results:** The magnitude of the semantic interference effect was significantly greater in the semantic compared to nonsemantic PPA group ( $p=0.001$ ); however, both groups showed the effect. Further, the interference effect significantly correlated with neuropsychological measures of semantic but not syntactic processing.

**Conclusions:** Although PPA can present with diverse aphasia profiles, the word-finding difficulties may be related to a graded blurring of boundaries within superordinate semantic categories.

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**E.G. SCHLICHTING, S. CORREIA, P. MALLOY & S. SALLOWAY. Performance on the MMSE, MoCA, and Expanded-MoCA in Mild Cognitive Impairment and Dementia.**

**Objective:** To evaluate differences between patients with mild cognitive impairment (MCI), mild dementia, and normal elderly controls (NEC) on the MMSE, MoCA, and an expanded MoCA (MoCA-E).

**Participants and Methods:** Participants were patients with MCI ( $n=64$ ), mild dementia ( $n=40$ ,  $\text{MMSE}>16$ ), and NEC ( $n=12$ ). All participants completed the MoCA and MMSE. The MoCA-E was computed as follows: MoCA score + 2 additional points for each word spontaneously recalled on the delayed recall item + words recalled on each learning trial (1 point/word), semantic cueing (2 points/word), and multiple choice (1 point/word); total possible MoCA-E score = 50. One-way ANOVA and follow-up Tukey HSD tests were used to examine group differences in MMSE, MoCA, and MoCA-E.

**Results:** One-way ANOVA revealed significant group differences on all three measures (all  $p<.001$ ). Post-hoc Tukey HSD tests revealed that the dementia group performed significantly below the MCI and NEC groups on all measures ( $p<.05$ ; all). The MCI group performed significantly more poorly than the NEC group on the MoCA and MoCA-E ( $p<.05$ ), but not the MMSE. Effect sizes (Hedge's  $g$ ) between the MCI and NEC groups were slightly larger for the MoCA-E ( $g=.95$ ) than the MoCA ( $g=.85$ ).

**Conclusions:** The MoCA and MoCA-E scores discriminate between MCI and NEC groups. Results provide preliminary support for further research using the expanded MoCA score which might be more useful for detecting the mildest stages of MCI.

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**C. SETER, T. GIOVANNETTI, P.L. BRITNELL, L. BRENNAN, E. ROSENTHAL, M. GROSSMAN, D.J. LIBON & A. SIDEROWF. Everyday Action Task Knowledge and Executive Control: A Model for Omission and Commission Errors.**

**Objective:** Omission (i.e. failure to perform a step) and commission errors (i.e., inaccurate execution of a step) in everyday tasks are posited to be due to different cognitive deficits in individuals with dementia. A preliminary model suggests that omission errors are related to episodic memory and task knowledge and commission errors are related to measures of executive control. This study evaluated this model with individuals with Parkinson's disease dementia (PDD) and Alzheimer's disease (AD).

**Participants and Methods:** 20 participants with PDD and 19 with AD were administered the Naturalistic Action Test (NAT), which requires completion of 3 everyday tasks: 1) make toast and coffee, 2) wrap a gift, 3) pack a lunchbox and a schoolbag. NAT performance was videotaped and coded for the number of omission and commission errors. Participants also completed the MMSE and tests of task knowledge (Action Semantic Probe Test), executive control (Self-Ordered Pointing, Digit Span), and episodic memory (Warrington Recognition Memory Test). Hierarchical multiple regressions, with MMSE and diagnosis entered in the first block and all other neuropsychological tests entered in the second block, were performed to identify predictors of NAT error types.

**Results:** The model for NAT omissions accounted for 31% of the variance ( $F(6, 35) = 3.67, p<.05$ ) with MMSE ( $\beta = -.35, t = 2.14, p<.05$ ) and the Action Semantic Probe Test ( $\beta = -.44, t = 2.51, p<.05$ ) as the only significant predictors. Participants' commission errors were unrelated to MMSE, diagnosis, and all other cognitive measures.

**Conclusions:** Partial support was obtained for the preliminary model of everyday action errors, as omissions were significantly predicted by a measure of task knowledge in both groups of dementia participants. The results imply that interventions that target task knowledge deficits may benefit patients who fail to execute critical task steps in everyday life.

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**J. TAN, E. STRAUSS, M.A. HUNTER & D.F. HULTSCH. Classification of Mild Cognitive Impairment: Contributions of Cognitive and Functional Capacity Components.**

**Objective:** Questions have arisen whether the diagnostic criteria of mild cognitive impairment (MCI) should include mild functional disability.

Moreover, the utility of functional ability over and above cognitive measures for predicting future MCI is unclear. The present study aimed to add to existing research on functional ability as it relates to the diagnosis of MCI by using a report-based measure, the modified Scales of Independent Behavior-Revised (mSIB-R).

**Participants and Methods:** Self- and informant-reports (e.g. spouse) of participants' functional status were obtained on the mSIB-R from a sample of 214 community-dwelling, non-demented older adults, ranging in age from 69 to 95. Baseline functional ability and an index of one-year functional decline were used to predict future (three years) cognitive status.

**Results:** Results showed that both baseline and decline scores were useful in predicting cognitive status three years later. However, baseline functional ability did not provide additive information over and above cognitive measures in this regard. Similarly, both baseline and decline scores did not predict changes in cognitive status over three years. Using attrition as the outcome measure, functional ability and cognitive measures both predicted attrition from the study three years later.

**Conclusions:** These results suggest that functional disability is observed among community-dwellers with varying degrees of cognitive impairment, but the inclusion of functional disability in the diagnostic criteria of MCI does not appear to improve the prediction of long term cognitive status changes. Moreover, characteristics of individuals who drop out of studies differed from those who remained, suggesting that attrition effects need to be considered in longitudinal studies.

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**P. TOOFANIAN, S. GROSSMAN, M. GROWDON, J. JUNG, P. POORZAND, B.M. MILLER & K.P. RANKIN. Sensitivity to Social Reward and Punishment in Neurodegenerative Disease.**

**Objective:** Sensitivity to social reward and punishment cues show divergent patterns of change across neurodegenerative diseases (NDG), but thus far, only time-consuming face-to-face tests (e.g., gambling paradigms) have been available to assess this symptom. We investigated whether a simple informant questionnaire describing social behaviors corresponding to left- versus right-frontal damage would demonstrate these different, potentially diagnostic patterns of reward responsiveness in NDG patients.

**Participants and Methods:** Caregiver-informants described 114 participants (31 Alzheimer's, 24 frontotemporal dementia [bvFTD], 12 semantic dementia [SemD], 9 progressive supranuclear palsy [PSP], 9 corticobasal syndrome [CBS], 5 progressive nonfluent aphasia [PNFA], 24 older healthy controls [NC]) on the BIS/BAS Scales, a 20-item measure of behavioral inhibition/activation shown to be sensitive to frontal circuits mediating approach-withdrawal behaviors. Patients were matched for mild disease severity (average Clinical Dementia Rating=1.0±0.8). BIS/BAS scores were compared using SAS proc glm controlling for age and sex.

**Results:** ADs had abnormally high punishment sensitivity, while bvFTDs' was abnormally low. Though no disease group showed altered goal drive, ADs, bvFTDs, SemDs, and PSPs all showed reduced enjoyment and spontaneous seeking of reward ( $p<0.05$ ). CBSs and PNFA were not significantly different from NCs on any subscale.

**Conclusions:** A brief, informant-based questionnaire derived distinct patterns of social reward/punishment sensitivity across NDG diseases. While many groups showed decreased enjoyment of reward and sought reward less, only bvFTDs lost sensitivity to social punishment, likely due to disruption of right frontally-mediated appropriate withdrawal behaviors. ADs, conversely, showed abnormally increased sensitivity to social punishment, potentially explaining the social withdrawal seen early in the disease.

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**M. WALLIN, J. PRETELL, J. BUSTOS, M. CABALLERO, M. ALFARO, R. KANE, J. WILKEN, C. SULLIVAN, T. FRATTO, M. ENSLEY, T. MCKENZIE, A. SULLIVAN & H. GARCIA. Cognitive and Quality of Life Changes in Neurocysticercosis.**

**Objective:** Objective: Neurocysticercosis (NCC) is a common parasitic disease of the central nervous system with seizures as the most frequent presenting symptom. The impact of the disease on cognitive status and quality of life (QOL) has not been defined.

**Participants and Methods:** Participants and Methods: Fourteen patients with NCC were recruited at the Instituto Nacional de Ciencias Neurológicas in Lima, Peru. For comparison, 14 healthy neighborhood controls and 7 epilepsy controls were recruited. Patients with NCC were treated with albendazole and anticonvulsants after presenting with an initial seizure. Patients with epilepsy were recruited after their initial diagnosis. All participants were evaluated at baseline and at 6 months with a standardized Spanish cognitive battery and the SF-36 (to assess QOL).

**Results:** Results: At baseline, patients with NCC had lower scores on measures of attention compared with epilepsy controls ( $p=0.003$ ). QOL at baseline suggested poor physical ( $p<0.001$ ) and social ( $p=0.002$ ) functioning in the NCC group compared with healthy controls. After treatment, improvements in cognition and QOL were noted in the NCC group. Scores of NCC participants improved in the cognitive domains of attention ( $p=0.012$ ) and working memory ( $p=0.016$ ). Moreover, QOL for the NCC group improved in the SF-36 domains assessing physical functioning ( $p=0.018$ ) and social functioning ( $p<0.001$ ).

**Conclusions:** Conclusions: This sample of patients with NCC was noted to have mild cognitive deficits and significantly impaired quality of life compared with controls at baseline. Temporal improvement in cognitive status and quality of life was noted after 6 months.

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## Emotional Processes

**C.L. ARMSTRONG, E. MOITRA & C. BELASCO. Emotion and the Cerebellum: A Pediatric Study.**

**Objective:** Following the seminal work of Jeremy Schmahmann in extending the functional role of the cerebellum to that of higher cognition and emotion, there is burgeoning interest in psychiatric syndromes associated with cerebellar injuries. Via reciprocal connections between cerebellum and cortex, the cerebellum is thought to regulate cognition and emotion by helping to establish a set and to maintain it optimally. The cerebellum has emerged as a common substrate for two well known disorders of emotional dysregulation - autism and the cognitive affective syndrome. Anxiety is most often associated with neural damage in the right temporal region, left cerebellum, or cerebellar vermis in extant data. This study of anxiety and depression in pediatric brain tumor patients examines their association with injury to the cerebellum.

**Participants and Methods:** The Screen for Child Anxiety Related Emotional Disorders and the Children's Depression Inventory were administered to 64 (data collection is ongoing (projected  $n>75$ )) children between 8 and 17 years with abnormalities in the brain caused by brain tumors or spongiform dysplasia (in cases with neurofibromatosis 1). Patients with lesions in the left or right cortex, cerebellum, and subcortical nuclei are compared in levels of anxiety and depression. Anxiety scores in relation to left or right cerebellar hemisphere or central-vermian cerebellar region are analyzed.

**Results:** In our prior study (Moitra & Armstrong, 2009), data from 25 remitted pediatric brain tumor patients revealed significant symptoms of anxiety in 32% of patients, and only 12% reported depressive symptoms. MRI showed that all patients with elevated anxiety had lesions in regions of right cortex or left cerebellar hemisphere. This study is being updated in a larger group of pediatric neuro-oncology cases.

**Conclusions:** Results have important implications for our understanding of the cerebellum's role in affective processing and for patients with damage to this critical neural structure.

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**J. AYALA BADGLEY, E. MUSCAL, B.L. MYONES & D.R. BLOOM. Ratings of Emotional, Behavioral, and Cognitive Characteristics of Children with Systemic Lupus Erythematosus.**

**Objective:** There is a paucity of literature on rating scales in pediatric lupus. We investigated the emotional, behavioral, and cognitive characteristics of children with lupus and the relationships among these variables, and discuss the potential role of rating scales in this population. **Participants and Methods:** We examined clinically acquired data from patients (7-19 years old) and their parents. The Behavior Assessment System for Children-2 (BASC-2), Behavior Rating Inventory of Executive Function (BRIEF), and Personality Inventory for Youth (PIY) were completed during formal neuropsychological evaluations.

**Results:** The records of 21 children were reviewed. Patients had a mean age of 14.2 (SD = 3.3; 85.7% female; 71.4% African-American). Mean disease duration was 2.1 years (SD = 1.7) and mean prednisone dosage was 14.8mg (SD = 12.5). There were statistically significant differences (mean difference range = 6.5-12.4,  $p < .01$ ) between the SLE group and norms on the BASC-2 Internalizing Problems composite, PIY Psychosomatic Syndrome and Isolation subscales, and BRIEF Initiation and Working Memory scales (mean T-scores in the subclinical range = 56.5-62.4). There was a robust correlation between the PIY Cognitive Impairment subscale and the BRIEF Global Executive Composite ( $r = .91$ ,  $p < .01$ ). These subscales were correlated with the BASC-2 Internalizing Problems, Externalizing Problems, and Behavioral Symptoms Index composites ( $r$  range = .68-.91,  $p < .05$ ).

**Conclusions:** Findings suggest a correspondence between self- and parent-report regarding cognitive difficulties. The BASC-2, PIY, and BRIEF may capture subclinical concerns in children with lupus, and may identify children in need of neuropsychological and psychosocial evaluation. Correspondence: Jennifer Ayala Badgley, Ph.D., Texas Children's Hospital, 2614 Starboard Point Drive, Houston, TX 77054, United States. E-mail: jcbadgley@texaschildrens.org

**J.C. BOROD, D. KRCH, T. MYERS & E. TEAGUE. Effects of Demographic Factors on the Emotion Perception Tasks from the New York Emotion Battery.**

**Objective:** We examined the impact of demographic factors on emotional perception measures from the New York Emotion Battery (NYEB; Borod, Welkowitz, & Obler, 1992). Age was examined as considerable literature shows affective changes with age. Gender was considered because women are reported as more accurate in perceiving emotion than men. Education was examined due to the cognitive component of NYEB tasks. Ethnicity was included as facial and prosodic stimuli were created by Caucasian posers.

**Participants and Methods:** Healthy adults ( $n=103$ ) were screened for absence of dementia, learning disability, substance abuse, and neurological, psychiatric, and/or major medical disorders. Tasks administered included emotional perception measures (3 discrimination, 4 identification) and respective non-emotional control measures. Each task examined 3 positive and 5 negative emotions via facial, prosodic/intonational, and lexical/verbal channels.

**Results:** Four-way ANOVAs were conducted for each emotion task on these between-subjects variables: Age (3: 20-39, 40-59, 60-81 years), Gender (2), Education (2: 15 years or less, 16 or more), and Ethnicity (2: Caucasian, Non-Caucasian). There were significant Age effects for each task, with the oldest less accurate than younger groups. There were significant Education effects, but only for lexical tasks. There was one significant Ethnicity effect and no Gender effects. Among interactions, three were significant.

**Conclusions:** Overall, these emotional perception tasks were relatively resistant to gender and ethnicity effects. Age, however, affected each task. Education had an effect, but only for lexical tasks, with higher performance for college graduates. In light of these findings, normative data will be made available for the tasks for combinations of demographic factors.

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**A. ELLIS, T. WELLS & C. BEEVERS. Evidence of a Cognitive Priming Effect for Negative Information in Clinical Depression.**

**Objective:** Cognitive processing deficits have been implicated in depression as vulnerability and maintaining factors. The current ongoing study sought to elucidate these deficits with use of an affective priming task. Hypotheses predicted differences in the cognitive processing of primed and negatively primed emotionally valenced self-referent information in depressed and non-depressed individuals.

**Participants and Methods:** Participants were diagnosed as depressed ( $N = 8$ ) or non-depressed ( $N = 24$ ) following administration of the SCID diagnostic interview. They completed a modified Negative Priming task (c.f. Joormann, 2006) which requires self-reference judgments of emotional words.

**Results:** Preliminary results revealed that depressed individuals were significantly faster in a negatively valenced test trial when primed in the preceding trial with a negative word than were non-depressed individuals ( $F(1, 30) = 4.63$ ,  $p = 0.04$ ). However, in negative priming trials designed to measure cognitive disinhibition of negative material, depressed and non-depressed individuals had similar response time ( $F(1, 30) = 0.36$ ,  $p = 0.56$ ). Further, these group differences were specific to primed negatively valenced words such that no differences were revealed for primed or negatively primed positive words between our depression groups ( $F(1, 30) = 1.40$ ,  $p = 0.25$  and  $F(1, 30) = 0.20$ ,  $p = 0.66$ ).

**Conclusions:** Preliminary findings indicate that depressed individuals are more easily primed to negatively valenced self-referencing words than are their non-depressed counterparts. These results suggest that a depressed mood may sensitize the activation of negative cognitive pathways enhancing the priming effect. Implications for the sensitivity of negative material in depression will be discussed.

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**A. FREITAS-MAGALHÃES & . CASTRO. Facial expression: The recognition of basic emotions happiness and anger. Empirical study with Portuguese babies of aged between 04 and 08 months.**

**Objective:** Facial expression of emotion is essential for communication and takes place in almost every social interaction. According to that, the focus of this pioneer study was evaluate the capacity to recognize basic emotions in babies.

**Participants and Methods:** The sample involved 46 Portuguese babies (20 girls and 20 boys) of aged between 04 and 08 months. The basic emotions on study were the happiness and anger take from the F-M Portuguese Face Database (Freitas-Magalhães, 2003).

The protocol consisted to show at babies and as a stimulus 25 photographs of adult men and women were exhibiting in his face the basic emotions happiness and anger with the display and no display of the teeth.

**Results:** Babies recognizes the faces with and without the exhibiting of rows of teeth, but they not distinguished the same in case in the both emotions were displayed the teeth. The recognition of features of the face is found. This does not occur in the recognition of emotions associated with the face.

**Conclusions:** The aim of this study was evaluated the babies ability to identification and recognition the basic emotions. The results show an impairment in this ability which could be influenced or conditioned the relationship communication and emotional process between babies and their relationship.

It is a study to understand until point human are able to detect early basic emotions, understand why babies are not able to identify them.

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**M. HARRIS, K. LAU & R. BOWLER. Manganese Exposure in Welders: A Longitudinal Study of Mood over 3 years.**

**Objective:** Welding can be a hazardous vocation due to frequent unprotected exposures to heavy metal fumes (Chandra et al., 1981). Chronic overexposure to manganese (Mn) can be neurotoxic, and a risk factor for neuropsychological decline and parkinsonism-like symptoms (Feldman, 1999). Previous research has shown mood effects associated with Mn exposure, such as anxiety and depression (Bowler, 2007).

**Participants and Methods:** In this study, 43 men performing welding in confined spaces on the San Francisco Bay Bridge were evaluated over 3 time points, resulting in analyses of 23 welders for all 3 time points. The Symptom Checklist-90 Revised (SCL-90R) was used at each time point.

**Results:** At baseline evaluation in 2005, blood Mn levels (Mn/B) were slightly elevated at 9.89 ug/L, and mood disturbances were found on multiple domains of the SCL-90R. The highest elevations were obtained on Somatization (T = 70.9), Obsessive-Compulsive (T = 71.5), Depression (T = 68.8), and Anxiety (T = 68.0). At Time 3 in 2008, welders (who were now removed from their confined welding) had decreased Mn/B (8.58 ug/L) compared to Time 1,  $t(21) = 1.31$ ,  $p < .01$ . Linear mixed-effects modeling showed overall reductions over time in mood disturbances on Somatization,  $4.01(21)$ ,  $p = .024$ , Anxiety,  $5.85(22)$ ,  $p = .005$ , Depression,  $3.35(22)$ ,  $p = .042$ . Global Severity Index,  $4.76(21)$ ,  $p = .012$ , and Positive Symptom Distress,  $8.44(21)$ ,  $p = .001$ . At Time 2, these elevations increased from baseline, then improved at Time 3.

**Conclusions:** This study supports mood effects from Mn persisting over time, but decreasing once high exposures cease.

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**W.D. KILLGORE & D.A. YURGELUN-TODD. Cerebral Correlates of Amygdala Responses to Masked Fear, Anger, and Happiness in Adolescent and Pre-Adolescent Children.**

**Objective:** During nonconscious perception of facial affect, healthy adults commonly activate a right-lateralized pathway comprising the superior colliculus, pulvinar, and amygdala. It is not known whether this system is fully functional prior to adulthood or whether the development of the non-conscious affect perception system continues to mature during adolescence. Accordingly, we examined amygdala responses in adolescent children during a backward masked facial affect paradigm that minimizes conscious awareness of the expressions.

**Participants and Methods:** Twenty-three healthy adolescents ranging in age from 8 to 18 underwent functional magnetic resonance imaging (fMRI). During scanning, adolescents viewed brief (30 msec.) presentations fearful, angry, and happy faces, backward masked by neutral faces for 170 msec. Amygdala responses to each facial affect were extracted and correlated voxel-wise with activation within the rest of the brain.

**Results:** Left amygdala activation differed among the three masked affect conditions, showing reductions to masked anger and increases to masked fear and happy faces. During masked fear, left amygdala activation correlated positively with extrastriate cortex and temporal poles and negatively with precuneus and middle cingulate gyrus. Responses of the left amygdala to masked anger correlated positively with right parahippocampal gyrus and negatively with dorsal anterior cingulate. Amygdala responses to masked happy faces were uncorrelated with other brain regions.

**Conclusions:** Each affect category was associated with distinct patterns of amygdala activation and unique cerebral correlates. Furthermore, contrary to the right-lateralized pathway seen in adults, adolescents showed evidence of a predominantly left-lateralized extrastriate pathway during masked presentations of facial affect, suggesting that affective lateralization shifts across adolescent development.

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**D.A. LOWE, E.L. RISHER & S.A. ROGERS. Marital Status and Symptoms of Depression in Older Adults.**

**Objective:** Many studies indicate a beneficial effect of marriage on one's emotional health, particularly during the later stages of life. However, little research has considered how the specific symptoms of depression (i.e., overall depression and the emotional, cognitive, and behavioral symptoms of depression) may vary with older adults' marital status and gender. This study examines the potential influence of marital status and gender on the specific symptoms of depression in older adults.

**Participants and Methods:** 148 older adults (ages 56 to 104) were divided into married and unmarried (i.e., single, widowed, or divorced) groups. Participants completed a comprehensive neuropsychological battery. Current level of depression was assessed with the Geriatric Depression Scale, which was coded into cognitive, emotional, and behavioral subscales by three raters (ICC = 0).

**Results:** T-tests revealed that those who were married reported significantly lower overall, emotional, and cognitive symptoms of depression than those who were unmarried,  $t(35) > -2.15$ ,  $ps < .04$ . There were no gender differences in overall depression or the subtypes of depression. However, a two-way ANOVA revealed a significant interaction between gender and marital status on the emotional symptoms of depression,  $F(1, 51) = 4.01$ ,  $p < .05$ , such that unmarried men reported a greater number of emotional symptoms than both married men and married women.

**Conclusions:** Older adults seem to experience depression differently according to their gender and marital status. Marriage seems to serve as a buffer against heightened levels of overall depression, as well as the emotional and cognitive symptoms of depression. This buffering effect seems to be particularly absent for unmarried men, who appear to be at increased risk for the emotional symptoms of depression compared to married men and women. These findings have important implications for assessing, diagnosing, and treating depression in older adults.

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**G. OROZCO, F. OSTROSKY, R. SALIN, K. BORJA & G. CASTILLO. Gender identity disorder affective evaluation.**

**Objective:** To compare the affective evaluation of a battery of emotional stimuli in a group of transsexuals with heterosexual subjects.

**Participants and Methods:** 37 subjects were studied: 20 heterosexuals (10 Women and 10 males) and 17 transsexuals (male to females). Transsexuals were diagnosed using psychiatric interview according to DSM IV-R criteria. A battery of 100 pictures with different types of emotional content and previously standardized in our laboratory according to two psychological dimensions: valence (pleasant to unpleasant) and arousal (calmed to excite) was used. The battery included pictures with sexual content (i.e. nudes and erotic scenes) neutral stimuli (i.e. household objects, people), unpleasant pictures (i.e. Body mutilation, dangerous, animals) and pleasant pictures (i.e. flowers, children). Stimuli were presented using a computer and subjects evaluated the valence and arousal of each stimuli using the Self-Assessment Manikin (Lang, 2000)

**Results:** Transsexuals score the sexual stimuli significantly higher both in valence and activation than both groups (male and females) of heterosexuals. In comparison with the women, transsexuals scored the sexual stimuli with higher arousal.

**Conclusions:** Emotional processing does appear to be different in transsexuals and might reflect distinctive neurobiological mechanisms. Results are discussed with reference to cerebral anatomical differences between transsexuals and non transsexuals.

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**T.S. PATERSON, R.J. SHAPIRO & W.L. THORNTON. Modeling Medication Adherence: Depression, Cognition, and Illness Variables as Contributors to Adherence by Renal Transplant Recipients.**

**Objective:** Cognitive abilities and depressive symptoms have been linked to medication adherence following renal transplant. To further understand adherence in this group, we compared two mediational models: 1) depressive symptoms mediate the relationship between cognition and adherence; and 2) cognition mediates the relationship between depressive symptoms and adherence. We also examined relationships between various illness variables and adherence.

**Participants and Methods:** Renal transplant recipients ( $N=101$ ) completed demographic and health questionnaires, a cognitive battery, the CES-D, and the Adherence scale of the Transplant Effects Questionnaire (TxEQ). Regression Analyses and Sobel's Test were used to determine the relationships between the variables of interest.

**Results:** Weaker cognitive performance was correlated with reduced adherence. Additionally, depressive symptoms (CES-D total) and the CES-D Somatic Symptoms subscale, each partially mediated the relationship between cognition (PCA derived composite score) and TxEQ adherence scores. As well, having or being at risk for diabetes, and having higher hemoglobin levels, were related to increased adherence (all  $p$ 's  $<.05$ ). These variables, considered together, accounted for a significant amount of variance in medication adherence in this group ( $R^2 = .213$ ,  $F(2, 98) = 6.69$ ,  $p <.001$ ). The second mediational model was not supported.

**Conclusions:** Depressive symptoms, and somatic symptoms more specifically, are potentially important modifiers of medication adherence in renal transplant patients. As well, illness variables such as hemoglobin levels and diabetes may provide insight as to likelihood of adherence in this group. Use of the CES-D Somatic Symptoms sub-scale, along with a brief review of medical history, may have utility in predicting adherence in renal transplant patients.

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**M. STRAND, . HAMMAR, K. HUGDAHL & A. LUND. Depression and information processing - is emotional visual search an appropriate paradigm?**

**Objective:** To discuss various paradigms used in research on depression and cognitive control, inhibition and rumination

**Participants and Methods:** 21 depressed patients and matched controls. Patients were recruited from the University Hospital of Bergen Norway. The patients were all diagnosed according to the DSM-IV criteria for recurrent major depressive disorder, and all patients had scores above 18 on Hamilton depression rating scale at inclusion. Patients were tested during remission, within six months of hospitalization. A new visual search paradigm including emotional information (based on the FEEST stimulus material) was developed, and the data obtained was RT on 36 visual search trials.

**Results:** There was no significant group difference between patients and control on the test, reflecting that patients were in remission. However, when investigating the patient group there was a positive correlation between level of depressive symptoms and RT on selected, mood-congruent stimuli.

**Conclusions:** It seems that subjects in remission from major depressive disorder experience a gradual improvement in inhibition of mood-congruent emotional information. A discussion is further presented regarding the appropriateness of this paradigm, and if the distinction between forced and non-forced designs can reflect cognitive control, inhibition and rumination processes.

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**A.C. VEDERMAN, L. FRANTI, N. HUQ, B. HAASE, S. WALKER & S. LANGENECKER. Emotion Processing and Phase of Psychiatric Illness.**

**Objective:** Previous investigations by our group revealed that healthy controls (HC) have greater difficulty identifying emotional stimuli in an

auditory emotion processing task (AEPT) versus visual emotion processing task (FEPT) modality and have an increased bias to label stimuli as "angry" in both modalities. Prominent biases for fear and sadness were also found in the visual domain. The smallest bias was seen for identifying stimuli as "happy" in both modalities. The current investigation widened this investigation to those with diagnosed psychiatric illness.

**Participants and Methods:** Subjects were healthy controls (HC) ( $N=109$ ), bipolar depressed (BD-D) ( $N=82$ ) and euthymic (BD-E) ( $N=103$ ), and major depressed active phase (MDD-D) ( $N=49$ ) and euthymic (MDD-E) subjects ( $N=13$ ). Subjects were administered the auditory version of the Emotional Perception Test (EPT) and Facial Emotional Perception Test (FEPT).

**Results:** For the sample, individuals were accurate 84% on the EPT and 78% on the FEPT which represents a significant statistical difference between tasks. On the FEPT, HC and MDD-E individuals performed significantly better than BD-D individuals ( $p <.001$  &  $.05$  respectively). Specifically, HC demonstrated significantly increased accuracy for fear, sad, and angry visual stimuli relative to BD-D. HC demonstrated increased accuracy for happy stimuli as well in a finding that approached significance ( $p=.056$ ). Interestingly, BD-E demonstrated increased bias to label stimuli as happy relative to HC ( $p=.025$ ).

**Conclusions:** The above findings lend continued support to the notion that emotion processing accuracy and bias is influenced not only by psychiatric diagnosis but also by phase of illness with the greatest contrast seen between HC and bipolar depressed individuals.

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## Imaging (Structural)

**M.M. BERL, K. BLACKSTONE, S. LOHIA, J. MAYO, J. VANMETER & W.D. GAILLARD. Differences in Organization of White Matter Associated with Working Memory Performance in Typical Children.**

**Objective:** Diffusion tensor imaging (DTI) was used to investigate the association between white matter organization and working memory (WM) in typical children.

**Participants and Methods:** 18 controls ages 7-15 (Mean age 10.3; 11F) underwent DTI scans and neuropsychological assessment. IQ (WASI) and WM skills (6 measures) were assessed. Using a 3T system, 2 DTI images were acquired using an EPI sequence in 35 directions, following the ICBM protocol. The fractional anisotropy (FA) was calculated using internally developed software resulting in an average FA map normalized in Talairach space for each subject. Regression analyses were performed in SPM5 to identify areas where FA was associated with age and WM skills.

**Results:** Cognitive abilities were average (Mean FSIQ=108, range 88-128; Mean z-scores= 0.07, range -2.33-2.67). Age was not significantly correlated with standardized scores of WM. FA values within several regions were correlated with age and most WM measures ( $p <.001$ , uncorrected,  $\text{min} > 20$  voxels). Identified regions are known to be important for WM including cerebellum, middle frontal gyrus (MFG), parietal, sub-cortical (i.e., putamen, caudate,), and limbic areas. Higher FA bilaterally in the cerebellum was the most robust association with better WM performance. The only instances when performance was negatively correlated with FA was for 2 verbal working memory tasks; lower WM scores were associated with greater FA in right MFG. Two measures (digits backward, verbal fluency) were not associated with any differences in FA.

**Conclusions:** Age and WM performance independently correlated with differences in white matter organization in typically developing children, demonstrating the utility of DTI for probing brain-behavior hypotheses. Greater white matter organization, particularly in the cerebellum, was associated with better WM performance; however, lower WM scores were associated with greater FA in right MFG, suggesting that lateralization of white matter organization in some regions may benefit performance.

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**R. BRAHMACHARI, A. SWAN, M.Y. KIBBY, M.J. COHEN & G.W. HYND. Hippocampus Volumes and Memory: A Structural MRI Study.**

**Objective:** The hippocampus may play a role in organizing memory for spatial position of objects (Kolb & Whishaw, 2003). The hippocampus is involved in declarative memory as well (Tulving & Markowitsch, 1998). Nonetheless, there has been limited work looking at the hippocampus in children with dyslexia or ADHD. In this study, a morphometric analysis was conducted to examine the relationship between hippocampus volume and memory functioning in children with dyslexia and/or ADHD.

**Participants and Methods:** Participants were obtained from a larger study on dyslexia (NIH R01 HD26890). Data analysis and write-up were partially supported by another grant (NIH R03 HD048752). Participants, ages 8 to 12 years, completed a neuropsychological battery and a MRI scan: 15 had dyslexia, 15 had AD/HD, and 14 were controls. The hippocampus was traced on every slice in the sagittal plane using modified guidelines from Johns Hopkins University's Psychiatric Neuroimaging protocol as well as an anatomy text (D'Amasio, 2005).

**Results:** Left hippocampus volume was positively correlated with delayed recall for a selective reminding task (Children's Memory Scale [CMS] Word Lists) but not for delayed recall of paired associates (CMS Word Pairs) or passages (CMS Stories). Right hippocampus volume was positively correlated with delayed recall for spatial position (CMS Dot Locations). This relationship was not seen on the CMS Faces Delayed subtest; however, it does not have a substantial spatial component.

**Conclusions:** Although we did not find differences in hippocampal volume between groups, the left hippocampus was related to memory for unrelated words (CMS Word Lists) and the right hippocampus was related to memory for spatial position.

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**R. BRAHMACHARI, A.E. MOLNAR, M.Y. KIBBY & G.W. HYND. Cingulate Gyrus Volumes and Internalizing Disorders: A Structural MRI Study.**

**Objective:** Research suggests that children with learning disabilities and/or ADHD often have comorbid emotional disorders. Reduced right anterior cingulate volume has been associated with emotional problems. Thus, the relationship between cingulate volume and emotional/behavioral problems were examined in children with dyslexia and/or ADHD.

**Participants and Methods:** Testing and MRI data were obtained from a study on dyslexia (NIH R01 HD26890). Data analysis and write-up were partially supported by another grant (NIH R03 HD048752). Participants, ages 8 to 12 years, completed a neuropsychological battery and a MRI scan: 20 had dyslexia, 18 had ADHD, and 16 were controls. The anterior, middle, and posterior cingulate was traced on every slice in the sagittal plane using modified guidelines from Crespo-Facorro et al. (1999).

**Results:** Groups did not differ in anterior, middle or posterior cingulate volume. However, left anterior cingulate volume was inversely related to RCMAAS Physiological Anxiety and Social Concerns and Teacher-rated BASC Depression scores in the total sample. Left posterior volume was positively correlated with Atypicality and Aggression scores on the Parent-rated BASC. Right posterior cingulate volume was inversely related to Teacher-rated Depression.

**Conclusions:** Smaller left anterior and right posterior cingulate volumes were associated with internalizing problems, whereas larger left

posterior cingulate volume was associated with externalizing problems. Thus, some of our results were not in the expected direction since several studies have found a relationship between the right anterior cingulate and emotional processing. Further research on the left cingulate in emotional/behavioral functioning is warranted.

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**L. FREUND. The NIH MRI Student of normal brain development.**

**Objective:** This is one of the most extensive MRI studies of brain and behavioral development from birth through young adulthood. A longitudinal, cross-sectional design was used to characterize normal, healthy brain and behavioral development.

**Participants and Methods:** The resulting sample is representative of the United States 2000 Census in terms of race/ethnicity, family income, and is comprised of equal numbers of males and females. Comprehensive behavioral, neurological, neuropsychological and MRI assessments were conducted at regular intervals for all participants. MRI assessments included structural as well as Diffusion Tensor Imaging (DTI) and Spectroscopy (on a subsample of children) analyses. All data are freely available to the clinical and research community through web-based download.

**Results:** All data are freely available to the clinical and research community through web-based download. Several published papers have described the sample, methods, and major developmental brain outcomes.

**Conclusions:** This presentation will include an overview of the database contents, how to access the data, and describe the imaging tools that are freely available to researchers. A brief review of selected age-related brain-behavior results will be given.

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**C.P. JOHNSON, J. JURANEK, L. KRAMER, M. PRASAD, P. SWANK, A. BLAKELY, A. KAPLAN & L. EWING-COBBS. Predicting Attentional Deficits Following Traumatic Brain Injury Through Dissociated White Matter Pathways of Attention: A Diffusion Tensor Tractography Study.**

**Objective:** Attention deficits are common following traumatic brain injury (TBI). However, the deficits vary across individuals and may be related to specific regions of damage within the frontal white matter pathways. Probabilistic diffusion tensor tractography of the superior longitudinal fasciculi (SLF) and uncinate fasciculi (UF) was utilized to predict outcome on two measures of attention.

**Participants and Methods:** Diffusion weighted images and a T1 image were collected at 2 months post-injury in children with moderate to severe TBI (n=14) or orthopedic injury (n=15). Fractional anisotropy (FA) was derived from the whole brain, SLF, and UF. The attention subscale from the Child Behavior Checklist (CBCL) indexed behavioral attention. Variability and hit reaction time block change variables from the Conners' Continuous Performance Task (CPT) at 12 months post-injury measured sustained attention.

**Results:** GLMs examined the relation between group and laterality of SLF and UF on CPT and behavioral attention scores. Neither group effects nor group by metric interactions were identified for any of the attention variables. Whole brain white matter FA predicted outcome on the attention subscale of the CBCL (p=0.03), but was unrelated to CPT performance. However, bilateral UF FA, but not SLF FA, predicted CPT variability (p=0.006) and hit reaction time block change (p=0.005). Conversely, bilateral SLF FA but not UF FA predicted attention on the CBCL (p=0.004), but no summary CPT variables.

**Conclusions:** Specific tracking of frontal white matter pathways may offer increased specificity and sensitivity over whole brain imaging techniques in isolating specific neural substrates related to different dimensions of attention. NIH R01 NS43608

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**J.T. KLUTH, K.M. HASAN, P.T. CIRINO, H.J. HANNAY & J.M. FLETCHER. Diffusion Tensor Tractography of Hypoplastic Corpora Callosa in Spina Bifida.**

**Objective:** Diffusion tensor tractography (DTT) provides macro- and microstructural quantitative assessments of the integrity of white matter. Patients with spina bifida myelomeningocele (SBM) exhibit a wide range of corpus callosum (CC) pathology, from severe agenesis to hypoplasia or “normal-appearing.” Using DTT, we investigate the differences between the normally developed CC and the hypoplastic CCs in SBM.

**Participants and Methods:** Total and segmented CC volumes and DTT metrics were obtained on 33 participants with SBM and CCs that showed no evidence of agenesis and 30 age-matched normal controls (NC). The CC was divided into 8 subvolumes: CC1 (prefrontal), CC2 (anterior frontal), CC3 (superior frontal), CC4 (posterior frontal), CC5 (anterior parietal), CC6 (posterior parietal), CC7 (temporal), and CC8 (occipital).

**Results:** Participants with SBM had reduced total CC volume ( $p < 0.0001$ ) compared to NC. Individual subvolumes revealed that only the posterior CC was significantly reduced ( $p < 0.04$ ): CC5, CC6, CC7, and CC8. Patients showed significantly reduced fractional anisotropy (FA) in mostly posterior regions of the CC ( $p < 0.002$ ): CC3, CC4, CC5, CC7, and CC8 and mean diffusivity was elevated in the posterior CC ( $p < 0.01$ ): CC4, CC5, CC6, CC7, and CC8.

**Conclusions:** Despite being “normal-appearing” on MRI, DTT revealed reductions in volume, reduced FA, and elevated mean diffusivity in posterior segments of the CC. Lower FA and increased mean diffusivity indicate reduced axonal integrity, demyelination, and neuronal loss. Hypoplastic CCs are therefore not normal.

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**M. LANCASTER, M. SEIDENBERG, S. DURGERIAN, A. BUTTS, N. HANTKE, L. GUIDOTTI, K. NIELSON, J. WOODARD, P. ANTUONO & S. RAO. Influence of Risk Factors for Alzheimer's Disease on White Matter Integrity: A Diffusion Tensor Imaging Study.**

**Objective:** White matter changes are evident across the continuum from normal cognitive aging to Alzheimer's disease (AD), and various studies indicate that white matter integrity is linked to cognition. White matter abnormalities are reported in both mild cognitive impairment (MCI) and AD patients compared to healthy elderly controls. Less studied, however, is the relationship between cognitive aging, white matter alterations, and known risk variables for AD in asymptomatic individuals.

**Participants and Methods:** Sixty-six participants were divided into three groups ( $n = 22$  each): amnesic MCI patients; cognitively intact elders at-risk for AD (APOE  $\epsilon 4$  allele and a positive family history); and participants without AD risk factors (negative for APOE  $\epsilon 4$  allele and family history). Participants received neuropsychological testing and a diffusion tensor imaging (DTI) sequence. Tract-Based Spatial Statistics (TBSS) was used to create a mean fractional anisotropy (FA) skeleton, and each subject's data was projected onto the skeleton. Data was randomized and thresholded. Regression analyses were conducted to determine the relationship of age and risk group on FA.

**Results:** Age and group membership were significant predictors of FA in four clusters corresponding to the left middle frontal gyrus, left anterior cingulate, right posterior hippocampus, and right precuneus. Increased age and MCI status were related to FA decline. In addition, verbal memory performance was positively correlated with FA values in the right precuneus and left middle frontal gyrus white matter.

**Conclusions:** White matter disruption is associated with AD risk factors and verbal memory performance. Longitudinal studies are necessary to confirm these findings.

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**A.K. LEE, K. LEAHY, M. KARPEL, M. JERRAM, C. FULWILER & D.A. GANSLER. Neural Correlates of Impulsivity Factors: A Voxel-Based Morphometry Study.**

**Objective:** Impulsivity is a multifactor trait but studies have not differentiated their neural correlates. Bechara's model of impulsivity, in which a 'reflective' prefrontal system exerts control over an 'impulsive' amygdala system, makes relevant predictions. Impulsivity factors may also be associated with dysfunction at different stages in Barbas and Zikopoulos' model of sequential emotion processing. Hypothesized neural correlates of motor, attentional and non-planning impulsivity were examined using voxel-based morphometry.

**Participants and Methods:** Thirty-five male psychiatric patients and 18 healthy men (HCs) completed the Barratt Impulsiveness Scale-11. Brain MRIs were obtained from 1.5T scanners and processed with SPM5. Voxelwise regressions of impulsivity components were performed for each group.

**Results:** Among the psychiatric group, a positive correlation was found between motor impulsiveness and right cerebellar culmen grey matter volume, while negative correlations were found between attentional and non-planning impulsiveness and left posterior orbitofrontal cortex (OFC), as well as non-planning impulsiveness and right medial frontal pole. Results differed slightly in HCs, in whom attentional impulsiveness correlated positively with right anterior cingulate, whereas non-planning impulsiveness correlated positively with bilateral anterior OFC. No significant correlation was found with motor impulsiveness.

**Conclusions:** Top-down OFC influence on impulse control was supported; however, bottom-up influence was identified in the cerebellum as opposed to the amygdala. Motor impulsiveness appeared to be characterized by bottom-up processes, while attentional and non-planning impulsiveness were associated with the top-down system. In terms of sequential emotion processing, impulsivity correlates were located in the anterior OFC for HCs, but more posteriorly for patients, whose dysfunction may occur earlier in the processing sequence.

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**M. MURPHY, N. SCHUFF, W.J. MARKS, W. LANGSTON, G. KANG, G.A. GRAHAM & W. ZHAN. Relationship of Neuropsychological Performance and Brain Region in Patients Diagnosed with Parkinson's Disease.**

**Objective:** A subset of data obtained for a study on Parkinsonism as a Model to Detect Neurodegeneration using High Field MRI was analyzed in order to look at the relationship between different brain regions and neuropsychological test performance. Specifically, susceptibility weighted imaging (SWI) was used to study the relationship between changes in the brain and performance on selected neuropsychological measures.

**Participants and Methods:** Data was collected at the San Francisco VA Medical Center (SFVAMC), the Neurology clinics at UCSF, and affiliated centers. Control participants were recruited from family and friends of patients and the general public. Participants with Parkinson's disease (PD) were recruited from the neurology clinics at SFVAMC, UCSF, the Parkinson's Institute, and through public advertisement. Sixty-two individuals participated in this study (PD = 39, control = 23).

**Results:** There were no significant differences between the control and PD groups on neuropsychological measures. However, there were significant differences between the PD and control groups on certain brain regions (e.g., left and right caudate, left substantia nigra). In participants diagnosed with PD, the left globus pallidus predicted perform-

ance on Trails B; right caudate and left subthalamic nucleus predicted performance on CVLT-II Immediate Recall. In control participants, the right substantia nigra and left globus pallidus predicted performance on Trails B; left caudate and left substantia nigra predicted performance on CVLT-II Immediate Recall.

**Conclusions:** The findings suggest a relationship between brain regions and performance on certain measures of cognitive functioning. This relationship differs somewhat for PD as compared to the control group.

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**L. QUITANIA, S. FARIAS, D. MUNGAS, B. REED & C. DECARLI. Structural MRI variables relate to neuropsychological domains and everyday cognitive domains in similar ways.**

**Objective:** The goal of this study was to examine some potential neuroanatomical substrates of cognition and everyday function in older adults. Specifically, we evaluated whether structural MRI volumetric measures of total brain matter (BM), white matter hyperintensities (WMH), and hippocampus (HC) relate similarly to standardized measures of neuropsychological functions and informant-rated measures of everyday cognition.

**Participants and Methods:** Participants included 228 older adults with and without cognitive impairment. The Spanish and English Neuropsychological Assessment Scales (SENAS) were used to measure Language, Memory, Executive Functioning, and Visuospatial Processing. BM and HC were corrected for total intracranial volume. Everyday cognition was measured using the ECog across six domains: Everyday Memory, Everyday Language, Everyday Visuospatial Functioning, Everyday Organization, Everyday Planning, and Everyday Divided Attention. Multiple regressions were used to examine the independent associations between the brain variables and the SENAS variables, and between the brain variables and the ECog.

**Results:** BM related to SENAS memory ( $p < .01$ ), executive functioning ( $p < .001$ ), and visuospatial functioning ( $p < .001$ ). HC was independently related only to memory ( $p < .01$ ). WMH was unrelated to cognition. BM also related to all ECog domains ( $p < .05$ ). HC was also marginally related to Everyday Memory ( $p = .05$ ). WMH was not related to any ECog domain.

**Conclusions:** Findings suggest that total brain volume is significantly associated with numerous neuropsychological domains, as well as multiple domains of everyday cognition. Additionally, hippocampal volume contributed unique additional variance to neuropsychological measures of memory and a similar relationship also seems to exist with a measure of everyday memory.

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**G. SEIDEL, S.D. TOWLER, S. MITCHELL, J.J. TANNER, C. PRICE, D.J. LIBON & T. GIOVANNETTI. Neuroimaging Predictors of Everyday Action Errors in Dementia.**

**Objective:** Dementia patients exhibit differential everyday impairment characterized by omission (i.e. failure to perform a step) vs. commission (i.e., inaccurate execution of a step) errors. The former pattern has been associated with declarative (i.e., episodic, semantic) memory deficits and the latter with deficits in executive control. The neuroanatomical underpinnings of this model have not been evaluated.

**Participants and Methods:** 28 participants with AD or vascular dementia were administered an MRI of the brain and the Naturalistic Action Test (NAT), which requires completion of 3 tasks (e.g., make toast). NAT omissions and commissions were coded from videotape. Coders, blind to NAT data, quantified hippocampal and cortical (gray + white matter) volumes, structures associated with declarative memory. The

volume of subcortical white matter lesions also was obtained, as this measure relates to executive control in dementia. Hierarchical regressions, with MMSE entered first and neuroimaging variables (adjusted for whole brain volume) second, were performed to identify predictors of NAT errors.

**Results:** The model for NAT total errors accounted for 36% of the variance ( $p < .01$ ) with MMSE ( $\beta = -.54$ ,  $t = 3.30$ ,  $p < .01$ ) and hippocampal volume ( $\beta = -.35$ ,  $t = 2.15$ ,  $p < .05$ ) as the only significant predictors. The model for omissions accounted for 38% of the variance ( $p < .01$ ) and had MMSE ( $\beta = -.45$ ,  $t = 2.79$ ,  $p < .05$ ) and cortical white and gray matter volume ( $\beta = -.43$ ,  $t = 2.68$ ,  $p < .05$ ) as the only significant predictors. Commissions were related to only MMSE (13% of variance explained;  $\beta = -.40$ ,  $t = 2.10$ ,  $p < .05$ ).

**Conclusions:** After adjusting for MMSE, hippocampal volume and the volume of the cerebral cortex significantly predicted everyday action errors. Consistent with our preliminary model, cortical volume significantly predicted omissions but not commissions. These data illustrate the potential (and limitations) for imaging variables to predict real world functioning.

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**E. STAMBROOK, P. WANG, S. HEVERLY-FITT, A.C. LYON, C. PRICE, O. SELNES, S. RATCLIFFE, T. GIOVANNETTI & T.F. FLOYD. White Matter Lesion Volume and Cognitive Performance among Older Adults with Vascular Risk Factors.**

**Objective:** White matter lesions (WMLs) are commonly seen on brain magnetic resonance imaging (MRI) in the elderly. WMLs have been associated with vascular disease, age, and cognitive functioning in community and clinical (dementia) samples. This study examined the association between WML and cognitive and motor functioning in older adults with vascular risk factors.

**Participants and Methods:** Fifty-eight older adults (M age = 75; M education = 15 years) with a diagnosis of aortic stenosis and/or coronary artery disease were administered a comprehensive neuropsychological protocol and MRI scan of the brain. The MRI fluid attenuated inversion recovery (FLAIR) images were used to calculate WML volume. Patients with a history of recent stroke, TIA or addiction, and/or any history of mental illness were not included in the sample.

**Results:** WML volume significantly correlated ( $R^2 > .30$ ,  $p < .05$ ) with age, education, and tests of motor speed/dexterity (Grooved Peg Board), visuomotor processing speed (Digit Symbol, Trails-A), executive control (Trails-B), and episodic memory (Rey Osterrieth Long Delay). After adjusting for age and education, WML volume significantly predicted motor speed/dexterity (Grooved Pegboard,  $\beta = .46$ ,  $t = 3.17$ ,  $p < .01$ ) and visuomotor processing speed (Digit Symbol,  $\beta = -.27$ ,  $t = 2.05$ ,  $p = .05$ ).

**Conclusions:** WML volume was significantly correlated with performance on cognitive tests which required rapid and/or motor responses. After adjusting for age and education, WML remained significantly associated with performance on tests of motor and psychomotor speed. Thus, the relationship between WML and cognition, and functioning more generally, may be mediated by demographic factors as well as motor speed and dexterity.

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**T.M. SUSMARAS, A.K. LEE, M.W. JERRAM, R. HARDAWAY, R.A. BHADELIA, C. FULWILER & D.A. GANSLER. Using The Lifetime History of Aggression – Revised Questionnaire and Voxel Based Morphometry to Investigate the Neural Correlates of Aggression.**

**Objective:** Several brain regions have been implicated as neural correlates to aggression. Evidence suggests that one of these regions is the amygdala. This structure plays a role in emotional perception responses.

Given evidence indicating that the amygdala processes negative stimuli in relation to past emotional conditioning, it is possible that aggressive action may be more likely to result from decreased amygdalar function. It was hypothesized that those high in aggression would have lower volume in the amygdala compared to those low in aggression.

**Participants and Methods:** This study included twenty-five males high in aggression and thirty males low in aggression. High was defined as a score of 13 and above on the physical and verbal components of Lifetime History of Aggression – Revised. This sample was made up of a heterogeneous psychiatric population and control group who were assigned to aggression group regardless of diagnosis. To investigate the hypothesis, VBM was performed using SPM5. An anatomic mask of the amygdala was created and analysis was constrained to this region.

**Results:** A focus of significant amygdalar group difference ( $p = .04$ ) (MNI coordinates: -15, 12, -20; 81 voxels) was found. Those high in aggression had lower volume in this cluster than those low in aggression.

**Conclusions:** This study demonstrates that the amygdala plays an essential role in aggressive action, most likely in that amygdalar volume has implications in processing of emotional cues and resulting responses. Importantly, this result was found in a mixed psychiatric and control sample and indicates that this effect is not a function of psychopathology.

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#### A.A. SWAN, R. BRAHMACHARI, M.Y. KIBBY, M.J. COHEN & G.W. HYND. Hippocampus Volume is Related to Spatial Processing and Nonverbal Reasoning in Children.

**Objective:** The link between the hippocampus and spatial ability has been extensively explored with rodents, commonly utilizing the Morris Water Maze (Liang, Hon, Tyan, & Liao, 1992; Morris, 1984). In humans, the relationship between the hippocampus and spatial ability, dyslexia, and ADHD are not as well understood. This study sought to evaluate the relationship between the hippocampus and various indices of spatial ability in children.

**Participants and Methods:** Data were obtained during a study on dyslexia (NIH R01 HD26890). Data analysis and reports were supported by a separate grant (NIH R03 HD048752). Forty children, 8 to 12 years of age, completed a neuropsychological battery and a MRI scan: 15 had dyslexia, 15 had ADHD, and 14 were controls. Using the sagittal plane, the hippocampus was traced on every slice employing guidelines adapted from Johns Hopkins University's Psychiatric Neuroimaging protocol in addition to a neuroanatomy text (D'Amasio, 2005). Inter-rater reliability was  $> 0.90$ . Children were well matched for age, Full-Scale IQ, and gender.

**Results:** Groups did not differ in hippocampal volume ( $ps > .90$ ). The volume of the right hippocampus was positively correlated with two measures of visual-spatial ability (TONI-3 and NEPSY Arrows) but not with WJ-R Visual Closure. Hippocampus volume was not significantly related to a measure of constructional praxis (WISC Block Design), but its relationship with the DTVMI approached statistical significance ( $p=0.075$ ).

**Conclusions:** The volume of the right hippocampus is related to tasks requiring mental spatial rotation/manipulation (TONI-3) and tracking (NEPSY Arrows). It is not related to presence of dyslexia or ADHD.

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#### A. TREBLE, J. JURANEK & J.M. FLETCHER. Regions of Increased and Decreased Cortical Complexity in Spina Bifida: An aMRI Study.

**Objective:** Spina bifida myelomeningocele (SBM) is a congenital disorder characterized by abnormal neurodevelopment of the brain and spinal cord. Neocortical regions are reorganized in SBM as demonstrated by regionally-specific patterns of reduced gray matter volume, reduced surface area, and increased cortical thickness. We examined patterns of cortical complexity in SBM relative to age-matched controls.

**Participants and Methods:** To obtain whole-brain MRI coverage, a three-dimensional T1-weighted sequence (SPGR) was performed in the coronal plane. A fully-automated image processing stream was completed and followed by a fully-automated 3D local gyrification index (LGI) analysis using freesurfer software. For group comparisons, the QDEC utility was utilized to correct for multiple comparisons of vertex-wise analyses of LGI as well as covariates including age and gender.

**Results:** Relative to controls, significantly higher LGI in SBM localized to bilateral parietal and temporal cortical regions and bilateral regions of the dorsolateral prefrontal cortex. Lower LGI in SB localized to bilateral inferior prefrontal cortex as well as bilateral medial regions of the temporal, parietal, and occipital cortices. Interestingly, higher LGI values in SB tended to be specifically observed in regions of reduced cortical thickness and lower LGI values in regions of increased cortical thickness.

**Conclusions:** The neocortex in SBM reveals distinct patterns of regions with increased and decreased cortical complexity as compared to typically-developing age-matched controls. The degree of regional cortical complexity may be inversely related to its degree of cortical thickness.

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#### V.J. WILLIAMS, E.C. LERITZ, R.E. MCGLINCHAY, W.P. MILBERG, J.L. RUDOLPH, L. LIPSITZ & D.H. SALAT. Variation in Serum Cholesterol is Associated with Regional Changes in White Matter Tissue Integrity in Healthy Older Adults.

**Objective:** This study sought to examine the relationship between serum cholesterol levels and white matter (WM) structural integrity within a normal sample of healthy older adults.

**Participants and Methods:** One hundred twenty-eight participants without a history of cerebrovascular disease (CVD) or dementia were recruited to undergo structural imaging of the brain. Diffusion tensor images (DTI) were collected for each participant, with WM structural integrity indexed by changes in fractional anisotropy (FA), as well as by the radial and axial components of mean diffusivity. Fasting blood was drawn from each participant to determine low density lipoprotein (LDL), high density lipoprotein, total cholesterol, and triglyceride levels.

**Results:** Whole-brain voxelwise analysis, controlling for age and gender, revealed LDL cholesterol as the most robust predictor of WM structural integrity. Higher LDL was most strongly associated with decreased FA bilaterally in the internal capsule, corona radiata and temporal WM regions, as well as in white matter subjacent to the left parahippocampal cortex. These areas also showed a significant positive correlation between radial diffusivity and LDL, with little changes in axial diffusivity.

**Conclusions:** These findings suggest that normal variation in cholesterol levels is associated with altered WM structural integrity, even for those not at risk for CVD. Given the health concerns and prevalence of conditions with high cholesterol in our society, along with mounting evidence suggesting a vascular role in dementia and Alzheimer's disease etiology, our results suggest that careful monitoring and treatment of cholesterol levels in the subclinical aging population could prove beneficial to long term neuronal health and WM preservation. Further investigation into the relationship between cholesterol and brain tissue microstructure could have important clinical implications for early detection of vascular-related cognitive disorders.

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#### H. WISHART, E. KEE, J. FORD, J. MACDONALD, S. ANEY & Z. LOVERDE. A novel approach for semi-automated segmentation of MS lesions on FLAIR imaging: Reliability and clinical correlates.

**Objective:** We present a new approach for semi-automated segmentation and quantification of MS lesions, tailored for fluid-attenuated in-

version recovery (FLAIR) images and designed for rapid, reliable segmentation with minimal manual editing. "FLAIRSEG" performs a seeded intensity-based classification of each voxel followed by optional median filtering to eliminate isolated intensity variations. Here, we report the reliability and clinical correlates of lesion volumes obtained using FLAIRSEG.

**Participants and Methods:** Sixty-seven adults with multiple sclerosis underwent 1.5T FLAIR imaging and cognitive testing as part of a larger study. Fifteen patients underwent repeat evaluation 13.8 (4.9) months later. All scans were segmented by a single rater blind to clinical data. A second rater independently segmented a subset of eight scans. Total lesion volumes, obtained using our established but more labor-intensive segmentation method, were available for 54 participants.

**Results:** FLAIRSEG lesion volumes showed high intra- and inter-rater reliability (ICC = 0.99 and 0.94 respectively,  $p < .001$ ) and corresponded well with those obtained using our established method despite systematic differences in our approach to classifying voxels in dirty-appearing and periventricular white matter (ICC = 0.94,  $p < .001$ ). FLAIRSEG lesion volumes were modestly related to cognitive impairment on six of the seven cognitive outcomes ( $r = 0.23$  to  $0.35$ ,  $p < .05$  to  $< .005$ ), but did not predict disability level, similar to the pattern of findings observed with our established method. Longitudinal change in FLAIRSEG lesion volume predicted decline in processing speed ( $r = -0.58$ ,  $p < .05$ ).

**Conclusions:** FLAIRSEG provides reliable semi-automated MS lesion segmentation using a single imaging modality. Future refinements will include development and testing with higher field strength images.

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**R. YALLAMPALLI, T.C. WU, S. SHAH, E.D. BIGLER, Z. CHU, A.C. VASQUEZ, X. LI, H.S. LEVIN & E.A. WILDE. White Matter Changes in Frontal and Temporal Regions Following Traumatic Brain Injury: Correlation with Visual and Verbal Memory.**

**Objective:** Memory complaints are common following traumatic brain injury (TBI). In this study, we used diffusion tensor imaging (DTI) to examine white matter changes in the inferior longitudinal fasciculus (ILF) and frontal lobar white matter following TBI and the relation of those changes to performance on visual and verbal memory tasks.

**Participants and Methods:** Thirteen young adults (11M, 2F) aged 17-32 years (mean age = 22.2 years) with severe TBI (GCS score < 8) and 14 (12M, 2F) healthy controls of similar demographic variables underwent DTI on Philips 3T scanners 3-6 months post injury. Quantitative tractography analysis was performed for frontal regions and ILF using Philips PRIDE v4.1 fiber tracking software. All subjects were administered the Rey-Osterrieth Complex Figure Test (ROCF) and Verbal Selective Reminding Test (VSRT).

**Results:** T-tests revealed significant group differences on mean FA for right ( $p < .001$ ) and left ( $p < .001$ ) frontal regions, and right ( $p = 0.002$ ) and left ( $p = 0.001$ ) ILF. On the ROCF, right ILF correlated with copy ( $r = 0.509$ ), immediate recall ( $r = 0.715$ ), and delayed recall ( $r = 0.591$ ) scores, and left ILF correlated with copy ( $r = 0.487$ ) and immediate recall ( $r = 0.0496$ ) scores, such that higher FA was related to better performance. Also, right frontal FA correlated with delayed recall ( $r = 0.556$ ) and immediate recall score ( $r = 0.644$ ) scores. For the VSRT, left ILF correlated with long-term retrieval score ( $r = 0.616$ ), continuous long-term retrieval score ( $r = 0.635$ ) and delayed recall ( $r = 0.615$ ).

**Conclusions:** ILF and frontal FA correlated with performance on both verbal and visual memory tasks. DTI is a promising tool in further evaluating the effects of TBI.

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## TBI (Child)

**A. BLAKELY, C.P. JOHNSON, J. JURANEK, L. EWING-COBBS, A. KAPLAN & M. PRASAD. Mean Diffusivity of the Orbitofrontal Cortex is Associated with Inhibitory Control in Children with TBI.**

**Objective:** Few studies have investigated the neurobiological bases for cognitive and behavioral changes following pediatric traumatic brain injury (TBI). We examined whether mean diffusivity (MD) of the prefrontal cortex predicted inhibitory control in school-aged children with TBI one-year post injury.

**Participants and Methods:** Participants included 15 children with TBI and 15 children with orthopedic injuries between ages six and sixteen. Parent ratings of inhibitory control were obtained from the Behavior Rating Inventory of Executive Function (BRIEF), completed one-year post injury. All participants underwent high resolution T1-weighted MRI scans for automated segmentation and diffusion tensor imaging (DTI) to examine the microstructural integrity of white and gray matter 2 months post injury. Segmented masks of the lateral and medial regions of the orbitofrontal cortex were converted to diffusion space to calculate the MD of each region.

**Results:** For the TBI group, inhibitory control scores were significantly correlated with MD values of the lateral orbitofrontal cortical regions in both left ( $r = .492$ ,  $p = .02$ ) and right ( $r = .548$ ,  $p = 0.009$ ) hemispheres and with medial orbitofrontal cortical region in the left ( $r = .493$ ,  $p = .02$ ) and right ( $r = .471$ ,  $p = .03$ ) hemispheres. For the orthopedic group, inhibitory control was positively correlated with MD values only from the left hemisphere medial ( $r = .523$ ,  $p = .038$ ) orbitofrontal region.

**Conclusions:** In children with TBI, greater MD in bilateral medial and lateral orbitofrontal cortex was predictive of lower inhibitory control one year post-injury. For children with orthopedic injuries, relations of MD and inhibition were less robust. Microstructural measures of gray matter integrity may predict behavioral regulation, particularly for children with brain injury.

NIH R01 NS43608

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**S. BROWN, H. NEWITT, H. HOILE, S. EREN, F. MUSCARA, C. CATROPPA & V. ANDERSON. QUALITATIVE RESEARCH: ITS ROLE IN INVESTIGATING ADULT PSYCHOSOCIAL OUTCOMES POST PAEDIATRIC TBI.**

**Objective:** Clearly defined long-term outcome from paediatric traumatic brain injury (TBI) is difficult to predict, affecting immediate and ongoing treatment and management. This study, quantitatively and qualitatively, examined the retrospective consideration of psychosocial outcome from perspective of the parent and adult child.

**Participants and Methods:** Inclusion was via inspection of information regarding medical status at admission to the Royal Children's Hospital, Melbourne, Victoria. Participants were 84 young adult survivors of child TBI (54 males), aged 18-31 years at testing (M = 22.7, SD = 2.9), with injury on average 14 years prior to evaluation. They were grouped according to injury severity: mild (n = 32), moderate (n = 24) and severe (n = 28). The Sydney Psychosocial Reintegration Scale (SPRS) was used to measure outcome, as was an open ended question regarding perceptions of outcome from both the adult child and parent's viewpoint.

**Results:** Preliminary analysis of the quantitative data suggests that parents and adult survivors perceive long-term outcome similarly regardless of severity of injury or time since injury. However qualitative data suggests underlying differences may exist.

**Conclusions:** These findings indicate that parents of adults injured as children commonly remain aware of the ongoing effects of TBI, as does the injured person. However further investigation utilising less structured approaches may reveal underlying differences.

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**L. EWING-COBBS, K.M. HASAN, A. KAMALI, J.P. WAUGH, M. DENNIS, M.R. PRASAD, M.A. BARNES & P.R. SWANK. Theory of Mind after Pediatric TBI: Relation with Microstructure of the Uncinate Fasciculus.**

**Objective:** Childhood traumatic brain injury (TBI) disrupts the use and understanding of social language, including cognitive perspective taking (Theory of Mind, TOM) and affective communication (irony, empathy) which have been related to temporal and frontal brain regions. We examined literal truth, irony, and empathy after pediatric TBI in relation to microstructural integrity of the uncinate fasciculus (UF), which connects anterior temporal and orbitofrontal regions.

**Participants and Methods:** Fractional anisotropy, which indexes fiber organization and integrity, was derived from diffusion tensor tractography obtained 2.5 months after moderate to severe pediatric TBI (n=43) or orthopedic injuries (n=35). The Irony and Empathy test assesses understanding of first and second-order intentionality in social scenarios depicting literal truth (cognitive TOM), ironic criticism, and empathic praise (affective TOM). GLMs examined group and fractional anisotropy laterality in relation to TOM scores.

**Results:** Fractional anisotropy of the left or bilateral UF was related to TOM scores. Group interacted with laterality of UF anisotropy for second-order literal truth and empathic praise. For the TBI group, lower second-order cognitive TOM scores were associated with lower anisotropy of the left UF. For second-order empathic praise, group interacted with bilateral UF anisotropy values. Ironic criticism was related to left fractional anisotropy for both groups.

**Conclusions:** Following TBI, reduced UF integrity is related to aspects of social language comprehension, particularly understanding what one person wants another to believe in situations involving both literal truth and empathic praise. This may reflect disruption of the frontal-temporal brain systems involved in cognitive and affective TOM. NIH R01 NS43608.

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**G.A. GIOIA, C.G. VAUGHAN, J. REESMAN, C. MCGILL, E. MCGUIRE, L. GATHERCOLE, H. PADIA, K. NICHOLS, P. ALLEN & C. WELLS. Characterizing Post-Concussion Exertional Effects in the Child and Adolescent.**

**Objective:** This study describes the nature of symptom exacerbation following physical and cognitive exertional activity (i.e., exertional effects, EE) in children and adolescents with concussion, presumably associated with neurometabolic dysfunction post-injury.

**Participants and Methods:** 142 children (56% boys; Mean age = 13.3, range 6-18) with concussion underwent serial symptom and neuropsychological assessments. Causes of injury varied (sports-related 64%) with 26.1% LOC, 23.5% retrograde amnesia, 38.9% anterograde amnesia, and median days to first visit=14.0. Detailed information regarding EE was collected: (1) response to specific physical and cognitive activity over the prior week(s) (presence, absence, no opportunity), and (2) in direct response to clinic testing (presence/absence, quantitative rating) in a subsample (n= 94).

**Results:** Overall group frequencies reveal significantly higher reported cognitive (69.3%) relative to physical EE (29.3%), with similar in-clinic cognitive EE (68.1%). Significant sex differences in EE were found (e.g., Visit 1 prior week(s) cognitive EE, girls = 88.5% vs boys = 54.5%; in-clinic cognitive EE girls = 80.5% vs boys 58.5%). Opportunities for physical and cognitive EE differed significantly (physical 63.6% vs. cognitive 97.1%). Reports of prior EE and in-clinic EE are significantly related. Serial assessment of exertion reveals significant changes (reductions) over time. Relationships of EE to injury characteristics and age were also examined.

**Conclusions:** Differing frequency of symptom exacerbation from physical and cognitive activity (EE) are reported in pediatric concussion. Significant differences between types of EE, opportunities for EE, relative presence in girls and boys, and frequency over time provide important treatment implications. Cognitive EE is particularly prominent.

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**G.A. GIOIA, R.M. ROTH, C.G. VAUGHAN, L. MONETA & P.K. ISQUITH. Serial Assessment of Children and Adolescents with Mild TBI on the Tasks of Executive Control.**

**Objective:** Mild TBI (mTBI) in children and adolescents has been associated with deficits in working memory and processing speed. We examined children's performance on a novel measure of working memory and inhibitory control immediately following mTBI and again on follow-up.

**Participants and Methods:** 101 students aged 5 to 18 years (M = 12.80, SD = 2.96, 89 males) with mTBI and 101 matched controls completed the Tasks of Executive Control (TEC) between 1 and 20 days following injury (M = 6.8, SD = 4.12). A subset of 70 completed the TEC again 1 to 3 weeks later. The TEC is a repeatable computer administered series of six tasks that combine an n-back task (0-, 1- and 2-back) to assess effects of increasing working memory load with a go/no-go task to evaluate response to inhibitory demand.

**Results:** On first post-injury evaluation, the mTBI group performed significantly worse than the control group in most respects with effect sizes ranging from .3 to .22. Students with mTBI were considerably slower, more variable and less accurate than matched controls. On follow up evaluation, the mTBI group improved but still remained significantly slower and more variable than the non-injured group.

**Conclusions:** Children and adolescents with recent mTBI showed reduced accuracy and response speed and increased variability on the TEC but demonstrated significant improvement on all variables at follow-up evaluation. These findings provide evidence of improvement in working memory and processing speed reflecting likely neurometabolic recovery over time in children and adolescents with mTBI.

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**G.A. GIOIA, M. PALACIOS, N. ZUCKERBRAUN, M. COLLINS, S. ATABAKI, L. BOLLING, R. ST. CHARLES & R. GRUBBS. Emergency Care System Features in the Treatment of Pediatric Mild TBI.**

**Objective:** Early diagnosis, evaluation, and treatment of mild TBI (mTBI)/concussions in the Emergency Department (ED) is an essential initial step to appropriate management. We characterize the standard operating procedures for the care and management of mTBI in the ED of two urban pediatric hospitals.

**Participants and Methods:** Serial phone interviews were conducted with parents of 164 patients (5-22 years, Mean age = 10.7 years, 68% male) treated in the ED for concussion/ mTBI 7-10 days post-injury. Comprehensiveness of discharge education was assessed with respect to symptom education, follow-up appointment recommendations, and physical and cognitive restrictions.

**Results:** 85.4% of parents reported receiving mTBI discharge instructions in the ED. 79.2% report learning new knowledge about concussion symptoms. 76.8% were instructed to make follow up medical appointment within one week but only 28.2% complied (35.6% within 4 weeks). Differences in type of restrictions were evident: 61.6% of patients were instructed to limit physical and sports/recreation activity but only 16.5% were given cognitive/ school-related recommendations.

**Conclusions:** While a high percentage of families received discharge education and most instructed to follow up with primary care, the actual adherence in this urban sample was low. Families received recommendations related to physical and sports/recreation-related restrictions much more frequently than cognitive-related guidelines, reflected by the minimal school-related recommendations. There is a significant need to improve discharge education and follow up linkage with primary care systems, as well as injury-specific treatment recommendations.

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**G.A. GIOIA, M. PALACIOS, S. ATABAKI, N. ZUCKERBRAUN, M. COLLINS, R. ST. CHARLES, L. BOLLING & R. GRUBBS. Post-injury Course of Pediatric Mild TBI Initially Treated in the Emergency Department.**

**Objective:** We report the post-injury course of pediatric mild TBI/concussions initially treated in Emergency Department.

**Participants and Methods:** Parents of 164 patients (5-22 years, Mean = 10.7 years; 68% male) treated for concussion in the ED at two urban pediatric hospitals completed 3 phone interviews about the child's post-injury course at 1, 2 and 4 weeks. Progression of concussion symptomatology, adherence to follow up appointment recommendations, and the association of symptom level on school, sports and daily activities were assessed.

**Results:** Report of symptoms reveals headache, fatigue, drowsiness, irritability, and dizziness to be the top five. 25.8%, 77.2%, and 86.9% report symptom resolution at 1, 2, and 4 weeks. Gender and age were unrelated to symptom level; age had a small positive association with return to full activity ( $r = .32$ ). Symptom level across the 4-week period was significantly associated with extent of activity restriction and need for academic support. A small but positive association was found between age and need for greater academic support.

**Conclusions:** The post-injury symptom resolution is reported of children and adolescents initially treated in the ED with typical symptom types. Most of the sample indicated full resolution by 4 weeks. Level of symptoms is related to need for activity restriction and school supports. Gender is unrelated to outcome although age has small effects, with older students requiring more academic supports. Future study of key discharge instruction and follow up supports from the ED is planned.

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**A.B. GOLD, J. JURANEK, M.R. PRASAD, P.R. SWANK & L. EWING-COBBS. Attention Networks in Children with Traumatic Brain Injury (TBI): Relations with Regional Brain Volumetry.**

**Objective:** Pediatric traumatic brain injury (TBI) is often associated with both diffuse cerebral damage and focal injury to frontal and parietal regions implicated in attentional control. Therefore, we examined post-traumatic changes in neural networks subserving attention alerting, orienting, and conflict.

**Participants and Methods:** Regional cortical volumes from MRI scans obtained two months following TBI (n=19) or orthopedic injury (n=20) were examined in relation to Attention Network Task (ANT) scores. The ANT assesses efficiency of maintaining alertness, orienting to sensory information, and resolving conflict from competing responses. Bilateral gray (GM) and white matter (WM) volumes from regional frontal and parietal lobes as well as volumes from the anterior and posterior cingulate cortex were analyzed. GLMs examined effects of group and regional brain volumes on ANT network scores.

**Results:** ANT scores were comparable in the TBI and comparison groups. Regional cortical volumes were not related to alerting network performance. For the orienting score, significant interactions with group were obtained for volume of the right superior parietal GM, right dorsalateral prefrontal GM, and bilateral posterior cingulate GM and WM volumes. Group interacted with both anterior cingulate GM and WM for conflict scores.

**Conclusions:** The relation between regional GM and WM volumes and the orienting and conflict scores varied for the TBI and comparison group. Alerting scores, which have been related primarily to subcortical structures, were not related to the cortical volumes for either group. The ANT shows promise for examining the impact of regional brain injury on disruption of specific attention networks.

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**S.A. GORMAN, M. BARNES, M. PRASAD & L. EWING-COBBS. Are Visual-Spatial and Verbal Working Memory Equally Affected by Pediatric TBI?**

**Objective:** Working memory (WM) deficits are often a consequence of traumatic brain injury (TBI) in children. The present study examined the impact of TBI on visual-spatial and verbal WM to determine whether the impact of TBI is similar across visual-spatial and verbal WM.

**Participants and Methods:** Thirty seven children and adolescents with moderate to severe TBI and 41 comparison participants were administered Visual Spatial Span (visual) and Category Listening Span (verbal) WM tasks. The visual-spatial and verbal WM tasks require maintaining the same number of stimuli in WM at each span level while simultaneously performing an attention monitoring task requiring responding to specific targets.

**Results:** A repeated measures ANCOVA controlling for age at assessment was utilized to examine the effects of WM task type on performance across groups. A significant task by group interaction ( $F(1,75) = 8.55, p < .01$ ) indicated that performance of the TBI and comparison groups differed across tasks. While performance was comparable on Category Listening Span ( $t(36) = -0.046, p = .963$ ), the comparison group scored significantly higher on Visual Spatial Span ( $t(40) = 3.88, p < .01$ ).

**Conclusions:** Participants with TBI performed significantly more poorly than the comparison group on visual-spatial, but not verbal measures of WM. TBI preferentially decreased performance on visual-spatial WM suggesting that visual-spatial WM may be more vulnerable to the effects of TBI. NIH R01 NS43608.

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**M.N. GRAGERT, N.C. WALZ, K.O. YEATES, H.G. TAYLOR, T. STANCIN & S.L. WADE. Posttraumatic Stress Symptoms Following Early Childhood Traumatic Brain Injury.**

**Objective:** This study examined the emergence of posttraumatic stress symptoms (PTSS) following early childhood TBI. We hypothesized that PTSS would be greater following TBI than orthopedic injury (OI) and that both preinjury PTSS and parent/family stress would be significant predictors of PTSS.

**Participants and Methods:** Young children (aged 3-6 at time of injury) with TBI (64 moderate, 23 severe) and OI (117) were assessed at 6, 12, and 18 months postinjury. Preinjury PTSS were assessed shortly after the injury. PTSS were assessed using a modified CBCL-PTSD scale validated for young children. Mixed model analyses were used to examine group differences in PTSS adjusted for preinjury PTSS across time and to examine the relationship of parent/family stress to child PTSS. Analyses were conducted with child factors (race, sex, and age at injury) and SES as covariates.

**Results:** Longitudinal changes in PTSS symptoms were predicted by injury severity. Severe TBI was associated with higher PTSS over time than OI and moderate TBI. The moderate TBI group showed an initial increase in PTSS at 6 months postinjury but then evidenced some resolution of symptoms at 12 and 18 months postinjury. Preinjury PTSS and parent/family stress were significant predictors of child PTSS.

**Conclusions:** PTSS emerge following severe TBI during early childhood and do not resolve over time. In contrast, there is an initial increase in PTSS following moderate TBI that resolves over time. Preinjury PTSS and parent/family stress are significant contributory factors to the development of PTSS following pediatric TBI, and these warrant assessment.

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### G. HERNANDEZ & T. MONTIEL-RAMOS. Cognitive Deficits in Spanish-speaking Children with Traumatic Brain Injury.

**Objective:** In childhood, to suffer a traumatic brain injury (TBI) causes multiple deficits on cognition. The aim of this study was to know the neuropsychological performance of Spanish-Speaking Children with TBI selected from the medical consultation of child neurologist in the Hospital Civil de Guadalajara Fray Antonio Alcalde.

**Participants and Methods:** Seventeen Spanish-speaking children (14 boys and 3 girls, age mean 8.65 years old, IQ range from 61 to 112) with a TBI diagnosis were evaluated with tasks of Attention, Verbal Auditory Memory, Spatial Abilities, Constructional Abilities And Executive Functions from the Evaluación Neuropsicológica Infantil – ENI (Child Neuropsychological Assessment). Comparisons between mean of sample and ENI's parameters in each task were made. The sample was evaluated between 1 year and 4 years after injury, by the report of learning disabilities or behaviour problems.

**Results:** The results shows significant differences between mean of sample and parameter in digits cancellation, draw cancellation, human figure draw, complex figure copy, verbal-auditory memory, verbal free recall, verbal clue recall, verbal-auditory recognition, spatial abilities, right-left comprehension, right-left expression, different angles draws, lines orientation, verbal fluency, graphic fluency and failure to maintain the set.

**Conclusions:** The founded deficits on this TBI sample include a wide range of neuropsychological abilities, particularly in attention, visual-spatial skills and long term memory. The founded deficit has shown a generalized brain dysfunction profile. Like a future research, we need to examine the development of the children with recent injury and the postinjury disorders including predisposing child characteristics, type of brain insult, time of injury and the environmental influences.

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### S.M. HILLEARY, S. DEBOARD MARION, W.S. BROWN, T. BABIKIAN, S.A. COPELAND, C. GIZA, E. CHIN & R. ASARNOW. Corpus callosum MRI morphology and functional outcomes following pediatric traumatic brain injury.

**Objective:** White matter damage has consistently been found in association with traumatic brain injury (TBI), yet the functional implications are not well understood. The current investigation used structural MRI to characterize corpus callosum (CC) atrophy and functional status on interhemispheric tasks subsequent to pediatric TBI.

**Participants and Methods:** Structural MRI and bimanual coordination performance were examined in 13 healthy controls (12.60-18.50 years,  $M = 15.94$ ) and 17 adolescents (12.10-18.30 years,  $M = 16.03$ ) with moderate-to-severe TBI, six of whom had identifiable CC lesions. Individuals were imaged and assessed 3-8 months post-injury and one year later in both cross-sectional and longitudinal designs.

**Results:** MANOVA indicated significantly reduced CC only in TBI participants with lesions and only at the chronic (vs. post-acute) period. Importantly, CC deterioration was diffuse and not explained by lesion size or location. Genu area was correlated with bimanual motor speed. Among controls, larger genu size was related to the ability to slow performance to ensure accuracy, whereas TBI participants were slow and inaccurate. Callosal deterioration predicted worse performance over time on interhemispheric aspects of bimanual coordination.

**Conclusions:** This is one of the first investigations showing correspondence between CC structure and interhemispheric functioning in the months immediately following moderate-to-severe closed head injury in a pediatric population. This study is consistent with recent findings showing that CC lesions are a reliable indicator of continued white matter atrophy. Assuming replication with a larger sample, CC morphology may prove to be a reliable and efficient procedure to detect diffuse axonal injury.

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### C.P. JOHNSON, J. JURANEK, L. KRAMER, M. PRASAD, P. SWANK & L. EWING-COBBS. Predicting Behavioral Deficits Following Traumatic Brain Injury Through Damage To The Uncinate Fasciculus: A Diffusion Tensor Tractography Study.

**Objective:** Patterns of executive dysfunction and social skills deficits vary following traumatic brain injury (TBI). Injury to the uncinata fasciculus (UF) may contribute to behavioral and social dysregulation. We examined whether probabilistic diffusion tensor tractography (DTT) of the UF obtained 2 months after pediatric TBI predicted unique patterns of executive functioning and social skills.

**Participants and Methods:** Diffusion weighted images and a T1 image were examined in children with moderate to severe TBI ( $n=15$ ) or orthopedic injury ( $n=15$ ). Using Freesurfer, connectivity based probabilistic DTT reconstructed the UF via the connection between anterior temporal pole and orbitofrontal cortex. Fractional anisotropy (FA) from the UF was examined in relation to parental ratings on the Behavior Rating Inventory of Executive Function (BRIEF) and the Social Skills Rating Scales (SSRS) obtained 12 months post-injury.

**Results:** Repeated measures linear models examined the relation of group and laterality of DTT metrics from the UF on behavioral and social outcomes. Lower FA values predicted worse behavioral regulation scores. UF FA interacted with BRIEF scale and predicted behavioral regulation, but not metacognition scores, regardless of group membership ( $p = 0.016$ ). Right FA predicted the emotional control subscale of behavioral regulation ( $p = 0.005$ ). Right UF FA predicted problem behaviors ( $p = 0.003$ ), but not social skills on the SSRS.

**Conclusions:** A pattern of greater behavioral dysregulation, but not metacognitive deficits, followed reduced FA to the right, but not left UF. Similarly, greater problem behaviors, but not social skills, followed right UF, but not left UF, reductions of FA. NIH R01 NS43608.

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### V. KRISHNAMURTHY, I. BABAKHANYAN, L. ZAYTSEV, J. PIVONKA-JONES & K. FREIER-RANDALL. Neuropsychological Outcomes in Children with Head Injury vs. Traumatic Brain Injury.

**Objective:** Brain injury is a leading cause of cognitive deficits in children. However, a population of children who receive head injuries (HI) do not fit the criteria for traumatic brain injury (TBI) (do not display altered states of consciousness or abnormal brain imaging). This study attempts to identify potential neuropsychological sequelae associated with HI as compared to TBI for the purposes of identifying need for early intervention.

**Participants and Methods:** 18 age-matched English-speaking children with documented histories of TBI and HI (mean age=9.21,  $SD=1.96$ ; 72% Male, 28% Female) participated. Functioning was assessed with the age appropriate Wechsler scale and the NEPSY Attention/Executive Functioning (A/EFx) and Memory domains. Data was collected from 2003-2009 with IRB approval.

**Results:** Significant differences were noted between the TBI and HI groups on age at time of injury (TBI=88.4 months, HI=35.9). Neuropsychological scores were as follows:  $FSIQ_{TBI}=98.67$ ,  $FSIQ_{HI}=79.67$ ;  $VCI_{TBI}=99.78$ ,  $VCI_{HI}=79.44$ ;  $PRI_{TBI}=102.44$ ,  $PRI_{HI}=86.67$ ;  $WMI_{TBI}=96.14$ ,  $WMI_{HI}=78.20$ ;  $PSI_{TBI}=92.71$ ,  $PSI_{HI}=79.89$ ;  $A/EFx_{TBI}=85.33$ ,  $A/EFx_{HI}=93.44$ ;  $Memory_{TBI}=102.57$ ,  $Memory_{HI}=88.78$ . Univariate ANOVAs revealed statistically significant differences on FSIQ ( $F=5.55$ ,  $p = 0.03$ ), VCI ( $F=6.47$ ,  $p=0.02$ ), and WM ( $F=4.89$ ,  $p<0.05$ ). The TBI group outperformed the HI group on all domains except A/EFx. Though not statistically significant, a trend of memory deficit emerged in HI sample.

**Conclusions:** The results demonstrate that children with a mild HI can present with deficits on cognitive and memory functioning. It appears that older age at the time of injury may serve as a protective factor. However, the small sample size limits power and generalizability of these results. Future studies are needed relative to this topic.

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**S.D. MARION, J. LEE, T. PARSONS, A. VAN ROOYEN, J. GOOCH, E. KNUTH & A. RIZZO. Attentional functioning in children following mild closed head injury: The importance of prospective sampling.**

**Objective:** Attention is commonly disrupted in children after traumatic brain injury (TBI), yet there is continued debate regarding the presence of attention difficulties in mild TBI. The present study sought to investigate acute mild TBI via virtual reality (VR)-based testing. We hypothesized that mTBI would lead to increased commission and omission error relative to controls.

**Participants and Methods:** Eleven children 8-14 years of age admitted to the ER for a mild closed head injury were assessed within 9 months of injury on a VR classroom-based continuous performance task (the Virtual Classroom). Performance was compared with eight age-matched, non-injured children in two separate conditions based on the presence or absence of typical classroom distractions.

**Results:** Results revealed that the mild TBI and control groups committed similar rates of omission ( $F = .12, p = ns$ ) and commission ( $F = .42, p = ns$ ) error under both distraction conditions. This was not likely a function of sample size, as younger controls committed significantly more commission errors than younger TBI participants.

**Conclusions:** The fact that Virtual Classroom performance was comparable in mTBI and control groups suggests that children are not likely to experience sustained attention problems after mTBI. This was somewhat surprising yet consistent with other prospective (vs. clinic-referred) studies of mTBI. This study underscores the importance of sampling prospectively when seeking to generalize findings to all mild injury cases. It is crucial to recognize, however, that a subset of children experience more complicated recovery after mTBI, a fact that should guide ongoing understanding of risk following mTBI.

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**L.M. MORAN, K.O. YEATES, H. TAYLOR, J. RUSIN, B. BANGERT, A. DIETRICH, K. NUSS & M. WRIGHT. Do Post-Concussive Symptoms Discriminate Injury Severity in Pediatric Mild Traumatic Brain Injury?**

**Objective:** Several studies have shown that increases in post-concussive symptoms (PCS) are correlated with greater neurological damage or other indicators of severity following mild traumatic brain injury (mTBI) in children. This study assessed whether it is possible to predict injury severity from PCS presentation in children.

**Participants and Methods:** The sample included 285 children ages 8 to 15, 186 with mTBI and a comparison group of 99 with orthopedic injuries (OI). Both parents and children rated the severity of PCS at an initial assessment within 3 weeks post-injury and at follow-up visits at 3 and 12 months post-injury. The mTBI group was divided into high and low injury severity based on the presence/absence of either loss of consciousness or intracranial abnormalities on MRI.

**Results:** A series of discriminant function analyses revealed that both child and parent ratings of PCS collected at the initial assessment differentiated children with mTBI from children with OI, while ratings obtained at later time points could not. Somatic PCS accounted for most of the discriminatory power. Only parent ratings collected at the initial assessment were able to discriminate between all three groups. Overall, predicted group classification was poor, with a large proportion of false negatives in the mTBI group.

**Conclusions:** Although children with mTBI display and report more PCS than children with OI, accurate prediction of injury severity from symptom presentation is not yet possible.

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**T.W. OLIVIER, D.G. NEMETH, L.T. WHITTINGTON & N.E. MAY. Educating Children Who Suffered TBIs prior to Age Three.**

**Objective:** Many children sustain traumatic brain injury (TBI) before age three. Yet, when they are ready to enter the learning process, because their lower level functions have returned, oftentimes there is not appropriate preparation for this transition. Without a thorough evaluation and educational plan, these children often flounder and begin to exhibit attentional and behavioral problems within the school setting. As child traumatic brain injuries (cTBIs) typically interfere with working memory and the acquisition of knowledge, these children are especially vulnerable during the early school years.

**Participants and Methods:** Two similar cTBI patients who sustained brain injury before age three began exhibiting difficulties in kindergarten. After thorough neuropsychological assessments, comprehensive educational plans were developed. One began the first grade in the Fall of 2009, and the other began the second grade in the Fall of 2009.

**Results:** When comparing their scores on tests of school readiness and adaptive behavior, both of these children had reasonably adaptive behavioral composites. Their scores on tests of neuropsychological functions, however, revealed that their data was more consistent with same-age children who were likely to have brain-behavior based learning problems than with same-age normal children.

**Conclusions:** The participants' evaluation data and educational plans will be outlined in this paper. Commentaries on the success of the interventions that were recommended will be offered.

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**L.T. WHITTINGTON, D.G. NEMETH, T.W. OLIVIER & N.E. MAY. Self-Fulfilling Prophecies Versus Brain Limitations.**

**Objective:** A ten year old male, who sustained a head injury at age five, was referred for a comprehensive neuropsychological evaluation as a second opinion. This presentation, as demonstrated by the data collected, will address the self-fulfilling prophecies of this child versus his actual brain limitations.

**Participants and Methods:** This child's comprehensive neuropsychological evaluation consisted of information regarding his neurocognitive, psycholinguistic, attentional, memory, brain-behavior, and affective functioning. An educational assessment and an intellectual assessment had previously been performed by another practitioner.

**Results:** Results of this evaluation demonstrated that this child had a much greater learning and intellectual capacity than he was currently programmed to believe. The child, who would frequently say, "I can't!" on many tasks that he was asked to perform, did remarkably well on many measures of neurocognitive, psycholinguistic, and brain-behavior functioning. This data will be outlined.

**Conclusions:** This child, who sustained a head injury at age five, was programmed to believe that he could not perform on a level comparable with normal same-age children. Yet, his parents, who were told that their son was lucky to be alive, were hopeful that a better outcome could be achieved. Results of neuropsychological evaluation revealed average range scores in many of the key areas assessed. Different medication and intervention approaches were recommended. These as well as outcome information will be presented in this paper.

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**P. NOLIN. Pre- and Post-Injury Executive Dysfunctions in Adolescents with Traumatic Brain Injury.**

**Objective:** To study pre- and post-executive dysfunctions in adolescents with traumatic brain injury (TBI) using the Behavior Rating Inventory of Executive Function (BRIEF).

**Participants and Methods:** Study participants included 12 adolescents with mild TBI (mTBI) and 29 with moderate or severe TBI. Mean age of the participants at the time of the TBI and at post-injury assessment was 9.37 and 12.99 years respectively. Mothers completed the questionnaire twice. They first rated their adolescent's executive functions following the TBI (BRIEF POST-TBI) and then rated their adolescent's executive functions prior to the TBI (BRIEF PRE-TBI).

**Results:** Multivariate repeated measures analysis showed a significant Group (MTBI VS Moderate/Severe TBI) X Time (PRE- VS POST-Injury) effect [ $F(11,24) = 2.66, p < .05$ ]. Simple main effects tests revealed a significant increase in the scores from the PRE- to the POST-BRIEF for the Moderate/Severe TBI group, while the scores were stable for participants of the mTBI group. There were no differences between the two groups on the BRIEF PRE-TBI.

**Conclusions:** The results confirmed that Moderate/Severe TBI was associated with long-term deficits in executive functions in adolescents, and raised questions regarding the presence of these deficits in participants with mTBI. Participants who experienced mTBI and Moderate/Severe TBI do not differ with regards to their pre-injury executive functioning as assessed by their mother. The results of this study encourage use of the BRIEF as a tool enabling assessment of pre-injury functioning.

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**J. PAPOUTSIS & R. STARGATT. Long-term Effects of Complicated Mild Traumatic Brain Injury Sustained in Infancy.**

**Objective:** Mild traumatic brain injury (TBI) is the most common type of head injury to occur in children. Recent research has started to distinguish complicated mild head injury from simple mild head injury. Research on children who sustained a mild TBI during infancy is limited and there are no known studies to date that have examined the outcome of this group beyond 5 years post-injury. The aim of this study is to characterise the cognitive profile of children who sustained a complicated mild TBI in infancy at least eight years post-injury.

**Participants and Methods:** 32 children who presented to the Emergency Department with objective symptoms of complicated mild head injury as documented by medical personnel under the age of three were recruited. Children were administered a battery of neuropsychological assessments examining various cognitive domains.

**Results:** Children who sustained a complicated mild TBI performed significantly worse on measures of divided attention compared to a normative sample. Children who sustained a loss of consciousness (LOC) performed significantly worse than children who experienced two post-concussion symptoms but no LOC.

**Conclusions:** Complicated mild TBI has the potential to impact on the development of higher-level attention skills, many years after the initial insult. Injury characteristics differentially impacts on the future cognitive development of children, outlining the importance of a stratified definition of mild TBI. This will allow us to more clearly identify those children who are at greatest risk of developing ongoing difficulties.

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**V. PETRAUSKAS, C. MCKAY, M. STEWART & J.E. CASEY. Comparing BRIEF Parent and Self Profiles in an Acute Pediatric Traumatic Brain Injury Sample.**

**Objective:** This study examined the relationship between the parent and self-report forms of the Behavior Rating Inventory of Executive Func-

tion (BRIEF) and neuropsychological measures of executive function (EF) administered during the acute rehabilitation phase in children and adolescents with traumatic brain injury. Previous research (e.g., Vriezen & Pigott, 2002) found that the BRIEF does not correlate well with recognized executive functioning tests within a neuropsychological battery. However, past studies have only examined chronic populations. Additionally, the present study expanded upon previous research by examining the extent to which parents and children agree on the areas of executive dysfunction.

**Participants and Methods:** The present study examined correlations between 39 parent report BRIEF forms and child neuropsychological measures of EF. Thirty-one child self-report BRIEF forms were subsequently correlated with neuropsychological measures of EF. Twenty-three parent-child matched pairs were compared using t-tests to determine whether parents and children differed in their perceptions of the child's executive functioning.

**Results:** Parent reports of child EF did not correlate with any of the neuropsychological measures of EF. Child reports of working memory were found to correlate with measures of impulsivity and disinhibition. T-test comparisons of parent and child perceptions of EF revealed significant differences in perceptions of inhibition, working memory, and planning/organization, with parents perceiving greater problems than the child in all cases.

**Conclusions:** Standardized measures of executive functioning do not seem to relate to family's perspective of EF difficulties, regardless of whether it is the parent's or the child's.

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**M. PRASAD, P. SWANK & L. EWING-COBBS. Behavioral and Cognitive Aspects of Attention in Children with Traumatic Brain Injury One Year Post-Injury.**

**Objective:** We examined behavioral and cognitive dimensions of attention in children and adolescents with moderate to severe traumatic brain injury (TBI) at one year post-injury. Attentional problems can present as behavioral difficulties or cognitive deficits in attention and a strong relationship between the two has not been consistently found.

**Participants and Methods:** 54 participants with moderate to severe brain injury and 35 orthopedic controls participated in this prospective, longitudinal study of outcome from brain injury in children and ranged in age from 7 to 15 years at time of injury. Children were assessed on the following measures: premorbid and one year post-injury Child Behavior Checklist (CBCL) behavioral attention scale; inattention (Connor's Continuous Performance Test (CPT) omissions), inhibition (CPT commissions), cognitive flexibility, and short-term memory.

**Results:** The groups did not significantly differ on socioeconomic status, age, or premorbid behavioral attention ratings. Children with TBI were rated as having more behavioral attention problems at 1 year-post-injury and scored lower than the control group on short-term memory. A hierarchical linear regression model was used to assess the relation between premorbid behavioral attention, group, inattention, inhibition, cognitive flexibility, and short-term memory to post-injury attentional behavior. Premorbid attentional ratings were found to be significantly related to behavioral attention at 1 year post-injury. Addition of group to the model significantly improved prediction. The remaining variables were not significant.

**Conclusions:** Premorbid behavioral attentional and TBI are strong predictors of post-injury behavioral attention. Neither cognitive attention skills nor related executive processes were found to be strongly related to behavioral functioning. Supported by NIH R01 NS43608.

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**K.P. RAGHUBAR, C.P. JOHNSON, M.A. BARNES, J. JURANEK, M.R. PRASAD & L. EWING-COBBS. Relations Between White Matter Integrity and Mathematical Outcomes in Children with TBI and Typically Developing Children.**

**Objective:** Children with traumatic brain injury (TBI) often demonstrate difficulties in math. Performance on mathematical tasks was compared between children with TBI and typically developing children. The integrity of right and left hemisphere white matter (WM) was used to predict math performance.

**Participants and Methods:** Participants included 14 children with moderate to severe TBI and 15 children with an orthopedic injury. Diffusion weighted images and a T1 image were collected at 2 months post-injury and processed through FSL and Freesurfer to obtain fractional anisotropy (FA) and mean diffusivity (MD) composites for left and right hemisphere WM. Participants completed Math Fluency, Math Calculation, and Applied Problems subtests from the Woodcock-Johnson III, and an experimental simple addition task whereby participants determined the veracity of small- and large-size correct and incorrect equations.

**Results:** Children with TBI performed worse than controls on Math Calculation ( $p < .01$ ) and Applied Problems ( $p < .05$ ). On the simple addition task, only the children with TBI solved correct equations more quickly than incorrect equations. Right and left hemisphere WM MD predicted performance on Math Fluency across participants ( $p$ -values  $< .05$ ). Left hemisphere WM MD also predicted reaction time performance on small-size problems for TBI participants alone ( $p < .05$ ).

**Conclusions:** Overall, children with TBI performed more poorly on a range of math tasks. MD served as a bio-marker for processing speed and performance deficits on math tasks with speeded components following TBI. Whole brain diffusion metrics may serve as early indicators of functional deficits following TBI. NIH R01 NS43608.

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**A.T. SCHMIDT, K.D. ORSTEN, G. HANTEN, X. LI & H.S. LEVIN. Relationship of Family Functioning to Emotional Prosody Following Pediatric Traumatic Brain Injury.**

**Objective:** Children with traumatic brain injury (TBI) often experience persistent difficulties with processing emotional information. Injury related factors in combination with environmental variables such as family functioning, financial resources, and parental coping impact a child's behavioral recovery after TBI. However, the relationship between environmental factors and performance on more basic emotional processing tasks remains unclear. This study investigated the relationship between caregiver perceived stressors and resources and performance on an emotional prosody task following pediatric TBI or orthopedic injury (OI).

**Participants and Methods:** Participants included 142 children – 75 children with moderate to severe TBI and 67 children with OI – between the ages of 7-17 years assessed at baseline, three months, and one year after injury using the parent report on the Life Stressors and Resources Scale (LISRES) and a task of emotional processing.

**Results:** Results indicated a negative correlation between emotional prosody and financial stress in both groups but only in children  $< 14$  ( $p = 0.008$ ), and a positive correlation between financial resources and task performance but only for children sustaining a TBI ( $p = 0.0072$ ). Time since injury did not influence the findings in either group and none of the other LISRES subscales were associated with emotional prosody performance.

**Conclusions:** Findings highlight the importance of adequate financial resources to promote recovery after TBI, and suggest that caregiver perceived financial stress may influence processing of emotional material following a traumatic injury especially in younger children. Implications of these findings for the broader construct of social cognition are also discussed.

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**A. TREBLE, K. HASAN, A. IFTIKHAR, M. PRASAD, M. BARNES & L. EWING-COBBS. Working Memory and Callosal Integrity following Pediatric Traumatic Brain Injury: A Diffusion Tensor Tractography Study.**

**Objective:** Deficits in working memory (WM) are a common consequence of pediatric traumatic brain injury (TBI). Reduced integrity of the corpus callosum (CC) after TBI may disrupt connectivity between bilateral anterior and posterior neural networks involved in WM. We examined diffusion tensor tractography (DTT) of the CC in relation to WM performance following pediatric TBI.

**Participants and Methods:** DTT was acquired in 84 children sustaining moderate to severe TBI (M age =  $12.0 \pm 3.3$ ) and compared with 50 community control children (M age =  $11.0 \pm 3.0$ ). The CC was divided into eight segments and tracked using DTI Studio software based on the fiber assignment by continuous tracking algorithm. Fractional anisotropy (FA) and mean diffusivity (MD) of each segment were extracted and examined in relation to performance on visuospatial and verbal WM tasks.

**Results:** WM scores were comparable in the TBI and comparison groups. Relative to the comparison group, FA was significantly increased in the genu, posterior body, isthmus, and splenium and MD was increased in all regions following TBI. Pearson partial correlations controlling for age were calculated between each WM task with FA and MD for each callosal region by group. Only in the TBI group, visuospatial WM was positively correlated with FA in the genu ( $p = .034$ ), and verbal WM was positively correlated with FA in fibers tracked from the temporal lobe into the splenium ( $p = 0.028$ ). MD did not correlate significantly with any WM scores.

**Conclusions:** Integrity of the genu and splenium of the CC was associated with verbal and visuospatial WM performance after pediatric TBI. NIH R01 NS43608.

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**C.G. VAUGHAN, G.A. GIOIA & P.K. ISQUITH. Stability and Internal Structure of the Pediatric Version of the ImPACT Battery.**

**Objective:** We examined the internal structure and stability of Pediatric ImPACT, a new version of the ImPACT computerized test battery designed to assess cognitive function in younger children with concussions.

**Participants and Methods:** 577 typically developing children without injury (66% male) aged 5 to 12 (M = 9.5 years) completed the test battery. Principle axis factoring with Promax rotation was employed to identify the factor structure of 27 variables measuring performance accuracy, response speed, and variability. Test-retest reliability examined temporal stability of the factor structure (mean test-retest interval = 0.2 days).

**Results:** A three factor structure- Response Speed, Learning and Memory, and Variability (ICV) -accounted for 48.4% of the total variance. Factors had moderate covariance with each other (.43 to .70). Factoring a second administration of the test produced the same internal structure, lending support to its replicability. A similar factor structure also emerged with alternative rotation methods. Test-retest stability was high for the Response Speed factor (.95), and moderate for Learning and Memory (.67) and Variability factors (.72).

**Conclusions:** Factor analysis of a new pediatric version of the ImPACT test battery revealed a stable three-factor structure. Appropriate test-retest reliability was demonstrated for all three factor scores.

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**C.T. WELLS, P. ROMER, H. BHATT, E. HUNTLEY, H. PADIA, L. KRIVITZKY, D. LEWIN & G. GIOIA. Parent-Report of Sleep Problems Following Mild Traumatic Brain Injury in Children and Adolescents.**

**Objective:** This study describes the type of sleep problems reported by parents of children and adolescents with mild traumatic brain injuries (mTBI). It was hypothesized that patients would report significant excessive daytime sleepiness (EDS) and difficulties with sleep onset and maintenance following mTBI when compared to pre-injury baseline and a control sample.

**Participants and Methods:** The parents of 50 children (35 male; Mean age at injury = 13.8 years, range 8-17 yrs) with mTBI recruited from a concussion clinic completed a comprehensive sleep questionnaire reporting on pre- and post-injury sleep habits. The mTBI group was then compared to an age- and gender-matched community-recruited control sample. The sleep questionnaire completed by both groups included 5 scales: 1) EDS, 2) Onset & Maintenance, 3) Parasomnias, 4) Narcolepsy, and 5) Sleep Disordered Breathing (SDB).

**Results:** There were no significant differences on any of the 5 sleep scales in analyses of mTBI pre-injury baseline sleep habits compared to control participants. Analysis of change in sleep scale symptoms revealed no significant change from baseline in frequency of parasomnia, narcolepsy, or SDB symptoms at any of the 3 post-injury appointments. There was a trend toward significance ( $p = .057$ ) for the EDS scale with a significant increase in EDS noted at the first post-injury visit and a return to baseline by the third visit. For the Onset & Maintenance scale, symptoms significantly increased from baseline to the first visit and persisted through the third visit ( $p = .016$ ).

**Conclusions:** Significant increases in EDS and difficulties with sleep onset and maintenance were observed. Thus, there is a clear need for assessment and intervention of sleep in children and adolescents following mTBI.

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**J.R. WOZNAK, B.A. MUELLER, E.E. WARD, C.J. BELL, L.E. KRACH & K.O. LIM. Inter-hemispheric resting-state fMRI disturbances associated with specific neurocognitive deficits in children with Traumatic Brain Injury.**

**Objective:** We hypothesized that disruptions in inter-hemispheric synchronization of brain activity, as measured by resting-state fMRI, would be associated with specific neurocognitive deficits in child and adolescent patients following traumatic brain injury.

**Participants and Methods:** Participants were 15 patients with TBI and 15 matched control subjects, ages 11 to 18. Patients underwent MRI scanning and neurocognitive evaluation within 18 months of mild to severe brain injury. The MRI sequence included high resolution anatomical images, a 6-minute resting-state fMRI series, and a 30-direction Diffusion Tensor Imaging (DTI) series. Right and left hemispheric correlations were computed for resting-state fMRI BOLD signal from 9 cortical regions as indexes of functional connectivity.

**Results:** Because of the heterogeneity of injuries in the TBI group, we chose not to analyze the data strictly by groups. Instead, relative comparisons were made for subgroups of patients who showed specific neurocognitive deficits. For patients ( $n=5$ ) who showed verbal memory impairment (CVLT), resting fMRI disturbances were seen in anterior regions (pars orbitalis). Microstructural abnormalities were also seen in left pars orbitalis on DTI. For patients ( $n=4$ ) with working memory impairment (Wechsler), fMRI disturbances were seen in superior-frontal and superior-parietal regions. DTI showed trend-level abnormality in the left superior-parietal region. For patients ( $n=8$ ) with executive impairment (BRIEF), medial orbitofrontal fMRI abnormalities were seen.

**Conclusions:** These analyses demonstrate that specific resting-state functional connectivity disturbances may be related to common neurocognitive deficits following TBI in young patients. In addition, DTI reveals evidence of microstructural abnormalities in some cases.

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**Visuospatial Functions/Neglect/Agnosia**

**P. CHEN, N. ZAIDI, K. PIGGOT & A.M. BARRETT. Perceptual versus Representational Influence on a Motor Walking Task in Spatial Neglect.**

**Objective:** Spatial neglect is a disabling disorder often under-diagnosed clinically, especially when the symptoms are only present at a remote distance or behind the body. Daily activities, such as driving, demand stimulus perception and internal representation of far and rear space. We developed a walking test to examine far and rear spatial bias via forward and backward walking, respectively. Perceptual bias may influence walking relatively more with eyes open, versus representational bias, which may influence walking with eyes closed.

**Participants and Methods:** A 31-yr right-handed female, 7-wk post right temporal-occipital hemorrhage with left spatial neglect and hemianopia, without leg weakness, walked forward and backward on a walking path 180 cm wide and 300 cm long (6 trials per condition: eyes open forward and backward, eyes closed forward and backward).

**Results:** With eyes open, our subject veered leftward, relative to the body, while walking forward (-153.7 mm; SD =28.2; one-sample two-tailed  $t(5) = -13.24$ ,  $p < 0.001$ ) but did not veer significantly walking backwards (-112.2 mm; SD=143.5; ns). Blindfolded, she improved walking forward (-22.8 mm; SD =45.1; paired-samples two-tailed  $t(5)=4.50$ ,  $p=0.006$ ), but veered more rightward walking backwards (281.0 mm, SD=198.5;  $t(5)= 3.97$ ,  $p= 0.011$ ).

**Conclusions:** Our results suggest that environment-centered neglect induced visual perceptual, but not representational, navigation errors during forward walking. However, we observed environment-centered representational navigation bias during backward walking. Spatial neglect may independently impair representational navigation for forward and rear space. Adaptive backward movement, important for accident avoidance, may rely on rear space representational systems.

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**E.E. GALLETTA, S. PEKRUL, P. ESLINGER & A.M. BARRETT. Visual Distraction: An Altered Aiming Spatial Response in Dementia.**

**Objective:** Distractibility can interfere with function (e.g. driving). We asked: compared to controls, do subjects with probable AD (pAD) demonstrate greater visual perceptual-attentional ("where"), or motor-intentional ("aiming") system distraction while performing a line bisection (LB) task?

**Participants and Methods:** Six subjects with dementia and twenty-two controls were tested on a video LB task in near and far space. We right-left reversed the perceived direction of movement as subjects bisected lines in half of the bisection trials, and were thus able to fractionate "where" versus "aiming" bias. Pseudo-randomized trials were in: left and right distractor, and a no-distractor condition.

**Results:** We identified a three-way interaction: group (pAD, controls), "where" vs. "aiming" bias, and distraction side ( $p = 0.007$ ). Although left distraction increased leftward errors in both groups, "where" distraction bias was more leftward in controls, and in pAD subjects, left distraction was associated with decreased rightward "aiming" bias. Right-sided distraction exerted no significant effects on either controls or pAD subjects.

**Conclusions:** We found "where" left-sided distraction in controls was not observed in pAD, rather left-sided distraction potentially influenced "aiming" bias. This is potentially consistent with Drago et al. (2008), and may reflect vulnerability of "aiming" motor-intentional top-down systems to distraction in these patients. Whether this could reflect preferential access of the superior colliculus to motor, rather than visual, spatial processing in pAD requires further exploration.

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**B.K. WEBSTER, R.W. PARTRIDGE, R.J. HEINRICH & L.E. BAADE. Relationship Between the RBANS Visuospatial Subtests and the MMSE Intersecting Pentagons.**

**Objective:** The Mini Mental Status Exam (MMSE) is the measure of cognition most frequently used by health care providers. Though the total score has traditionally been used to identify impairment, individual items within the MMSE have been found to be more sensitive to certain impairments, e.g. three word recall score with memory impairment. Poor performance on the MMSE intersecting pentagons is thought to reflect impairment of visuospatial abilities. This study examines the relationship between impaired performance on this MMSE subtest and performance on the Repeatable Battery to Assess Neuropsychological Status (RBANS) Figure Copy and Line Orientation subtests.

**Participants and Methods:** Participants were 116 older adults aged 61 to 97 years (mean age = 77 years, SD = 8) who were admitted to the geriatric psychiatric unit of a rural Midwestern hospital: 99% were Caucasian and 82% were women.

**Results:** Mean differences for three RBANS subtests were compared for two groups: those who successfully completed the MMSE intersecting pentagons and those who failed. Analysis revealed a significant difference between the means of the two groups on the RBANS Figure Copy subtest and the Line Orientation subtest,  $t(52.48) = -4.387, p < .0001$ ;  $t(37.52) = -3.542, p < .001$ , respectively. No difference was found on the RBANS Digit Span subtest  $t(67.50) = -1.74, p = .08$ .

**Conclusions:** This study provides convergent validity and added interpretive information for the MMSE's intersecting pentagons item. The study also suggests that impairments measured by the intersecting pentagons are due to visuo-spatial impairment and not attention deficits. Correspondence: *Blake K. Webster, MS, Clinical Psychology, Wichita State University, 1845 Fairmount, Wichita, KS 67260, United States. E-mail: bkwebster@wichita.edu*

### Genetics/Genetic Disorders

**D.A. JACOBSON, K.E. LUCE & R. LAJINESS-O'NEILL. Involvement of the Anterior Cingulate Cortex and Insula in the Regulation of Negative Affect in Individuals with VCFS.**

**Objective:** The anterior cingulate cortex (ACC) and insula have been jointly implicated in the experience of empathy, theory of mind, and social cognition. Furthermore, the co-activation of these structures has been linked to the suppression of reflexive and voluntary behaviors and cognitions. Children with VCFS, a neurodevelopmental disorder, experience deficits in attention, impulsivity, emotional regulation, and social cognition. As such, it was hypothesized that the combined averaged volumes of the ACC and insula in children with VCFS would be smaller than aged-matched controls. Furthermore, it was hypothesized that combined insula and ACC volumes would be related to deficits in attention, impulsivity, emotional regulation, and social competency.

**Participants and Methods:** These deficits were measured by the Continuous Performance Test (CPT), Child Behavior Checklist (CBCL), Connor's Parent Rating Scale: Revised-Long (CPRS:R-L), and the Child Depression Inventory (CDI). A composite variable consisting of the combined averaged volume of the ACC and insula were compared in six individuals with VCFS and six gender and age-matched controls.

**Results:** Structural volumes were then correlated with behavioral measures. MRI data was acquired with a 3.0 Tesla scanner and analyzed with Eigentool software. The composite ACC-insula volume was significantly smaller in individuals with VCFS relative to controls;  $t(5) = .334, p < .05$ . Additionally, a positive relationship was observed between the ACC-insula composite and the negative emotions subscale of the Child-Depression Inventory;  $r(6) = .833, p < .05$ .

**Conclusions:** These data reveal smaller volumes in regions purported to underlie the suppression of behaviors and cognitions which are related to the experience of negative emotions in individuals with VCFS. Correspondence: *Kelly E. Luce, B.S., Psychology, Eastern Michigan University, 537 Mark Jefferson, Ypsilanti, MI 48197, United States. E-mail: kluce85@aol.com*

### Dementia (Alzheimers)

**R. CORONA, T. SHAH, T. CLAYCOMB, N. DAFEEBOINI & J. RAZANI. Predicting Psychological Distress in Caregivers from Functional Performance of Dementia Patients.**

**Objective:** The purpose of the study was to better understand the relationship between daily functional deficits in dementia patients and the types of psychological distress experienced by their caregivers. It was hypothesized that lowered scores on specific domains of a performance-based activities-of-daily-living task by patients would predict their caregivers' psychological symptoms.

**Participants and Methods:** This project included 79 patients with varying forms of dementia and their next-of-kin caregivers. Caregivers completed the Beck Depression Inventory (BDI) and the Brief Symptom Inventory (BSI; an inventory that measures psychological symptoms such as anxiety and hostility) about their own psychological state. Patients were administered the Direct Assessment of Functioning Status (DAFS) which measures aspects of functioning as the ability to carry out a shopping task, financial skills, identify traffic rules and signs, and communication skills.

**Results:** Using stepwise regression, results showed that patients' DAFS Communication subscale scores best predicted caregiver's BSI Hostility ratings and patients' DAFS Financial subscale scores best predicted caregivers' BDI scores.

**Conclusions:** The findings indicate that as specific aspects of functional ability declines in patients with dementia, their caregivers' mental health is compromised. This information would be helpful to healthcare professionals for planning treatment for patients and their caregivers.

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### Invited Symposium Presented by ALAN: Neuropsychology of Emotion and the Neural Mechanisms Underlying Emotional Processing

**Discussant: Mitchell Valdes-Sosa**

**Speaker: Feggy Ostrosky-Solis**

**4:00–5:30 p.m.**

**F. OSTROSKY, M. VALDES-SOSA, H. NICOLINI & E. MATUTE. Neuropsychology of Emotion and the Neural Mechanisms Underlying Emotional processing.**

**Symposium Description:** Research on the neuropsychology of emotion and the neural mechanisms underlying emotional processing have received considerable attention in the last decade. Much relevant work has come from recent studies applying concepts and methods of cognitive neuroscience and neuroimaging techniques to the study of normal subjects and patients with neurological damage. This symposium aims

to present an overview of our current knowledge of neuroimaging, neuropsychological and psychophysiological studies on emotion in normal and brain damage subjects. The papers included will address key factors related to these issues. Feggy Ostrosky et al, will present new approaches to assess the processing of moral emotions in normal subjects and psychopaths criminal offenders. Mitchell Valdes-Sosa will present neuroimaging studies of normal and brain injured subjects that have identified candidates for the neural substrates of unconscious processing of emotional processing, Humberto Nicolini et al, will present a large-scale extended pedigree study of cognitive functioning in bipolar disorder that identified measures of processing speed, working memory and declarative (facial) memory as candidate endophenotypes for bipolar disorder. Esmeralda Matute et al, will present data regarding facial expressions recognition differences in children with dyscalculia, ADHD and dyslexia.

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**F. OSTROSKY, K. DIAZ-GALVAN, C. ROMERO-REBOLLAR, K. BORJA-JIMENEZ, A. VELEZ-GARCIA & M. PEREZ. Moral Emotions: Electrophysiological and Neuropsychological data in Normals and Psychopath Criminal Offenders.**

**Objective:** To study the neuropsychological profile and brain correlates of basic and moral emotions in a group of controls and of criminal offenders divided into psychopaths and non psychopaths. Method: Event Related Potentials were recorded while viewing pictures of emotionally charged scenes with and without moral content as well as emotionally neutral pictures. Neuropsychological measures included a battery that assesses frontal lobe functions (BATTERY OF FRONTAL AND EXECUTIVE FUNCTION; Flores, Ostrosky Lozano, 2008) and several measures of Attention and Memory (NEUROPSI ATTENTION AND MEMORY; Ostrosky et. al 2005, 2007)

**Results:** In normal subjects, unpleasant pictures with and without moral content prompt a marked negative slow wave, with higher amplitude at frontal, parietal and temporal sites of the left hemisphere. In psychopaths criminal offenders no significant differences between the stimuli were found. Psychopaths criminal offenders show memory impairments (verbal and nonverbal) as well as several executive alterations.

**Conclusions:** In psychopaths criminal offenders the emotional components of cognition are disturbed and poorly integrated. Neuropsychological data suggest alteration in the septal-hippocampal-frontal system. Partially supported by Consejo Nacional de Ciencia y Tecnología (CONACYT) # 49127-H Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica Universidad Nacional Autónoma de México (PA-PITT) # IN31260, and Gobierno del Distrito Federal, Mexico.

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**M. VALDES-SOSA. Neural substrates of unconscious processing of emotional information.**

**Objective:** Recent neuroimaging studies of normal and brain injured subjects have

identified candidates for the neural substrates of unconscious processing of emotional processing. Many studies have used emotionally laden face stimuli, not explicitly recognized due to masking, that yet are capable of activating in fMRI experiments the components of the core and extended face processing network. A fast route via the amygdala has been posited as responsible for these effects, although the anatomical and psychophysical support for this hypothesis is not entirely consistent. Confirmation of the speed of implicit emotional processing has been obtained from ERP experiments, including those using intracranial recordings. In addition to this pathway, evidence for routes based on direct cortical-cortical pathways has emerged from combined fMRI and DTI-tractography studies of implicit processing in brain injured patients (with neglect, prosopagnosia, and other conditions). The possible role of these unconscious pathways in normal cognition is discussed

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**H. NICOLINI, D. GLAHN, L. ALMASY, M. BARGUIL, E. HARE, J. PERALTA, J. KEN, A. DASSORI, J. CONTRERAS, A. PACHECO, N. LANZAGORTA, H. RAVENTÓS & M. ESCAMILLA. Neurocognitive Endophenotypes for Bipolar Disorder Identified in Multiplex Multigenerational Families from Latinoamérica.**

**Objective:** Although genetic influences on bipolar disorder are well established, localization of genes that predispose to the illness has proven difficult. Given that genes predisposing to bipolar disorder may be transmitted without expression of the categorical clinical phenotype, one strategy for identifying risk genes is the use of quantitative endophenotypes. The goal of the current study is to adjudicate neurocognitive endophenotypes for bipolar disorder.

**Participants and Methods:** 709 Latino individuals from the central valley of Costa Rica, Mexico City, Mexico, or San Antonio, Texas participated in the study. 660 of these persons were members of extended pedigrees with at least two siblings diagnosed with bipolar disorder (n=230). The remaining subjects were community controls without personal or family history of bipolar disorder or schizophrenia. All subjects received psychodiagnostic interviews and comprehensive neurocognitive evaluations. Neurocognitive measures found to be heritable were entered into analyses designed to determine which tests are impaired in affected individuals, sensitive to genetic liability for the illness and genetically correlated with affection status. The main outcome measure was neurocognitive test performance.

**Results:** Two of the 21 neurocognitive variables were not significantly heritable and were excluded from subsequent analyses. Patients with bipolar disorder were impaired on 6 of these cognitive measures compared to non-related healthy subjects. Non-bipolar first-degree relatives were impaired on five of these and three tests were genetically correlated with affection status: digit symbol coding, object delayed response, and immediate facial memory.

**Conclusions:** This large-scale extended pedigree study of cognitive functioning in bipolar disorder identified measures of processing speed, working memory and declarative (facial) memory as candidate endophenotypes for bipolar disorder.

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**E. MATUTE, O. BARRIOS, J. OROZCO & M. ROSSELLI. Recognition of emotional facial expressions in children with three types of neurodevelopmental disorders.**

**Objective:** It has been observed that children with some neurodevelopmental disorders show difficulties in establishing social interpersonal relationships. It is uncertain if these difficulties are associated with a defect in understanding and expressing facial emotional expressions. The aim of this study was to explore facial expressions recognition differences in children with dyscalculia, ADHD and dyslexia

**Participants and Methods:** Performance on an emotional facial expressions recognition task was analyzed in three groups: 1) 39 children with ADHD (mean age = 10.74 years). 2) 30 children with dyscalculia (mean age = 11.35 years) and 3) 20 children with reading disabilities (mean age = 11.1 years). Each group's performance in the facial expressions recognition task and in four object visual perception tasks (i.e. superimposed figures, blurry images, visual closures and integration of objects) was compared to the performance of their own matched control group.

**Results:** Dyscalculic children showed lower performance than the controls only in the facial expression recognition task; the ADHD group performed significantly lower on superimposed figures and facial expression recognition tasks. Finally, reading disabled children did not evidence difficulties in any of the visual perception tasks.

**Conclusions:** Our results suggest that children with dyscalculia as well as ADHD children exhibit difficulties in the recognition of emotional facial expressions. These findings are discussed regarding implications for the non-verbal disability disorder spectrum.

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## Symposium 10: When Should We Consider or Disregard a Person's Background for Neuropsychological Assessment?

Chair: David Schretlen

Discussant: George Prigatano

4:00–5:30 p.m.

### D.J. SCHRETLEN. When Should We Consider or Disregard a Person's Background for Neuropsychological Assessment?

**Symposium Description:** For nearly a century, psychologists have interpreted cognitive test performance by comparing a person's scores to those of healthy age peers. Modern neuropsychologists have expanded this approach by adding other variables, such as sex and years of education, to the stratification of normative data. The field has also witnessed an increasing use of regression-based methods to benchmark expected performance on testing. These procedures increase the precision with which we can estimate a person's pre-morbid abilities. This, in turn, has the potential to improve the diagnostic accuracy of neuropsychological testing. However, such increased precision also comes at a cost. For example, adjusting test scores for age, sex, or race precludes using test performance to study these variables as predictors of disease prevalence. Further, Silverberg and Millis (2009) have shown that adjusting scores can actually decrease the usefulness of test performance for predicting functional outcomes, such as the ability to work.

The aims of this symposium are twofold: First, each panelist will compare the usefulness of unadjusted and adjusted measures of cognitive performance for predicting specified clinical criteria. Second, by presenting the results in a single venue, the symposium seeks to evince a common understanding of when it is most useful to interpret cognitive test performance in light of a person's demographic background, and when it is most helpful to interpret test scores as measures of absolute ability without regard for a person's age, sex, or other characteristics.

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### N.D. SILVERBERG & S.R. MILLIS. When Demographically-Adjusted Norms Can Help and Harm Neuropsychological Prediction of Functional Competence After Traumatic Brain Injury.

**Objective:** Neuropsychological test performance is typically compared to demographically-adjusted normative data to estimate impairment, or decline from a patient's premorbid level. This interpretive method may not be ideal for predicting competence with real-world functional activities, a common goal of neuropsychological assessment in traumatic brain injury (TBI) rehabilitation. Rather, a patient's absolute level of current ability (estimated by comparisons to normative data that is not adjusted for demographic variables) seems more relevant to determining whether they can live alone, drive or use public transportation, compete for gainful employment, and manage other universal functional activities. We conducted a preliminary empirical investigation of this hypothesis.

**Participants and Methods:** Patients with post-acute moderate-to-severe TBI underwent neuropsychological testing and were rated on standardized measures of living independence, community ambulation, employability, and global daily functioning. Raw neuropsychological test scores were converted into both demographically-adjusted and unadjusted norm-referenced scores.

**Results:** Demographically-adjusted and unadjusted scores often differed substantially within participants. In a series of regression models, unadjusted scores better predicted certain functional outcome measures. Unadjusted scores also achieved higher dichotomous classification accuracy of independent/dependent status on the functional outcome measures.

**Conclusions:** Absolute ability level appears better suited to predict competence with functional activities that have universal cognitive demands. To determine readiness to return to a complex pre-injury activity after TBI, impairment (or residual ability) is proposed as most helpful. This presentation will outline evidence-based recommendations to enhance ecological validity by matching the interpretive method to the functional criterion.

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### R.H. BENEDICT & B.A. PARMENTER. Regression-Based Norms and the Minimal Assessment of Cognitive Function in Multiple Sclerosis (MACFIMS).

**Objective:** The Minimal Assessment of Cognitive Function in Multiple Sclerosis (MACFIMS) is a consensus neuropsychological battery with established reliability and validity. Because the MACFIMS is merely a collection of tests and not a singularly constructed battery, manual norms from disparate sources are used for interpretation.

**Participants and Methods:** We derived regression-based norms for the MACFIMS, using a unique data set to control for standard demographic variables. MS patients (n=395) and healthy volunteers (n=100) did not differ in age, level of education, sex, or race. Multiple regression analyses were conducted on the performance of the healthy adults, and the resulting models were used to predict MS performance on the MACFIMS battery. We compared T-scores and rates of impairment between these two types of norms. We also evaluated how neurologic symptoms, such as motor and oral agility, may moderate neuropsychological performance. Finally, we explored the association between MACFIMS results and vocational outcomes, with and without controlling for neurologic variables.

**Results:** Compared to the manual norms, regression-based norms resulted in lower T-scores and higher rates of impairment on many measures. Further, patients with dysarthria performed more poorly on several measures reliant on speech; patients with reduced manual dexterity performed more poorly on all cognitive tasks.

**Conclusions:** Whether a patient is diagnosed with cognitive impairment may vary depending on which norms are used. Controlling the effects of demographic variables allows us to highlight how other neurologic symptoms may contribute to neuropsychological performance and vocational outcome. Correspondence: *David J. Schretlen, Ph.D., Department of Psychiatry, Johns Hopkins University, 600 N. Wolfe Street, Meyer 218, Baltimore, MD 21287-7218, United States. E-mail: dschret@jhmi.edu*

### S.M. TESTA & D.J. SCHRETLEN. The Impact of Test Score Adjustment in Neuropsychiatric Disorders.

**Objective:** Classification accuracy in clinical neuropsychology involves a tradeoff between sensitivity and specificity. With statistical control of demographic factors that influence cognitive test performance, regression-based normative (RBN) procedures may allow for improved sensitivity without significant loss of specificity.

**Participants and Methods:** Data from 328 healthy adults (HA) were used to develop scaled scores (M=10; SD=3) based on cumulative frequency distributions for 16 neuropsychological tests. These scaled scores were regressed on age, sex, race, years of education, and estimated pre-morbid IQ. The resulting regression formulas and raw-to-scaled-score conversions were then applied to 104 adults with schizophrenia and 25 adults with Parkinson Disease. In order to determine how the rate of abnormal test scores change following demographic adjustment, the proportions of raw and adjusted test scores that fell below the 5th percentile were tallied for both patient groups. Additionally, logistic regression analyses were conducted to determine how classification rates change following demographic adjustment.

**Results:** In both patient groups, the adjusted test scores identified higher rates of impairment than the unadjusted raw scores for many of the 16 measures. Additionally, compared to raw test scores, adjusted test scores yielded improved sensitivity with comparable specificity.

**Conclusions:** In adults with either schizophrenia or Parkinson disease, the diagnostic accuracy of neurocognitive testing was improved by using a regression-based approach to demographic adjustment. This improvement was mainly due to increased test sensitivity without any loss of specificity.

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#### **C.A. MUNRO & S.K. WEST. Demographically-Adjusted vs. Unadjusted Test Scores in the Prediction of Driving Errors by Elderly Drivers.**

**Objective:** As the population ages, the number of elderly drivers is also increasing. Compared to younger individuals, the elderly are more susceptible to conditions that affect cognitive and functional capacities. For this reason, the ability to predict factors that relate to motor vehicle crashes, such as driving errors, among this population is becoming increasingly important.

**Participants and Methods:** Participants were 1021 (513 women) elderly (age 69-90 years) individuals studied in Round 3 of the Salisbury

Eye Evaluation Driving Study (SEEDS). As part of the study, participants completed a battery of cognitive tests. In addition, a driving monitoring system (DMS) was installed in their cars for 5 days, during which numerous indices of driving behavior were recorded. Study raters extracted data from the DMS and determined error rates for various driving maneuvers, including performing successful lane-changes, and stopping at stop signs. We compared the predictive utility of demographically-adjusted cognitive test scores and cognitive test scores unadjusted for demographic variables on the prediction of various driving errors.

**Results:** For all types of driving errors measured, unadjusted cognitive test scores accounted for greater variance in error rates than did cognitive test scores that were adjusted for sex, race, age, and education.

**Conclusions:** Driving errors increase the risk of motor vehicle crashes. Results from this study indicate that cognitive test scores that are not adjusted for demographic variables are better predictors than scores that are demographically adjusted. These findings have applicability to clinicians as they make recommendations concerning driving in the elderly.

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### SATURDAY MORNING, FEBRUARY 6, 2010

#### **Invited Address: Developmental Neuroscience of ADHD: Are We There Yet?**

**Speaker: F. Xavier Castellanos**

**9:00–10:00 a.m.**

#### **F. CASTELLANOS. Developmental Neuroscience of ADHD: Are We There Yet?**

Research on ADHD is becoming increasingly developmental. Converging lines of neuroimaging evidence seem to support the clinical observation of maturational delays in self-regulatory abilities. Structural imaging studies highlight the delayed trajectories of initially increasing and then decreasing cortical thickness in children with ADHD compared to typically developing controls. However, a strict interpretation of the maturational delay model implies eventual normalization. In contrast, the first prospective study of children diagnosed with ADHD followed into adulthood demonstrates that structural deficits in ADHD endure into middle adulthood. Similarly, functional imaging of spontaneous fluctuations ("resting state" fMRI) reveals functional connectivity patterns in adulthood reminiscent of those found in children. These results will be discussed in light of Helperin's model that posits enduring subcortical deficits that can be ameliorated by prefrontal maturational compensation.

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#### **Symposium 11: Cognitive Remediation for Individuals with Schizophrenia**

**Chair: Elizabeth Twamley**

**Discussant: Susan McGurk**

**9:00–10:30 a.m.**

**E.W. TWAMLEY, S.R. MCGURK, M.M. KURTZ, J. CHOI, E.W. TWAMLEY & J.M. FISZDON. Cognitive Remediation for Individuals with Schizophrenia.**

**Symposium Description:** The neuropsychological impairments of schizophrenia result in poor functional outcomes such as unemployment and inability to live independently. Although these cognitive impairments have no known effective pharmacological treatments, there are several psychosocial interventions that can improve both cognition and functional capacity in this population. Cognitive remediation interventions vary in their length, modality (individual vs. group), specificity (one targeted cognitive domain vs. multiple domains), and incorporation of computers and technology. They also differ in their theoretical bases; top-down approaches, which tend to focus on compensatory strategy training, are contrasted with bottom-up approaches, which tend to focus on restorative drill-and-practice training. This symposium will include four presentations of theoretically and methodologically diverse cognitive remediation programs. Matthew Kurtz will discuss an intensive (12-month), computer-assisted, restorative cognitive remediation intervention, as well as the role of general computer training. Jimmy Choi will present on a brief (10 session) top-down, computer-based intervention focused on executive functioning, and will also discuss the role of expectancy theory and motivation to succeed in cognitive remediation outcomes. Elizabeth Twamley will discuss a brief (12 session) group-based compensatory cognitive training intervention focusing on prospective memory, attention, learning/memory, and executive functioning. Joanna Fiszdon will present on a brief (two month) intervention that incorporates both restorative and compensatory approaches

and uses both computerized and paper-and-pencil training. Susan McGurk, the discussant, will comment on the similarities and differences in the approaches of the four interventions, the methodology of the studies, and the future of cognitive remediation research for neuropsychiatric disorders.

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**M.M. KURTZ, J.C. SELTZER, D.S. SHAGAN & B.E. WEXLER. A Restorative, Drill-and-Practice Approach to Cognitive Remediation in Schizophrenia: How Specific Are Its Effects?**

**Objective:** An emerging body of research has shown that computer-assisted cognitive remediation, consisting of training in attention, memory, language and/or problem-solving, produces improvement in neurocognitive function that generalizes to untrained neurocognitive tests and may also impact symptoms and work functioning in people with schizophrenia (e.g., McGurk et al., 2007). The active ingredient of these interventions, however, remains unknown as control groups in these studies have typically included few, if any, of the elements of these complex behavioral treatments.

**Participants and Methods:** This study compared the effects of an extended (12-month), standardized, computer-assisted, restorative cognitive remediation intervention targeted at elementary neurocognitive functions and organized in a hierarchical manner (e.g., sustained attention trained prior to divided attention), with those of a computer-skills training control condition that consisted of many of the elements of the experimental intervention.

**Results:** Results revealed that cognitive-remediation training produced significant improvement in working memory, relative to the computer-skills training control condition, but that there was overall improvement in both groups on measures of working memory, executive function, episodic memory, and processing speed.

**Conclusions:** Taken together, these findings suggest that specific practice in neurocognitive exercises targeted at elementary skills attention, memory and language, produce improvements in neurocognitive function that are not solely attributable to non-specific stimulation associated with working with a computer, interacting with a clinician or cognitive challenge, but that non-specific stimulation has a salutary effect on neurocognition as well. Additional research investigating predictors of response to this restorative approach to cognitive remediation will also be discussed.

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**J. CHOI & A. MEDALIA. Expectancy Theory and Learning Persistence in Schizophrenia.**

**Objective:** Amotivation is a hallmark of negative symptomatology in schizophrenia, impacting many facets of behavior, including inclination to attempt demanding cognitive tasks involved in cognitive remediation (CR). Experiences of external reward and hedonic anticipatory enjoyment are diminished in psychosis, so therapeutics which instead target motivation for cognitive tasks may enhance task engagement, and subsequently, remediation outcome. Expectancy Theory posits that expectations of success on a learning task are a central determinant of motivation to learn, and research indicates that in healthy controls these expectations can sometimes influence the degree of improvement more so than general cognitive ability.

**Participants and Methods:** We examined motivational constructs, symptoms, and neuropsychological performance as predictors of outcome in a sample of 70 outpatients with schizophrenia who received 10 sessions of a top-down, computer-based executive training program designed to improve working memory and problem-solving skills.

**Results:** Baseline expectations of success as measured by the Perceived Competency Scale (PCS), a self report measure of perceived competence

on specific learning tasks, predicted greater learning from CR, even after accounting for baseline cognitive ability, symptoms, and self reports of task anxiety and enjoyment. Effects were still evident at follow-up, as subjects with high reports of self competency after treatment were 4 times more likely to retain what was taught during CR even after 3 months.

**Conclusions:** These findings support the notion that Expectancy Theory is operative in schizophrenia, and that treatment benefits may be enhanced and better maintained if CR also focuses on perceptions of competency for the training tasks.

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**E.W. TWAMLEY, L. VELLA & C.Z. BURTON. Compensatory Cognitive Training Improves Neuropsychological, Functional, and Clinical Outcomes in Psychosis.**

**Objective:** Individuals with psychotic disorders experience numerous neuropsychological and functional impairments. Compensatory Cognitive Training (CT) is a manualized, 12-week, group-based intervention to improve prospective memory, attention, learning and memory, and executive functioning. Sessions emphasize strategy learning, development of new cognitive habits, and transfer of skills into community settings. We hypothesized that CT would lead to improvement in the targeted neuropsychological domains and in functional capacity.

**Participants and Methods:** Sixty-four outpatients with schizophrenia or related psychotic disorders participated in a 6-month randomized controlled trial comparing CT plus standard pharmacotherapy to standard pharmacotherapy alone (SP). Measures, administered at baseline, 3 months, and 6 months, included assessments of neuropsychological performance (forward digit span; Hopkins Verbal Learning Test; Wisconsin Card Sorting Test; Memory for Intentions Screening Test), positive, negative, and depressive symptom severity, functional capacity (UCSD Performance-Based Skills Assessment; UPSA), and quality of life. Z summary scores were created to summarize targeted and non-targeted neuropsychological domains. Hierarchical linear modeling was used to analyze the data, with effect estimates (EE) generated for each treatment-by-time effect.

**Results:** CT participants improved differentially on the targeted neuropsychological domain score (EE=0.21,  $p=.036$ ) and the UPSA (EE=7.90,  $p=0.005$ ). Compared to the SP group, the CT group also exhibited less severe negative symptoms over time (EE=-3.84,  $p=0.023$ ). Changes in non-targeted neuropsychological performance, quality of life, positive, and depressive symptoms did not differ between groups (all  $p \geq 0.07$ ).

**Conclusions:** These results indicate that compensatory cognitive training may lead to improvements not only in cognition, but also in more distal outcomes, such as functional capacity and negative symptom severity.

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**J.M. FISZDON. Efficacy of a cognitive remediation program combining computerized hierarchical drill and practice training with paper-and-pencil training in the use of compensatory strategies: preliminary results.**

**Objective:** Extant literature documents significant cognitive impairments in schizophrenia. Cognitive function in schizophrenia has been linked to functional outcomes, and cognitive remediation has been proposed as a promising treatment that may attenuate cognitive impairments, which in turn may improve patients' abilities to benefit from other psychosocial treatments and hence improve functional outcomes. Cognitive remediation therapies have varied widely as far as treatment

focus, modality, length, and use of motivational enhancements. Current therapies usually implement a single modality, either paper and pencil versus computer-based exercises, or compensatory strategies versus bottom-up drill and practice training. The current study examined the efficacy of a cognitive remediation program which combined several treatment modalities.

**Participants and Methods:** Individuals with schizophrenia were randomly assigned (1:2 ratio) to either treatment as usual (TAU) or two months of a combined computerized drill-and-practice training along with paper-and-pencil training on the use of compensatory strategies (COG). Outcomes examined were pre-post performance changes on five neurocognitive indices: verbal memory, attention, working memory, executive function, and visual construction.

**Results:** Preliminary analyses indicated that both groups evidenced significant improvements on verbal memory. When between-group effects were examined, analyses indicated that the COG sample improved significantly more on a working memory composite, with trend-level improvements on an executive function composite.

**Conclusions:** Results will be discussed with respect to using combined drill-and-practice plus compensatory strategy training, length of training, potential effects of participant age on cognitive training gains, and potential practice effects.

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## Symposium 12: Primary Progressive Aphasia: Diagnostic, Clinical, and Research Perspectives

Chair: Sandra Weintraub

9:00–10:30 a.m.

**S. WEINTRAUB, E. ROGALSKI, J. MEDINA, D. COBIA & N. JOHNSON. Primary Progressive Aphasia: Diagnostic, Clinical, and Research Perspectives.**

**Symposium Description:** Primary Progressive Aphasia (PPA) is a dementia syndrome characterized initially by the insidious onset and gradual progression of language-based deficits, including impaired object naming, word finding, syntax, fluency, and word comprehension. These language-based symptoms occur in the presence of relatively spared functioning of other cognitive domains, for at least the first two-years after observed symptom onset. PPA has a unique presentation and course, and can be distinguished from other clinical dementia syndromes, such as probable Alzheimer's disease (PRAD) and the behavioral variant of frontotemporal dementia (bvFTD). While the history of progressive aphasias is over a century old, interest in PPA has recently reemerged based on the predictive validity of language deficits for specific forms of neurodegenerative brain disease, and on the unique challenges faced by patients and those who care for them.

The primary purpose of this symposium is to generate increased awareness and interest in PPA among neuropsychologists by providing information from recent clinical and laboratory investigations. First, Dr. Rogalski will provide an overview of the history, diagnostic criteria, epidemiology, and clinical features of PPA, including how its presentation differs from stroke-related aphasia and probable Alzheimer's disease. Second, Dr. Medina will discuss the neuropsychological assessment of PPA using patient profiles to highlight critical areas of language and other domains. Dr. Cobia will present findings from recent PPA functional and structural neuroimaging studies. Finally, Dr. Johnson will discuss the newly established national PPA registry and other large-scale collaborative efforts aimed at increasing knowledge about the epidemiology and semiology of PPA.

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### **E. ROGALSKI. An Overview of Primary Progressive Aphasia: a Language-Based Dementia.**

**Objective:** The term 'dementia' is used to denote any slowly progressive decline of cognition or behavior that undermines customary daily living activities and is caused by neurological disease. Alzheimer's disease is the most common dementia syndrome characterized by salient memory loss; however other clinical forms exist. The focus of this lecture is on the less common dementia syndrome, primary progressive aphasia (PPA). The diagnosis of PPA is made in any patient in whom a language impairment (aphasia), caused by neurodegenerative disease (progressive), constitutes the most salient aspect of the clinical picture (primary).

Our main objective is to provide a comprehensive review of the history, diagnostic criteria, risk factors, and epidemiology of PPA. The longitudinal 'Language in PPA' research project at Northwestern University, which uses hypothesis-driven experiments to investigate mechanisms of lexical disruption, will be described. Data from this project will be presented as they address issues related to clinical subtyping and clinical-neuropathological correlation.

Research over the past 30 years has led to substantial progress in the understanding of the clinical characteristics, genetics, and neuropathology of PPA. This work has contributed to refinement of the diagnostic criteria and clear distinctions of PPA from other dementia syndromes and also from aphasia resulting from stroke.

Despite substantial progress in PPA research, critical gaps in our understanding and low awareness of this syndrome remain as challenges. A summary of the controversies and future directions of research in the field will be provided.

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### **J. MEDINA. Neuropsychological Assessment of Patients Diagnosed with Primary Progressive Aphasia.**

**Objective:** Primary Progressive Aphasia (PPA) is a clinical neurodegenerative syndrome that initially causes a progressive loss of language functioning while other cognitive domains remain relatively preserved. Classical aphasiology has typically provided the framework within which to categorize aphasia. However, due to the partial and progressive nature of the lesions causing PPA, these patients' symptoms defy the classical characterizations. This presentation will discuss common neuropsychological profiles of patients who have participated in the 'Language in PPA' project at Northwestern University. Patient performance on cognitive testing, from early to late disease stages, will be used to delineate important areas to assess within the language domain, such as syntax and word comprehension. The challenges associated with evaluating patients with a language based dementia, such as the use of verbally mediated memory tests, will be discussed. Patient's test performance across domains will also be exemplified, and results will show that many PPA patients perform normally on tests in non-language domains in early stages, especially when language is not a mediator of test performance. Specific measures that are useful with PPA patients will be highlighted, as well as tests to avoid when assessing this population. Suggestions for overcoming assessment challenges, based on empirical data, will be presented. Finally, the utility of using individual neuropsychological assessment profiles to tailor clinical recommendations for the patient with PPA will be discussed.

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### **D. COBIA. Neuroimaging in Primary Progressive Aphasia.**

**Objective:** This presentation will concentrate on recent advances in the field of neuroimaging and computational anatomy that have allowed for

greater precision in the measurement and analysis of brain structures, with emphasis on the neurodegenerative syndrome PPA. Early MRIs of PPA patients revealed a highly selective pattern of atrophy targeting left frontal, parietal, and temporal perisylvian regions, consistent with the predilection of pathology for the left hemisphere language network and with the clinical salience of language dysfunction. Subsequent voxel-based morphometry studies confirmed these observations by demonstrating greater volume loss in left than right perisylvian regions compared to healthy individuals. Functional (PET/SPECT) imaging studies also confirmed isolated, asymmetric dysfunction in the form of hypometabolism and hypoperfusion in left perisylvian cortex, with normal values in the right. More recently, imaging studies have confirmed that selective areas of dysfunction and tissue loss exist within the language network that differ with the nature of the language deficits, or PPA "variants". Thus, different patterns of atrophy distinguish syntactic from semantic language impairments. In this presentation, new surface-based methods, such as cortical thickness and shape analyses, are presented showing precision measurement of cortical laminar and folding attributes combined with clinical and neuropsychological data in support of the clinical heterogeneity of this syndrome.

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#### **N. JOHNSON. An International Registry for Primary Progressive Aphasia.**

**Objective:** The goal of the project described in this presentation is to create an internationally accessible web-based registry of subjects with primary progressive aphasia (PPA). Because PPA is a relatively rare syndrome, previous research in this area has almost exclusively focused on case studies due to the small number of subjects available at any one site. This registry provides the infrastructure for collecting larger samples of subjects and for national and international collaborations on the biology and treatment of PPA. Thus, investigators can enter limited information on patients in their institutions and can search for other sources of available patients for studies. Summary statistics including demographic characteristics, language profiles, neuropathological findings, and genetic information collected to date will be presented. Another important purpose of this registry is to establish a site for patients and families to identify local resources, including speech therapy services, support groups, clinical trials, educational seminars, and specialized evaluation centers. Information on current programs for PPA patients and caregivers will be presented as well as information on how to submit resource information to the registry and collaborative study proposals.

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#### **Poster Session 8: Assessment/Psychometrics/Methods (Adult), Forensic Neuropsychology, Genetics/Genetic Disorders, Hemispheric Asymmetry/Laterality/Callosal Studies**

**9:30–11:00 a.m.**

#### **Assessment/Psychometrics/Methods (Adult)**

#### **L.J. ALTMANN, J.P. WILSON & S.E. KEY-DELYRIA. Comparing Computerized Versions of the Stroop and Cue-Switching Stroop Tasks.**

**Objective:** Recent literature has begun publishing studies using computerized versions of the Stroop task. Some report scores from cue-

switching versions of the task, and others report data from more traditional non-switching versions. Although intuition suggests that cue-switching versions should be harder, little is known about the properties of these versions of the Stroop. This study compares performance on cue-switching and non-switching versions of the Stroop task

**Participants and Methods:** 31 participants completed 2 Stroop tasks: non-switching color-word interference, and a cue-switching version in which participants were cued to produce either the WORD or the COLOR of the following stimulus. In all versions, cues were presented in white on a black background, followed by a color word shown in either the same color font (congruent) or a different color font (incongruent). 25% of trials were incongruent, and 75% were congruent. Only results for incongruent stimuli are reported.

**Results:** Color-Cued stimuli were least accurate and Word-Cued stimuli were significantly more accurate. Non-Switching accuracy did not differ from either of these. Accuracy across conditions did not correlate. Accuracy in only the Non-Switching condition correlated with other cognitive tasks.

RTs in the Non-Switching and Word-Cued conditions were similar and significantly less than RTs in the Color-Cued condition. Color-cued RTs correlated with RTs in the other two conditions, which did not correlate with each other. No RTs correlated with other cognitive scores.

**Conclusions:** These results demonstrate that the Cue-Switching Stroop task is an unknown quantity. While cue-switching is more difficult than the non-switching version, it is unclear whether it is measuring inhibition or switch cost, or whether the appropriate dependent variable is accuracy or RT.

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#### **E. ANDRESEN, E. SAMSIN, A. ORVIS, D.C. OSMON & A. HARRISON. Item Order Effects in the Symptom Validity Add-On Scale for Conner's Adult ADHD Rating Scale.**

**Objective:** Recent studies have demonstrated that it is relatively easy to feign symptoms of ADHD on self-report measures (Jachimowicz & Geiselman, 2004; Quinn, 2003). Allyson Harrison (personal communication) developed an experimental symptom validity scale for the Conner's Adult ADHD Rating Scale (CAARS) consisting of uncommon symptoms that appear to be related to inattention or difficulty concentrating, but which are rarely endorsed in clinical populations. This study investigated the effects of the placement of the symptom validity items within the CAARS questionnaire.

**Participants and Methods:** All participants took the CAARS online. 157 undergraduates received a version of the CAARS with the symptom validity items appended to the end of the questionnaire, and 197 undergraduates received a version of the CAARS with the symptom validity items distributed throughout the questionnaire. All students took the questionnaire in order to receive extra credit in a psychology course, and had no incentive to appear attention disordered.

**Results:** A MANOVA was significantly different between the groups. Specifically, the redistributed group had significantly higher scores on the DSM-IV Inattention index and on the symptom validity scale.

**Conclusions:** Scores on the symptom validity scale were 2 points higher in the redistributed version of the CAARS than when the symptom validity items were clustered at the end. Clustering the items could allow participants to more easily discern that the symptom validity items differ from the rest of the CAARS items, artificially deflating the scores.

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#### **E. ANDRESEN, A. ROZMARYNOWSKI, D.C. OSMON & A. HARRISON. Symptom Validity Check in Conner's Adult ADHD Rating Scales: A Simulator Study.**

**Objective:** Incentives to feign ADHD in psychoeducational assessments have been well documented (Sullivan, May, Galbally, 2007). Recent

studies have demonstrated that it is relatively easy to feign symptoms of ADHD on self-report measures (Jachimowicz & Geiselman, 2004; Quinn, 2003). The present study evaluated the utility of a symptom validity scale added on to the Conner's Adult ADHD Rating Scale (Harrison, personal communication) on the detection of simulated ADHD.

**Participants and Methods:** 56 undergraduate students took the CAARS as part of a larger study. Students were randomly assigned to a high incentive control or ADHD simulator group. Dr. Harrison's symptom validity add-on scale consists of items that appear to relate to attention or concentration problems, but which are not commonly endorsed by symptomatic populations.

**Results:** Simulators differed from controls on all CAARS scales except the Inconsistency Index. Control T scores fell within the average range or better on all scales, while simulator T scores were greater than 65 on scales measuring inattention, hyperactivity, DSM-IV ADHD symptoms, and an overall ADHD index. Simulator scores on the symptom validity scale were 10 points higher than controls. ROC analysis revealed that the symptom validity scale attained 82% sensitivity with 75% specificity and Area Under Curve=83%.

**Conclusions:** Dr. Harrison's symptom validity scale for the CAARS may be useful in the detection of simulated ADHD. More research using known groups would be useful in determining possible cut off scores.

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#### A. ARENIVAS, H. ROSSETTI, M. ROGERSON, K. NOLL & L. LACRITZ. Victoria Stroop Performance in Multiple Sclerosis, Parkinson's Disease, and Alzheimer's Disease.

**Objective:** The Victoria Stroop (VS) is an abbreviated Stroop task that assesses selective attention and response inhibition, yet has not been widely studied in specific clinical populations to identify differential patterns of performance.

**Participants and Methods:** A consecutive series of 499 patients [multiple sclerosis (MS; n=133), Parkinson's disease (PD; n=142), Alzheimer's disease (AD; n=224)], were administered the VS as part of a larger neuropsychological evaluation. Group performances were compared across trials (dot-color=T1, neutral word-color=T2, and incongruent word-color=T3), as were interference scores (incongruent color-word time/dot time) and number of errors on T3, using one-way ANCOVAs (controlling for education).

**Results:** Age scaled-scores were mildly impaired but not significantly different among groups on T1 [ $F(2, 495)=1.49, p=.23$ ]. ADs (M T2=6.09, T3=6.96) performed significantly worse than the PD (M T2=6.89, T3=8.07) and MS (M T2=6.78, T3=8.09) groups on T2 [ $F(2, 495)=4.12, p=.02$ ] and T3 [ $F(2, 495)=8.54, p<.001$ ]. Interference scores were not impaired and did not differ among groups [ $F(2, 495)=1.93, p=.15$ ]. ADs and PDs made more errors on T3, but there were no significant differences [ $F(2, 495)=2.19, p.11$ ].

**Conclusions:** MS and PD groups performed similarly (T1, T2 < T3), while the AD group was impaired across trials and lower than MS and PD on T2 and T3. No group demonstrated a specific interference effect on T3. Performances appear most related to generalized cognitive slowing, consistent with other reports of Stroop patterns in these populations, though the shorter VS format may not elicit interference effects to the same extent as longer versions of the test.

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#### M. KRYZA, S. LUKOWSKI, M. FREEDBERG, A. HOUGHTON, T.M. ATKINSON & J.P. RYAN. Equivalency of Trail Making Test Scores in Serial Assessment: Halstead-Reitan, Delis-Kaplan Executive Function System, and Comprehensive Trail Making Test.

**Objective:** The Trail Making Test (TMT) is one of the most frequently used neuropsychological assessment instruments; however the existence

of practice effects during serial administration can potentially skew results and cloud clinical interpretation. To remedy this methodological issue, it would assist clinicians to have an understanding of the psychometric properties of the available commercial forms of the TMT in order to determine whether they could be substituted across testing sessions while capturing information on the same underlying constructs. Construct validity, order effects and the equivalency of scores were examined in the TMT, Comprehensive Trail Making Test (CTMT), and Trail Making Test of the Delis-Kaplan Executive Functioning System (DK-TMT) during serial individual administration.

**Participants and Methods:** Over a three week period the TMT, CTMT, and DK-TMT were individually administered to 184 undergraduate psychology students in each of six possible orders. Confirmatory factor analysis was used to investigate construct validity of the outcome measures, factorial invariance, potential order effects, and score equivalencies.

**Results:** A two factor model (sequencing-switching) was shown to best fit the data and was invariant across groups. A latent means analysis showed no differences between the factor means for each of the groups, indicating the absence of order effects.

**Conclusions:** The TMT, CTMT, and DK-TMT share the same underlying factors of sequencing and switching. Structural analyses provided evidence that these measures can be used interchangeably in serial individual assessment without discernable practice effects. These results can assist clinicians in making meaningful interpretations across tests during serial neuropsychological assessment.

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#### M.D. BARKER, M.D. HORNER & D.L. BACHMAN. Embedded Indices of Effort in the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a Geriatric Sample.

**Objective:** Indices of effort embedded in standard neuropsychological tests were examined in a geriatric sample. The primary aim was to cross-validate Silverberg et al.'s (2007) embedded Effort Index for the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in an elderly sample. A secondary aim was to evaluate whether other embedded measures could augment prediction of suspect effort.

**Participants and Methods:** Participants were seen for clinical services in the geriatric Memory Disorders Clinic at a VA hospital. Suspect effort (n=45) was defined as failure of the Test of Memory Malingering (TOMM) and clinical consensus, and probable good effort (n=258) was defined as passing TOMM and clinical consensus. Following Silverberg et al. (2007), RBANS Digit Span and List Recognition subtests and a summary Effort Index were evaluated. In addition, RBANS Picture Naming, WMS-III Information/Orientation, and Trail Making were evaluated as potential effort indicators.

**Results:** In a logistic regression, significant predictors of suspect effort included all test scores except Trail Making Part A. Classification accuracy of the significant predictors was further examined using receiver operating characteristic curve analysis. Cut-offs are suggested for the Effort Index (>3), List Recognition (<15), Digit Span (<8), Naming (<9), and Information/Orientation (<11); these yield specificity of approximately 85% with sensitivities from 42-64%.

**Conclusions:** Embedded indices in the RBANS and WMS-III Information/Orientation offered modest predictive utility in detecting suspect effort in older adults. If used to supplement symptom validity tests, these indices could provide useful information about effort, which may be valuable in a shorter battery often used in memory disorders clinics.

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#### J. BARRASH, A. STILLMAN, S.W. ANDERSON, J. DAWSON & M. RIZZO. Predicting Real Life Driving Ability: Demographic Corrections Diminish Predictive Accuracy.

**Objective:** Demographic adjustments to test scores are assumed to enhance the accuracy of inferences based on neuropsychological assess-

ment. However, predictive accuracy for complex real-world activities may be diminished by adjusting scores for demographic factors, compared to “raw” scores. Despite the important implications, this possibility has not been well studied. It was hypothesized that driving ability is predicted by raw scores, and demographically-adjusted scores diminish predictive accuracy.

**Participants and Methods:** Participants were community-dwelling drivers, aged 65+, with MMSE of 26+. Twenty-four were normal controls; 26, Alzheimer’s disease; and 33, Parkinson’s disease. Neuropsychological assessment included five measures correlated with driving performance: Trail Making Test, A and B; Complex Figure Test; Benton Visual Retention Test; and WAIS-III Block Design. Driving ability was assessed with a standardized 45-minute on-road driving test.

**Results:** Multiple linear regression revealed that a model with raw scores from all five neuropsychological measures was significantly predictive of driving errors ( $R^2 = .196, p < .006$ ). A parallel model employing demographically-adjusted scores was not significantly predictive ( $R^2 = .112, p > .11$ ), with a significant reduction in variance accounted for compared to raw scores ( $p < .01$ ). Follow-up analysis showed higher correlations for raw scores than adjusted scores for each of the five neuropsychological measures. Findings were consistent across study groups.

**Conclusions:** Competency in complex real life activities depends on the integrity of requisite abilities, regardless of demographic considerations. Demographic corrections diminished the predictive accuracy of neuropsychological measures for driving safety, and this effect was observed across neuropsychological measures and across neurological status: healthy vs. neurodegenerative disease.

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#### **J. BARRASH, K. MANZEL, C. CARTER & D. TRANEL. The Iowa Scales of Personality Change: Sensitivity to Personality Changes Following Ventromedial Prefrontal Lesions.**

**Objective:** The Iowa Scales of Personality Change (ISPC) was developed for assessment of neurological patients. It was hypothesized that the ISPC would show sensitivity and specificity to personality disturbances found to be associated with damage to ventromedial prefrontal cortices (VMPF) in an earlier study with the initial version of the scales, the Iowa Rating Scales of Personality Change (IRSPC).

**Participants and Methods:** Participants were age 18 or greater, had adult-onset focal brain lesions and premorbid histories free of psychiatric disorder. All were in the chronic recovery epoch. Neuroanatomical data were used to form two groups: (1) 34 with VMPF lesions; (2) 52 with non-prefrontal (nPF) lesions. The ISPC includes ratings of patients’ characteristic premorbid functioning (“Before”) and since (“Now”) neuropathological onset on 30 characteristics rated by an informant. “Change” is calculated from Now and Before ratings.

**Results:** VMPF and nPF did not differ on premorbid personality characteristics with the exception of Poor Judgment (more characteristic of nPF). VMPF were rated as having significantly greater change in Irritability, Lack of Initiative, Perseverative Behavior, Lack of Planning, Inflexibility, Poor Judgment, Insensitivity, Social Inappropriateness, Poor Frustration Tolerance, and Vulnerability to Pressure. Acquired disturbances in Irritability, Perseverative Behavior, Inflexibility, and Insensitivity were specifically associated with VMPF damage, being characteristic of approximately 50% of VMPF and infrequent among nPF.

**Conclusions:** The ISPC is sensitive to specific personality changes following ventromedial prefrontal damage. Specificity was demonstrated for several scales. Results were consistent with past findings with the IRSPC. Findings support the external validity of the ISPC and its comparability to the IRSPC.

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#### **B.C. BAUGHMAN, E. CROUSE, L. HENNESSEY, B. ROPER, J. VANDERGRIF & J. CARON. Test of Practical Judgment (TOP-J): Measuring real-world judgment in geriatric veterans.**

**Objective:** Despite research demonstrating the ecological validity of some common neuropsychological measures (Chaytor & Schmitter-Edgecombe, 2007; Espinoza, et al., 2009), there remain a paucity of studies examining everyday judgment in geriatric populations. Most neuropsychologists lack confidence in the usefulness of traditional neuropsychological measures in estimating patients’ judgment (Rabin, et al., 2008). Rabin and colleagues (2007) developed the Test of Practical Judgment (TOP-J) as a clinician-administered measure of judgment in older adults. The TOP-J demonstrated strong psychometric properties in the normative sample of highly-educated, Caucasian, older adults without coexisting psychiatric disorders, as well as discriminating clinical group severity (e.g., healthy controls, MCI, mild DAT). However, generalizability of the TOP-J to geriatric veterans is unknown, given the broader demographic range and presence of comorbid psychiatric disorders in this population.

**Participants and Methods:** A convenience sample of 46 geriatric patients undergoing routine dementia evaluation at a VA medical center completed the TOP-J in the context of a neuropsychological battery.

**Results:** Participants were less educated ( $M=11.9, SEM=.47$ ), more racially diverse, and had lower TOP-J (9-item) scores ( $M=16.5, SEM=.63$ ) than the normative data sample. Robust correlations were found between the TOP-J and various measures of neurocognitive function, whereas performance was unrelated to education or mood.

**Conclusions:** Results broadly support Rabin’s initial findings regarding the TOP-J’s validity and reliability. However, there was evidence that normative data specific to veterans need to be developed, based on data from this small sample. Implications for future research and assessment of judgment in geriatric populations are discussed.

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#### **K.A. BERNARDO, H.C. ROSSETTI, A. COLEMAN, D.J. WOOLSTON, P. O’SUILLEABHAIN & L.H. LACRITZ. Longitudinal Texas Card Sorting Test Performance in PD.**

**Objective:** The Texas Card Sorting Task (TCST) is a brief executive function measure that correlates with other executive tasks and has shown orbitofrontal activation on fMRI. Individuals with Parkinson’s disease (PD) often demonstrate frontal systems dysfunction. It was hypothesized that the TCST would be sensitive to change over time in a PD sample compared to a global cognitive measure.

**Participants and Methods:** Fifty-eight individuals in early-stages of PD [ $M$  age 67.92 (9.46);  $M$  education 16.34 (2.94)] were administered the TCST and MMSE at Time 1 (T1) and 3 years later (Time 2; T2) [ $N=32$ ] as part of larger battery. Change Scores (CS) were derived, and effects of demographic variables on T1, T2, and CS were examined.

**Results:** TCST Total Scores (i.e., total logical sorts,  $\max=10$ ) at T1 [ $M=5.05(1.19)$ ] and T2 [ $M=3.81(1.64)$ ] were significantly different [ $t(31)=3.88, p=.001$ ], while MMSE at T1 [ $M=28.36(2.30)$ ] and T2 [ $M=27.63(2.34)$ ] was not [ $t(34)=1.62, p=.115$ ].

TCST-CS [ $M=-1.13(1.64)$ ] significantly correlated ( $p < .02$ ) with MMSE-CS [ $M=-0.89(3.24)$ ] ( $r=-.53$ ). Age, education, gender, and MMSE did not significantly impact TCST-CS [ $R^2=.10, \text{adjusted } R^2=-.03, F(4, 31)=.75, p=.57$ ].

**Conclusions:** The PD sample demonstrated similar performance to normal controls [Lacritz et al., 2008  $M=5.2(1.4)$ ] at baseline, but significant impairment at T2. The TCST was more sensitive to cognitive decline than a simple screening measure (MMSE). Demographic variables were minimally associated with T1 and T2 performance and did not correlate with TCST-CS. This study supports the utility of the TCST in PD. Correspondence: *Keith A. Bernardo, MA, UT Southwestern Medical Center, 5323 Harry Hines Blvd., Dallas, TX 75390-8846, United States. E-mail: keithbernardo@yahoo.com*

**E. CISNEROS, G. CHARETTE & M. MCKERRAL. Choosing rehabilitation goals after brain injury: The Client's Intervention Priorities instrument.**

**Objective:** People with acquired brain injury (ABI) must often contend with multiple sequelae that can negatively impact complex behaviours, in particular decision-making. Accomplishing tasks that involve making decisions relies on the activation of several cognitive processes including, among others, executive functions, divided attention, and working memory, often affected after ABI. In parallel, decision-making about oneself after ABI can be troubled by anosognosia. In spite of this, however, making decisions about one's own rehabilitation process, especially in a socio-professional reintegration level, is a central motivation factor to active participation in treatment, and contributes to the development of self-determination and autonomy, both main goals of rehabilitation. We present Client's Intervention Priorities (CIP), an interdisciplinary instrument for self-assessment of perceived performance on life habits and establishing rehabilitation priorities.

**Participants and Methods:** We describe the main principles guiding the development of the instrument, essentially the respect of patients' self-determination level, and the enhancement of intrinsic motivation for rehabilitation. We also present the material composing the instrument, as well as administration procedures that can help reduce the impact of cognitive problems on decision-making and examiner influence.

**Results:** Clinical uses of the instrument developed in Quebec, Canada, are discussed, in particular the patient's involvement in the elaboration of individualized objectives for in the intervention plan. Results of the initial metrological study of the CIP and future research projects are presented.

**Conclusions:** The CIP is a tool with high validity and fidelity for use with ABI populations. It is valuable in supporting patients' involvement and decision-making in regards to their rehabilitation goals, thus promoting motivation, self-determination, and successful rehabilitation. Correspondence: *Eduardo Cisneros, Centre de réadaptation Lucie-Bruneau, 2275, avenue Laurier Est, Montreal, QC H2H 2NS, Canada. E-mail: ecisneros.crlb@sss.gouv.qc.ca*

**J. CODA, L. MAUCIERI & C. RANDOLPH. Test-Retest Equivalence and The Use of Alternate Forms Versions C and D with The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS).**

**Objective:** The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS, Randolph, 1998) is commonly used for the clinical assessment of dementia, and as a brief neurocognitive battery for a variety of other clinical applications. It is relatively unique, in that it was specifically designed with alternate forms to reduce practice effects upon repeat administrations, and it is being increasingly used as an endpoint in clinical trials and for other research applications. In addition to forms A and B, published in 1998, forms C and D were recently released for research applications, but form equivalence has not yet been reported. The purpose of this study was to explore form equivalence and the magnitude of practice effects in a healthy sample administered all four forms of the RBANS at weekly intervals.

**Participants and Methods:** A sample of healthy ( $N = 35$ ) ranging from ages 26-87 were administered all four forms of the RBANS in counter-balance sequence, with a 5-7 day interval between administrations. Form equivalence and practice effects were examined via ANOVA.

**Results:** There was no difference between the forms in terms of total scale score, nor was there any difference between any of the forms on any of the five index scores. A minimal practice effect was observed over time on the total scale score.

**Conclusions:** The four forms of the RBANS appear to be equivalent in this preliminary investigation. The magnitude of practice effects observed was quite small, even for healthy adults over short time intervals, suggesting that the battery is well-suited to clinical trials and other research applications involving the repetitive assessment of neurocognitive status over time.

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**B.M. DOANE, K.L. SALEKIN & K.A. HEDGE. Vineland-II Concordance Rates between Adults with Mild Intellectual Disability and Their Caregivers.**

**Objective:** Previous research suggests that individuals with Intellectual Disabilities (ID) tend to respond to questions concerning their own objective abilities (e.g. dressing, eating, managing money, etc.) in a socially desirable or yea-saying manner. Consequently, many clinical assessments gather such diagnostic and treatment-relevant information from third-party/caregiver sources. The present study aimed to revisit the scientific basis for excluding individuals with Mild ID from their own assessments of adaptive behavior by examining concordance rates on a commonly-used adaptive behavior instrument.

**Participants and Methods:** Using a quasi-experimental, paired samples design, this study directly compared the responses of 28 adult participants with Mild ID to those of their primary caregivers using the Vineland Adaptive Behavior Scales—Second Edition—Interview Form (Vineland-II). Both "self" and "other" ratings of the participant's current adaptive abilities were calculated.

**Results:** Using paired samples *t* tests, no significant standard score differences were found between the dyad's Community ( $p = .300$ ), Social ( $p = .234$ ), and Motor Skills domains ( $p = .650$ ), while significant differences were detected for the Daily Living Skills domain ( $p = .049$ ) and the Adaptive Behavior Composite ( $p = .046$ ).

**Conclusions:** The results potentially suggest that the clinical assumption that individuals with Mild ID are not able to offer reliable information regarding their own adaptive abilities (in comparison to their caregivers' reports) may not be accurate. Although some significant statistical differences were found at the standard score level, these differences may not be clinically significant (e.g., all means were within 5 standard score points of one another and effect sizes were small). The current study's outcomes are especially notable given the increase in Atkins assessments for mental retardation in capital cases and the inherent difficulty in obtaining appropriate raters for retrospective evaluations.

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**L. GLASS & J.J. RYAN. Discrepancy Score Reliabilities for WAIS-IV/WMS-IV Composite and Subtest Comparisons.**

**Objective:** Memory-ability comparisons using the WAIS-IV and WMS-IV are undertaken to determine if memory and intellectual functioning differ significantly. Comparisons across memory domains may also be made (e.g., auditory vs. verbal memory). The WMS-IV Technical and Interpretive Manual provides several tables to determine significant differences between memory tests as well as between WAIS-IV composites and memory tests.

When conducting discrepancy analyses, it is essential to know whether the discrepancy scores of interest meet a minimum standard of reliability (e.g.,  $\geq .80$ ). Because WAIS-IV/WMS-IV discrepancy score reliabilities have not been published, the present study provides this information for both composite score and subtest score comparisons. This information should assist clinicians in conducting discrepancy score analyses.

**Participants and Methods:** The WAIS-IV-WMS-IV standardization sample provided the participants. In order to calculate discrepancy score reliabilities, internal consistency reliabilities and correlational data for the composites and subtest scores were obtained from the test manuals.

**Results:** Discrepancy score reliabilities for the 25 WAIS-IV-WMS-IV composite combinations are displayed in Table 1. These coefficients

range from .82 (PRI-VWMI) to .93 (VCI-VMI), with a mean of .89. Coefficients for the six WMS-IV Index comparisons range from .56 (IMI-DMI) to .91 (AMI-VMI). Table 2 provides discrepancy score reliabilities for 45 WMS-IV subtest combinations, which range from .27 (LM I-LM II) to .93 (VPA I-VR II), with a mean of .79.

**Conclusions:** The present results reinforce the position that clinical decision making based on the results of discrepancy analysis should be done cautiously and with knowledge of the reliabilities of the difference scores being interpreted.

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#### **M.C. GROSCH, M.F. WEINER, L.S. HYNAN, L. GRAHAM & C. CUL-LUM. Language Screening in Native Americans.**

**Objective:** There is a need for culturally sensitive normative data for neuropsychological measures. In particular, there is a paucity of neuropsychological research among Native Americans. Our objective was to compare performance among Native American and Caucasian groups on several brief neuropsychological measures of language, as these may be particularly susceptible to cultural effects.

**Participants and Methods:** The sample included 16 rural Native American and 18 urban Caucasian subjects with no diagnosed neuropsychiatric conditions (MMSE >25) selected to be similar in age and education. Groups were compared on three brief language measures: a 15-item Boston Naming Test (BNT; Mack et al., 1992), category fluency, and letter fluency.

**Results:** The Native American and Caucasian groups were similar in age (61 vs. 64 years), education (13.3 vs 14.5 years), and MMSE scores (28.5 vs 29.3), respectively. Independent t-tests revealed similar scores on the BNT ( $M = 13.4$  vs  $14.2$ ,  $p = .10$ ) and category fluency ( $M = 18.2$  vs  $19.8$ ,  $p = .19$ ), but a significant difference was seen on letter fluency ( $M = 30.8$  vs  $47.4$ ,  $p < .0001$ ).

**Conclusions:** Native American and Caucasian groups performed similarly on standard confrontation naming and category fluency tasks, but the former scored lower on letter fluency despite being similar in age and education. Findings suggest that available norms may be appropriate for some standard language measures in similar Native American populations, although other tests may require modification or the use of different norms for interpretation.

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#### **K. HARRIS, D. SCARISBRICK, J. BEAUVAIS, C. MARKER & C. GOLDEN. Neuropsychological Constructs Assessed by the WAIS-III Family Pictures Subtest.**

**Objective:** Little is known about the cognitive abilities that contribute to successful WMS-III Family Pictures (FP) performance. Generalizability of published research is limited by diagnostic heterogeneity and methodological variations. The present study expands upon previous research by examining the ability of several cognitive measures to predict FP performance in a clinically referred sample.

**Participants and Methods:** Data from 57 subjects who underwent comprehensive assessments at an outpatient neuropsychology clinic were examined. Mean age and education were 34 (SD = 13.74) and 13.5 years (SD = 2.67), respectively (54% male). Diagnoses included psychiatric and neurologic illnesses. Two separate hierarchical multiple regression analyses controlling for age and education were conducted for immediate and delayed memory measures. Verbal memory, visual memory, executive functioning, general verbal, and general visual/spatial measures were examined for predictive utility.

**Results:** Age and education accounted for approximately 17% of the variance in both models whereas cognitive variables accounted for 37.1% of the total variance. Verbal and visual memory (i.e., Logical Memory, Verbal Paired Associates, Information, and Faces) equally predicted

FP performances. Executive functioning (i.e., Category Test, Wisconsin Card Sorting Test perseverative errors, and Trails B), general verbal ability (Similarities, Information, Comprehension, and Vocabulary), and general visual ability (Block Design, Matrix Reasoning, and Picture Completion) measures failed to significantly predict FP performances.

**Conclusions:** These findings suggest that the FP subtest is not differentially influenced by verbal or visual memory, and the additional cognitive abilities explored do not significantly contribute to FP performance. Thus, caution should be utilized in interpreting FP primarily as a measure of visual memory.

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#### **B.D. HILL, M.E. BODZY, M.L. ALOSCO, J.T. SHELTON, E.M. ELLIOTT, H.K. WESTERVELT & D. GOUVIER. Contribution of Working Memory to Estimated IQ Varies Among Different WAIS-III 4-Subtest Short Forms.**

**Objective:** WAIS-III short forms are commonly used to estimate full scale IQ (FSIQ) when the entire WAIS-III cannot be administered. While short forms are commonly used in clinical populations where working memory (WM) may be impaired, the relation between WM and IQ estimates from WAIS-III short forms has not been examined. The purpose of this study is to examine the percent of variance accounted for by WM in commonly used WAIS-III short forms.

**Participants and Methods:** 180 healthy young adults (mean age 20.6, SD 3.6) completed the full WAIS-III and 3 experimental WM tasks (operation span, listening span, and n-back). The WM span tasks were reduced to a single factor score. Pearson correlation and regression analyses were conducted to determine the percent of variance accounted for by the WM factor score in WAIS-III FSIQ as well as estimated FSIQ on 3 WAIS-III short forms (SF1, SF2, and SF3). The following subtests comprised the short forms: SF1 (Arithmetic, Similarities, Picture Completion, and Digit Symbol-Coding; Donnell et al., 2007), SF2 (Letter-Number Sequencing, Similarities, Picture Completion, and Symbol Search; Donnell et al. 2007), and SF3 (Vocabulary, Information, Block Design, and Matrix Reasoning; Sattler, 2001).

**Results:** Short form estimates of FSIQ were highly correlated with actual WAIS-III FSIQ: SF1 ( $r = .83$ ), SF2 ( $r = .78$ ), and SF3 ( $r = .92$ ). Separate linear regressions were run with the WM factor score predicting performance for each WAIS-III short form and the full WAIS-III. WM factor score accounted for the following percent of variance in each measure: full WAIS-III (27%), SF3 (26%), SF2 (17%), SF1 (10%).

**Conclusions:** These findings highlight that the impact of WM on estimated FSIQ is variable depending on which WAIS-III subtests are utilized. Clinically, this is important as some short forms may underestimate actual FSIQ in populations with working memory impairment, such as TBI and ADHD.

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#### **J.E. HORWITZ & R.J. MCCAFFREY. Boston Naming Test Performance in a Cognitively Intact College Sample.**

**Objective:** The Boston Naming Test (BNT) is among the most widely used language tests in neuropsychology. Despite widespread use, this test, however, there has been minimal recent research on performance in young adults, particularly with participants from diverse, monocultural backgrounds. The present study sought to investigate overall and individual item performance in a diverse, cognitively intact young adult sample. Given the somewhat dated nature of certain test items, we hypothesized that the percentage of participants correctly responding to these items would be low.

**Participants and Methods:** Data from fifty-seven undergraduate students were included. Participants were administered the full BNT according to standardized protocol; however, administration began at item one and no discontinuation criteria were used in order to obtain performance data on all 60 items.

**Results:** Mean overall BNT score in this sample was 49.44 (SD = 5.4). Score interpretation with a commonly-used set of demographic and corrected norms (Heaton, Miller, Taylor, & Grant, 2005) for those participants self-identifying as Black or White ( $n = 4$ ) suggested that 16.1% and 36.1% of participants fell in the very poor and borderline ranges, respectively. In addition, less than 50% of the sample performed correctly on six items, and less than 1% performed correctly on two of these items.

**Conclusions:** Results from this study suggest that certain BNT items may no longer be appropriate for use among young adults. In addition, interpretation of BNT scores, even when correcting for age and other sociodemographic factors, may result in unacceptably high rates of misclassification of impairment.

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#### K. HUBEL, G.T. MILES & R.G. GOMEZ. Performance of Two WAIS-III Short Forms in a Clinical Veteran Population in Comparison to the WASI.

**Objective:** Four and seven-subtest WAIS-III short forms were evaluated in comparison to reported WASI – WAIS-III correlations.

**Participants and Methods:** 103 male veterans were administered the WAIS-III at the San Jose Clinic of the Palo Alto VA. Prorated short form IQ score estimates were derived using seven-subtests (Similarities, Information, Digit Span, Arithmetic, Picture Completion, Digit-Symbol Coding, Matrix Reasoning) and four-subtests (Similarities, Arithmetic, Picture Completion, Digit-Symbol Coding). Validity coefficients were based on correlations between full and short form IQ scores corrected for redundancy. Fisher Z-tests were used to determine significance of differences between each short form and the two and four-subtest WASI FSIQ, VIQ, and PIQ.

**Results:** Redundancy-corrected validity coefficients for the seven and four-subtest IQ scores were highly significant ( $p < 0.01$ ), as reported elsewhere. The seven-subtest short form validity coefficients were significantly higher than the WASI correlations (VIQ  $z = 3.67$ ,  $p = .0001$ ; PIQ  $z = 2.71$ ,  $p = .0034$ ; FSIQ\_4  $z = 3.19$ ,  $p = .0007$ ; FSIQ\_2  $z = 5.25$ ,  $p < .0001$ ). The four-subtest short form validity coefficients were not significantly different from the WASI correlations with the full form, except for the WASI 2-subtest FSIQ (FSIQ\_2  $z = 1.81$ ,  $p = .0351$ ).

**Conclusions:** The seven-subtest WAIS-III short form had significantly greater validity than the WASI correlations with the full WAIS-III reported in the WASI manual. The four-subtest short form did not outperform the WASI, except in comparison to the two-subtest WASI FSIQ. This study provides evidence that spending 10 to 15 more minutes using a seven-subtest short form will provide a significantly better estimate of a patient's intelligence over a four-subtest short form or WASI, while still saving time over the full WAIS-III.

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#### G.L. IVERSON, B.L. BROOKS & A.H. YOUNG. Identifying Cognitive Impairment in Adults with Mood Disorders Using Computerized Testing.

**Objective:** To develop and evaluate psychometric criteria for identifying cognitive impairment in adults with mood disorders.

**Participants and Methods:** Participants were adults between the ages of 20 and 54, including 659 healthy control subjects, 84 unmedicated outpatients diagnosed with depression, 59 outpatients diagnosed with depression who were on medications at the time of the evaluation, and 43 outpatients with bipolar disorder. All completed the CNS Vital Signs computerized battery. This battery of seven tests yields five domain scores (Memory, Psychomotor Speed, Reaction Time, Complex Attention, and Cognitive Flexibility).

**Results:** Base rates of low domain scores were calculated, using different cut-offs, for the healthy control subjects and the patients with mood

disorders. Having two scores at or below the 5th percentile occurred in 31.2% of the patients and only 8.2% of the control subjects [Chi Square(1)=66.67,  $p < .0001$ ; Odds Ratio=5.1, 95% CI=3.4–7.7]. This low false positive rate was maintained across age groups, sexes, and education levels. African Americans ( $N = 49$ ) had higher false positive rates (i.e., 14.3%) than Caucasians ( $N = 570$ ; 7.0%). A larger proportion of patients with bipolar disorder (41.9%) than patients with depression (27.1–28.6%) met criteria for cognitive impairment.

**Conclusions:** A substantial minority of adults with mood disorders appear to have cognitive impairment. The psychometric criterion for cognitive impairment on this computerized test battery has a low false positive rate.

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#### C.P. JOHNSON, M. HISCOCK, N. LACHNER & J. NYLUND. Relating The Expectancy-Valence Model To Advantageous Performance on the Iowa Gambling Task.

**Objective:** The Expectancy-Valence Model (EVM) of the Iowa Gambling Task (IGT) was designed to increase specificity in identifying cognitive differences between pathological groups (Busemeyer & Stout, 2002). However, the EVM parameters have not been related to classically identified outcome variables of advantageous deck selections. Additionally, questions have been raised about the utility of the EVM at the individual and clinical levels. The current study investigates the utility of the EVM in normal controls by testing the model fit of the EVM as well as the relationship between the EVM variables and advantageous draws on the IGT.

**Participants and Methods:** A sample of university students ( $N = 180$ ) completed the progressive losses version of the computerized IGT (Bechara et al., 2000). The resulting data were then run through the Expectancy-Valence Model as programmed in Matlab to produce the three variables of the EVM: recency, attention to losses, and consistency, as well as a model fit variable, which compared the results to a baseline model. Individuals who failed to fit the EVM were compared to those who did on model parameters. Model parameters were then tested against advantageous draws.

**Results:** The EVM only outperformed the baseline model in 88 participants. However, there were no group differences (fit vs. no fit) in advantageous selections or EVM variables. Of the three predictors and their interactions, general linear modeling revealed that only attention to losses predicted performance ( $p < 0.001$ ).

**Conclusions:** The EVM provides additional information for differentiating groups with respect to IGT performance. However, the cognitive processes measured in the EVM may not relate to task performance and may exclude too many participants to be utilized effectively in clinical practice.

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#### K.P. LLOYD, C.I. HIGGINSON, J.M. LATING & M.J. COIRO. Test Order Effects: A Memory Test has a Significant Affect on Verbal Fluency.

**Objective:** Many neuropsychological tests of specific cognitive functions are standardized independently despite that most are administered in a test battery; therefore, little is known about the effect of the other tests on examinees' performance. The concern of test-order effects has received little empirical attention and it appears that many examiners implicitly assume such effects are negligible. The current study examined the effect of a verbal memory measure on a measure of verbal fluency.

**Participants and Methods:** Two groups of 21 adults [mean (SD) age in years: 27 (11); gender: 76% female] referred for psychoeducational evaluation were administered the California Verbal Learning Test- Second Edition (CVLT-II) and verbal fluency measures from the Delis-Kaplan Executive Functioning System (D-KEFS) in counter-balanced orders.

**Results:** A multivariate analysis of covariance with age and gender controlled was significant [Wilks' Lambda = .64;  $F(2,37) = 10.39$ ,  $p < .001$ ] and determined that individuals who completed the CVLT-II prior to the D-KEFS produced more animal and furniture words on the D-KEFS [ $F(1,38) = 12.96$ ,  $p = .001$ ;  $\eta^2 = .50$ ] and they included more words from the CVLT-II amongst their verbal fluency responses [ $F(1,38) = 15.11$ ,  $p < .001$ ;  $\eta^2 = .53$ ].

**Conclusions:** These results suggest that test order can have a significant affect on performance and warrants additional clinical and empirical attention.

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**N. LOSER, M. BROOKS, S. CLAYTON & R. HUNSAKER. A Comparison of Woodcock-Johnson Reading Scores and Word Memory Test Failures: Malingering Detection in University Accommodation-Seeking Students.**

**Objective:** University students with diagnosed learning or attention difficulties are legally entitled to disability accommodations that assist them in the completion of their educational goals. Such accommodations may include extra time on university entrance tests as well as classroom assignments, and these provisions may be sufficient enough motivation for non-disability students to attempt to malingering disabilities at university accessibility centers. In recent years, accessibility centers have begun to implement the use of effort tests in their batteries, as researchers have suggested that test-taking effort consumes a significant amount of total assessment variance (Green, Rohling, Lees-Haley, & Allen, 2001). Thus, in an effort to determine the accuracy of effort testing implementation at a large private university, a malingering-effort detection measure, the Word Memory Test, was compared to the Broad Reading score from the Woodcock-Johnson Tests of Achievement.

**Participants and Methods:** The WMT was chosen due to the fact that it involves objectively easy tasks of a verbal nature, which are more directly related to Broad Reading abilities than other effort tests (Gervais, Rohling, Green, & Ford, 2004). In the present study, archival data was gathered from 110 consecutively presenting students who were evaluated for potential learning or attention disorders.

**Results:** An analysis of variance was performed to determine the relationship between students' WMT and Broad Reading scores, with the expectation that the WMT is insensitive to the presence of true reading disorders as predicted by the Broad Reading score.

**Conclusions:** Results and implications for accessibility testing are discussed.

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**S. CLAYTON, M. BROOKS, N. LOSER, R. HUNSAKER, E. MARTINELLI & J. CALL. Detecting Poor Effort among Accommodation-Seeking University Students: Implications for Psycho-Educational Evaluations.**

**Objective:** Universities have increasingly sought to provide accommodative services to students with learning disorders and ADHD in recent decades, thereby creating a need for diagnostic batteries designed to evaluate cognitive abilities relevant to academic performance. Recent findings suggest that a significant amount of the variance in assessment results can be accounted for by test-taking effort (Green, Rohling, Lees-Haley, & Allen, 2001) and that accommodative services (extended time on tests, alternate test forms, etc.) provide incentive to distort impairment. As such, these findings indicate that steps should be taken to estimate the rate at which students distort impairment and to evaluate an evaluator's ability to accurately identify symptom distortion.

**Participants and Methods:** In order to address these concerns, the Word-Memory Test, Test of Memory Malingering, and Fake Bad Scale (of the MMPI-2) were compared in terms of their sensitivity and speci-

ficity within a two-part study. In the first portion of this study, scores were collected for 117 consecutively presenting students who were evaluated for academic difficulty at a large private university. In the second portion of the study, an analogue design (which included a control group ( $n = 30$ ) and an experimental group ( $n = 30$ ) that was asked to simulate poor effort) was used to calculate the sensitivity and specificity of each measure.

**Results:** A regression equation based on the results from the analogue design was used to estimate the base rate of symptom distortion among the 117 students who had presented for evaluation.

**Conclusions:** Results are presented and recommendations for practice are given.

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**A.C. LYON, T.F. FLOYD, S. HEVERLY-FITT, E. STAMBROOK, C. PRICE, O. SELNES, S.J. RATCLIFFE & T. GIOVANNETTI. Test-Retest Reliability of a Neuropsychological Protocol in a Sample of Older Adults with Vascular Risk Factors.**

**Objective:** Older adults with vascular risk factors often require longitudinal testing for dementia assessment. However, the test-retest reliability of many neuropsychological measures with this population is unknown. This study examined the test-retest reliability of commonly used neuropsychological measures in a sample of older adults with aortic stenosis and/or coronary artery disease.

**Participants and Methods:** Thirty-nine older adults (M age = 74; M education = 15) with a diagnosis of aortic stenosis and/or coronary artery disease were administered a comprehensive neuropsychological protocol at two time points, separated by 4 – 6 weeks. Participants with a history of recent stroke, TIA or addiction, and/or any history of mental illness were not included in the sample.

**Results:** Good to satisfactory test-retest reliability ( $r$ ) was observed for measures of executive control (Mental Control -.86; Trails-B -.93; FAS -.93; Digit Symbol -.876; Digit Span -.78), delayed episodic memory (HVLT-delay recall -.83; Rey-Osterrieth Complex Figure- long delay -.88), and language/lexical retrieval (BNT -.95; Animal Naming -.74). Test-retest reliability was unsatisfactory for the MMSE (.53) as well as measures of immediate free recall (HVLT-total free recall .63) and visuoconstructional abilities (Clock Drawing Test -.37; Rey Complex Figure Copy -.43).

**Conclusions:** Reliability estimates for this population were variable and suggest that longitudinal assessment for older adults with vascular risk factors should rely most heavily on measures of executive control, language/lexical retrieval, and delayed episodic memory retrieval (rather than immediate free recall). Caution should be taken when interpreting longitudinal data from the MMSE or tests of immediate free recall and visuoconstructional abilities, as measures of these constructs had the lowest reliability estimates.

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**J.B. MILLER, E.M. HOLCOMB, J.R. BASHEM & L.J. RAPPORT. Substitution of the CVLT-II for Verbal Paired Associates on the Wechsler Memory Scale - 4th Edition: Correlations between scaled scores in a traumatic brain injury sample.**

**Objective:** The Wechsler Memory Scale, 4th Edition (WMS-4) allows for substitution of indices from the California Verbal Learning Test-2 (CVLT-II) for standard indices Verbal Paired Associates (VPA) 1 and 2 raw scores, respectively. The present study investigated the effect of this substitution on WMS-4 profiles in a traumatic brain injury (TBI) sample.

**Participants and Methods:** Participants were 28 outpatient adults with moderate to severe TBI. Measures included the WMS-4, CVLT-II, and several embedded effort measures. All tests were administered and scored according to standardized instructions. Per the WMS-4 manual, CVLT-II Trial 1-5 T Score and long-delay free-recall z score were substituted for VPA 1 and 2, respectively.

**Results:** All participants were negative on indices sensitive to withholding effort. Scaled score means for VPA 1 and 2 were 6.36 (SD = 2.5) and 6.78 (SD = 2.4), respectively. Scaled score means based on CVLT-II substitution were 7.21 (SD = 2.7) for VPA-1 and 7.30 (SD = 3.6) for VPA-2. Pearson correlation between scaled scores for VPA-1 and CVLT-II Trial 1-5 was .38 ( $p=.049$ ); however, the correlation between VPA-2 and CVLT-II recall was .148 ( $p=.462$ ). There were no significant differences between scaled score means.

**Conclusions:** Average scaled scores generated by substitution of CVLT-II indices were not substantially different from those obtained from VPA; however, the substitutions showed only modest relation to immediate- and no relation to delayed-recall performances on the test. Clinicians using the WMS-4 with a TBI population should consider this observation when selecting instruments for the assessment of verbal list learning.

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**R.J. MINTZ, D.M. AASE, B. CHWALISZ, L. BITYOU, J.W. FINK & N.H. PLISKIN. Specificity of Neuropsychological Performance in Electrical Trauma Patients Compared to Trauma Controls.**

**Objective:** Neuropsychological studies of patients sustaining an electrical injury (EI) have shown decreased performance on attention/mental processing speed and motor skills tasks compared to demographically matched controls. However, there have been no studies comparing neuropsychological performance in electrical injury patients to other clinical and trauma control populations.

**Participants and Methods:** In this study, cognitive performance was compared between 3 clinical populations; 2 trauma groups including EI (N=179) and mild traumatic brain injury (TBI; N=145), and a chronic pain, non-central nervous system injury, trauma control group (N=72); as well as a group of healthy controls (N=29). All patients were administered a series of neuropsychological tests, which were grouped into domains consisting of either verbal memory or attention and mental processing. Multivariate analysis of variance was used to assess group differences.

**Results:** Findings indicate no distinct pattern of cognitive performance between the trauma patients and trauma controls. Among EI patients who exhibited the most cognitive impairment, neither litigation status, level of depression or time since injury accounted for differences compared to other EI patients. Despite the lack of differences amongst the clinical samples, statistically significant differences were observed when compared to healthy controls, specifically between performances on measures comprising the attention and mental processing speed domain ( $p=.000$ ).

**Conclusions:** These results suggest that although neuropsychological testing was sensitive in identifying cognitive changes associated with clinical conditions, it did not yield a distinctive pattern that distinguished between different trauma and clinical groups.

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**B. REED, E. YUND, M.M. KISHIYAMA, T.J. HERRON, R.F. HINK, O. POLIVA, M.M. BATES & D.L. WOODS. Computerized Adaptive Testing of Digit Span.**

**Objective:** Digit span (DS) is among the most popular tests of working memory. However, traditional DS administration suffers from methodological limitations, including inconsistencies between and within examiners. We describe a brief computerized DS test that efficiently estimates DS by adaptively testing span length.

**Participants and Methods:** Experiment 1: A sample of convenience (30 young adults, ages 18-30) was administered the test 3 times at weekly intervals. Experiment 2: The test was administered to 763 participants ages 18-65 in the epidemiological project Chronic Hydrogen Sulfide Exposure Effects—The Rotorua Study (CHEERS). Exposure data are not yet available so this sample is treated as a single group.

**Results:** The stair-casing of the computerized administration allowed for an estimation of traditional DS metrics. These were compared with multiple metrics obtained in the computerized procedure. Estimates of span were very similar in both procedures but were more consistent (more reliable) across test occasions with the adaptive testing. Correlations between forward and reverse span were substantially higher for the computerized metrics than for the traditional, suggesting more consistent measurement of an underlying cognitive function. Detailed error information is recorded; Serial position analysis showed primacy and recency effects in forward span tests, and attenuated primacy effects on reverse span testing. Demographic effects will be presented.

**Conclusions:** Computerized adaptive testing of digit span is efficient and well tolerated. The method yields similar estimates of DS compared with traditional administration but with greater reliability and more granular response data.

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**M. RODRIGUEZ, R. WALTER & J. PONS. Using Spain Norms in the Assessment of Spanish Speaking Individuals from Other Countries: Biases on the Spanish WMS-III Working Memory Index.**

**Objective:** The question of the generalization of norms from one population to another that shares the same language has been of great debate in neuropsychological assessment. The WMS-III, one of the most commonly used memory batteries in Puerto Rico, lacks norms for this population. The present study addressed the validity of the cross cultural application of the norms from Spain to Spanish speaking individuals from another country.

**Participants and Methods:** A group of 39 normal Puerto Rican subjects aged 21-39 were administered the Wechsler Adult Intelligence Scale – III (EIWA-III /Puerto Rican adaptation) and the WMS-III (Spain adaptation). Significant differences were found between the scores of both Working Memory Indexes. A paired-samples T test was used to compare the scores of the Working Memory Indexes (WMI) of both tests.

**Results:** A significant 15 point (SD=13) difference was found. Subjects with an average FSIQ on the EIWA-III had an average of 1 Standard Deviation below average scores on the WM Index and its subtest on the WMS-III. For Letter-Number Sequencing (LN) there is a mean difference of 2.6 points between the Spain and Puerto Rico norms in subjects aged 21-34. EIWA-III scaled scores of LN of subjects in 21-34 age range are more similar to WMS-III scale scores of subjects in the 55-65 age range.

**Conclusions:** These results suggest that the norms from Spain may underestimate the working memory capacities of healthy Spanish speaking individuals of other countries, particularly, Puerto Ricans.

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**T. ROSKOS, S.R. MCCAULEY, C. BOAKE, H. GOODMAN, S. MERRITT, S. BROWN & H.S. LEVIN. Use of the Post-Traumatic Stress Disorder Checklist Civilian Version (PCL-C) with Civilian Mild Traumatic Brain Injury and General Physical Trauma Patients.**

**Objective:** Civilian and military mild traumatic brain injury (mTBI) research has used the PCL-C, but has employed diagnostic strategies validated in other samples and is limited by methodological issues. Literature has also suggested that mTBI patients may have a higher rate of post traumatic stress disorder (PTSD) than individuals with other types of injury. Comparison of these groups using the PCL-C has also not been conducted. This is the first prospective study to address these gaps in the literature. It was hypothesized that PCL-C would have lower specificity of PTSD diagnosis compared to a structured interview in mTBI and general physical trauma (GT) patients. Sensitivity and specificity of cutoff scores were also examined in each patient group.

**Participants and Methods:** 319 mTBI and 102 GT patients were collected at a level I trauma center emergency department and the PCL-C

and SCID-IV PTSD module were administered as part of a larger battery. Rates of meeting PTSD criteria were compared between groups using three methods: PCL-C score > 50, PCL-C item symptom clusters, and SCID-IV diagnosis. Receiver Operating Characteristic (ROC) curve analyses were also conducted using PCL-C scores and SCID-IV diagnosis.

**Results:** Results confirmed the hypothesis that the PCL-C showed significantly higher rates of PTSD diagnosis compared to SCID-IV regardless of group. The ROC areas under the curve were similar ( $mTBI = .825$  and  $GT = .844$ ).

**Conclusions:** Using the PCL-C as a screening tool may help to identify patients at risk for PTSD, but diagnoses should not be made based solely on PCL-C score due to potential for false positive errors.

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**J. SALVADOR, E. BALDERAS & G. GALINDO Y VILLA. Analysis of qualitative and quantitative properties of Taylor's figure in Mexican population aged between 20 and 60 years. Authors: Judith Salvador Cruz, Ma. Esther Balderas, Gabriela Galindo y Villa Molina. FES ZARAGOZA UNAM.**

**Objective:** Analyze the qualitative and quantitative properties of perceptual units of the Taylor's figure in Mexican subjects aged between 20 and 60 years

**Participants and Methods:** Participants were 300 subjects aged between 20 and 60 years. The application and grading follow the same score system designed by Galindo and Salvador (1996) and that was used to the standardization of the Complex Figure of Rey in Mexican population. The administration for copy and memory was achieved in an individual way.

**Results:** Averages and standard deviations were calculated by age groups for the total punctuation, the alfa coefficients of Cronbach and the frequency distributions. The reliability analysis reported an alpha of Cronbach of .76 for the copy and of .75 for the memory.

**Conclusions:** The curve of development to evaluate constructional praxis indicates maturity according to age, while in memory the younger remember more elements, in advanced age this capacity goes in decrement as literature reports. Another contribution is that the Taylor's figure gives similar results as the obtained in the Complex Figure of the Rey this supports the intern and extern validity, and the application in test-retest investigations

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**B. SCHNEIDER & P.A. LICHTENBERG. Impact of Reading Ability and IQ on Neuropsychological Test Performance in Black Older Adults.**

**Objective:** Performance on neuropsychological measures is influenced by several factors, including educational and cultural background. The first goal of this study was to identify how education, reading ability and IQ contribute to performance on neuropsychological measures normed by age and education in Black older adults. A second goal was to compare test performance of this sample with the original Mayo Older African American Normative Studies (MOAANS) normative data.

**Participants and Methods:** Seventy-two Black older adults residing in Detroit were recruited as part of a study investigating health and cognitive functioning. Data were collected in an individual interview session format.

**Results:** Multiple regression analyses were conducted to examine how scores on the Mini Mental State Exam, Rey Auditory Verbal Learning Test, Trail Making Test, Stroop, Controlled Oral Word Association Test and Animal Naming relate to reading ability (WRAT-3) and IQ (WASI FSIQ) after accounting for age and education. Reading ability and/or FSIQ accounted for a significant proportion of variance beyond education for all measures. Education was not significantly related to score on any measure. Mean scores for all measures fell within the average range using the MOAANS normative data.

**Conclusions:** Adjustment of neuropsychological test performance for age and education alone may result in misclassification of Black older adult. Results of this study support use of MOAANS normative data for older Black adults.

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**M. SELLBOM, R.O. GERVAIS & K.M. STANEK. Utility of the Personality Assessment Inventory in Detecting Symptom Validity Test Failure in Neuropsychological Evaluations.**

**Objective:** The Personality Assessment Inventory (PAI) validity scales and indices (NIM, MAL, and RDF) have gained substantial support for their utility in detecting malingering in mental health and criminal forensic settings (e.g., Sellbom & Bagby, 2008). However, no research to date has examined their utility in detecting cognitive response bias in neuropsychology evaluations. Such utility is important to determine given that the instrument is being increasingly used in these settings.

**Participants and Methods:** Participants were 272 (42% women) individuals who underwent neuropsychological evaluations as part of a workplace disability claim. Mean age was 42.1 (SD = 10.9); most were White Canadian. These individuals were administered (among other measures) the PAI and three symptom validity tests (SVT) (TOMM, WMT, CARB) as part of their evaluations. Participants who failed at least one SVT were assigned to a "failed SVT" group; the remaining participants were assigned to a "passed SVT" group.

**Results:** The results indicated that NIM was associated with the largest effect size ( $t [270] = 5.77, p < .001$ ; Cohen's  $d = .75$ ) in differentiating the failed vs. passed SVT groups. A regression analysis in which the three scales were entered simultaneously showed that only NIM ( $\beta = .31, p < .001$ ) contributed significantly to this differentiation. ROC curve analyses indicated modest overall classification accuracy for NIM (AUC = .70).

**Conclusions:** These findings suggest that the PAI might only be minimally useful in detecting cognitive response bias in neuropsychological evaluations. Further research should examine the possibility of developing scales specific to cognitive response bias for the PAI, analogous to the Response Bias Scale (Gervais et al., 2007) and FBS (Lees-Haley et al., 1991) for the MMPI-2.

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**B. DIXON, S. LEININGER, M. HATFIELD & R. SKEEL. Switching Decks on the IGT as a Behavioral Measure of Anxiety.**

**Objective:** The Iowa Gambling Task (Bechara et al, 1994) has been used in a variety of studies, with the most common dependent variables being based on choices from the disadvantageous versus advantageous decks. However, individuals may complete the measure with different approaches and obtain similar scores, limiting utility of the measure. The current study explored an alternative dependent measure for the IGT: the number of switches between decks, regardless of deck number. It was hypothesized switches would be associated with different outcome measures than traditional IGT scores.

**Participants and Methods:** Seventy-nine college-aged participants completed the IGT, reported drinking behavior for a period of three weeks, and completed the Zuckerman-Kuhlman Personality Questionnaire and The College Alcohol Problems Scale - Revised.

**Results:** Results showed an association between number of switches and disadvantageous choices ( $r = .27, p < .05$ ). There was also an association between switches and anxiety ( $r = .28, p < .05$ ). A 2 x 5 (hi/low anxiety x # of switches in blocks of 20 trials) ANOVA and post-hoc tests indicated higher anxiety individuals switched more often in the middle three blocks than lower anxiety individuals, ( $F(1, 77) = 3.98, p < .05$ ). Outcome measures, disadvantageous IGT choices were related to alcohol consumption, while switches were associated with Social Problems on the CAPS-R.

**Conclusions:** Research has suggested anxiety may impact performance on the IGT (Miyake et al., 2008) and current research suggests that the frequency of deck changing may provide unique information beyond scoring advantageous/disadvantageous deck choices.

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**K.M. STANEK, M. SELLBOM & R.O. CERVAIS. Association between Intelligence, Reading, and Executive Functioning on MMPI-2 Validity Scales in a Disability Evaluation Context.**

**Objective:** Although the MMPI-2 validity scales (F, Fb, Fp, FBS, and RBS) have substantial empirical support for their utility in detecting malingering in a variety of contexts (e.g., Greene, 2008), few studies have specifically examined the impact of intelligence, reading ability, and executive functioning on these scales in neuropsychological settings. The present study was designed to fill this gap.

**Participants and Methods:** Participants included 382 disability claimants referred for medico-legal neuropsychological assessment. The mean age was 40.6 (SD = 10.5). These individuals were administered the MMPI-2, WAIS-III, WRAT-3-Reading Subtest, and Wisconsin Card Sort Test as part of their evaluation. These participants had passed three different symptom validity tests (TOMM, WMT, CARB) and MMPI-2 indicators of inconsistent responding (i.e., VRIN, TRIN <80T).

**Results:** Partial correlation analyses, controlling for age and response inconsistency (VRIN), indicated that Fp was inversely associated with performance on all cognitive tests. The effects were most pronounced for verbal intelligence ( $r = -.16, p < .01$ ), reading achievement ( $r = -.16, p < .01$ ), and perseverative errors ( $r = -.15, p < .01$ ). No other F scales were significantly associated with cognitive test performance. Moreover, no MMPI-2 measures of psychotic symptoms (e.g., RC6, RC8) were associated with cognitive test performance.

**Conclusions:** The current findings suggest the possibility that individuals with low verbal abilities and/or executive dysfunction may produce artificially high scores on the MMPI-2 Fp scale. Given that response inconsistency and suboptimal effort based on symptom validity tests were ruled out, these findings suggest that these cognitive variables should be taken into consideration when interpreting moderately high scores on Fp.

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**A.M. STRUTT, I.G. AYANEGUI & M.K. YORK. The Authorized Spanish Translation of the Dementia Rating Scale, 2nd edition.**

**Objective:** The DRS-2 is a brief, yet multifaceted, screening tool that is widely used in the field of neuropsychology in the assessment of older adults. It is composed of 5 subscales that examine abilities of attention, initiation/perseveration, construction, conceptualization and memory; a total score for these subscales is also provided. Research has shown the clinical utility of this measure in the English speaking community; however, an authorized Spanish translation of the DRS-2 (ST-DRS-2), including normative data has not been available until now.

**Participants and Methods:** Seventy-five primarily Spanish speaking participants, ages 50-69, completed the ST-DRS-2 as part of a comprehensive neuropsychological norming study. Exclusion criteria included history of head injury, transient ischemic attacks, stroke, organ transplant, uncontrolled general medical conditions, and poor mood states.

**Results:** Normative data was stratified by age (50-59; 60-69) and education level (<12 and 13+). Differences between education levels were not found within either age group; thus normative data is stratified by age only. Sensitivity and specificity of the ST-DRS-2 will be presented. In addition, a comparison between the Spanish and English norms will be discussed.

**Conclusions:** This study will highlight the clinical utility of the ST-DRS-2. While the translation of neuropsychological measures is a topic

of controversy, the validation of this measure was completed in an attempt to provide primarily Spanish-speakers with the same neuropsychological tools that are currently available to the English community. The goal of this research is to decrease health disparities for Spanish speaking individuals in both clinical and research environments. As the Hispanic population continues to grow in the US, neuropsychological measures must be validated and normed specifically for Spanish speakers in order to correctly identify neurocognitive decline and provide accurate diagnostic services.

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**E.B. TEAGUE, K.R. SAVAGE, I. DZIOBEK, J. TWAITE, L. SULLIVAN & J.C. BOROD. The Cognitive and Emotional Empathy Questionnaire: Factor Structure and Psychometric Properties.**

**Objective:** Research has suggested that empathy is a multifaceted construct, comprised of several related, yet separable components. The Cognitive and Emotional Empathy Questionnaire (CEEQ; Rogers et al., 2008) is a newly constructed self-report measure, capable of assessing both cognitive and emotional empathy. The questionnaire is comprised of two main scales, the Cognitive Scale and Emotional Scale, each of which is divided into two subscales. The aim of this study was to provide evidence for the theoretical factor structure of the questionnaire and to further examine its reliability and validity.

**Participants and Methods:** The CEEQ was administered to a group of healthy adults ( $n=195$ ; 62% female; mean age= $23.0 \pm 7.0$ ). Internal consistency, structural validity, and construct validity were examined. Additional measures were administered to examine their relationship with the CEEQ (e.g., theory of mind, alexithymia, personality, and intelligence).

**Results:** Factor analysis yielded four factors corresponding to the four CEEQ subscales (Mental State Perception, Perspective Taking, Mirroring, and Empathic Concern), with clear separation of emotional and cognitive items. The subscales were found to have good internal consistency (median Cronbach's alpha=.80). Interscale correlations demonstrated a stronger relationship between the two emotional subscales and between the two cognitive subscales than for any emotional-cognitive comparison. Each subscale demonstrated a meaningful pattern of relationship with pertinent psychological constructs (e.g., cognitive empathy versus theory of mind).

**Conclusions:** Results support the theoretical factor structure of the CEEQ, demonstrating the existence of cognitive and emotional components and their respective subscales. Additional evidence is provided for the reliability and validity of the questionnaire.

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**H. TELLEZ, J. HERNANDEZ GONZALEZ & G. SALCEDA. Execution in Verbal and Spatial Tasks in The Right and Left Handed.**

**Objective:** Corroborate the existence of differences in verbal and spatial abilities between right and left handed people. To investigate the influence of both hemispheres in performing tasks that involve semantic skills and phonological evolution. Analyze the performance of left- and right-handed subjects in these tasks, comparing the run time to verify any differences. Also review results of tests of spatial abilities of left-handed people to confirm if there is a better performance in these tasks.

**Participants and Methods:** Were applied semantic and phonological fluency tests, besides the spatial skills bricks test Piéron at 37 handed subjects and 37 right-handed subjects. These tests were applied to subjects ranging in age from 17 to 40 years. The sample was chosen randomly.

**Results:** Against expectations, no significant difference in the scores between left- and right-handed subjects, both in verbal tasks and in space.

**Conclusions:** Despite the belief that there are large differences between the performance of verbal and spatial tasks between left- and right-handed subjects, the results of this research suggest that these differences, if any, are not significant. We present an analysis of the neuropsychological processes involved in these tasks in order to develop an explanation of these results.

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#### **H. TRONTEL, R. MADATHIL, T. KIMPTON & S. HALL. Early Warning Affects the Face Validity of Effort Tests.**

**Objective:** To determine if a warning prior to the administration of effort tests affects the face validity of the measures. It was hypothesized that receiving the warning prior to taking the test battery (early) would significantly decrease face validity and improve performance on effort tests compared to groups receiving the warning after taking the tests (late).

**Participants and Methods:** To determine if a warning prior to the administration of effort tests affects the face validity of the measures. It was hypothesized that receiving the warning prior to taking the test battery (early) will decrease face validity of the effort tests and improve performance, while receiving the warning after taking the tests (late) will have no effect.

Sixty psychology students were randomly assigned to either a coached brain injury simulator (CBIS) group or a control group. These participants were further divided into early or late warning groups. Participants were administered two effort tests, the Test of Memory Malingering (TOMM) and Memory for Complex Pictures (MCP), as part of a battery of standard neuropsychological tests. After completing the tests, they were asked to indicate what they thought each test was designed to measure (i.e. face validity). Responses were coded (e.g., memory, attention, learning) and average confidence ratings in those judgments were calculated.

**Results:** Face validity for both effort tests was significantly lower for the early-CBIS group. That is, fewer participants endorsed these tests as measuring aspects of cognition and some actually suspected that they were designed to measure effort. For the late-CBIS, early-Controls, and late-Controls, face validity was uniformly high. Participant's confidence in their judgments was high in all groups.

**Conclusions:** Providing a warning prior to administration of effort tests may decrease the face validity of these measures for individuals in a simulator role. A decrease in face validity may also improve performance on effort measures.

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#### **C. VON THOMSEN & T. FLYNN. Relationships Among Self-Report Variables and Census-Based Neighborhood Data Used to Estimate Socioeconomic Status.**

**Objective:** Socioeconomic status (SES) is a complex latent construct that affects many aspects of neuropsychological assessment and research. Income and education are manifest variables used to measure this construct. However, income is typically not assessed in clinical work and self-reported income is vulnerable to impression management, making estimation of SES potentially less valid. Over recent years, census-based block level neighborhood information has become readily available. The goal of this study was to explore relationships among traditional self-report variables reflecting SES and census-based neighborhood data.

**Participants and Methods:** Twenty-four African-American parents/caregivers of participants in a study conducted at The Children's Hospital of Philadelphia regarding sickle cell disease. Median household income levels from the 2000 United States Census for subjects' residence was obtained through the Philadelphia Neighborhood Information System and correlated with self-reported household income and parental education.

**Results:** There was a significant correlation between self-reported household income and comparable census data (Spearman's rho = .46, p = .031). Census block-level income level was not significantly correlated with self-reported family education level, but self-reported family education level correlated significantly with self-reported income (Spearman's rho = .55, p = .008).

**Conclusions:** In this urban African-American sample, census-based block level data correlated significantly with self-reported income level. Census data provides a means of improving SES estimates when home address is available. Clinical and research implications are discussed, including the advantages and disadvantages of household specific data versus block level aggregate data.

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#### **J. WINGO, D. HAN, E.R. TUMINELLO & C. RANDOLPH. Version Equivalence of a Computerized Neuropsychological Battery.**

**Objective:** We are currently piloting a new computerized battery, provisionally named CogTest. This battery includes measures of working memory, cognitive processing speed, and anterograde memory, all measured using both verbal and visually-based subtests, with several built-in measures of effort. Three separate versions of the battery were created, to minimize practice effects on repeated testing. The present study was conducted to explore form equivalence and short-term practice effects as part of initial psychometric validation of the battery.

**Participants and Methods:** Thirty-one undergraduate students were recruited for this study. Participants were randomized and completed all three versions of the computerized neuropsychological battery, at approximately one-week intervals.

**Results:** The equivalence of each of the twelve subtests in the battery across forms was examined by one-way ANOVAs. There were no significant differences between the different versions of the battery for any subtest. Practice effects were also explored in the same fashion, comparing performance on each subtest as a function of administration order. There was no effect of administration order (time) for any of the twelve subtests, suggesting that practice effects are minimal on this battery.

**Conclusions:** There may be a role for computerized neurocognitive testing in individual neuropsychological assessment, but well-validated, clinically-useful batteries are not yet in widespread use. The CogTest battery was developed to serve as a core measure of attention and memory in verbal and visual domains, with "built-in" measures of effort. These preliminary results suggest that the three forms of the battery are equivalent, and that practice effects are minimal, even over short retest intervals with healthy subjects. Further psychometric and clinical validation of the battery is pending.

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#### **F. WOON, C. BECK & R. HOPKINS. Cognitive Screening Tests Predict Functional Outcomes and Quality of Life in Survivors of Critical Illness.**

**Objective:** Critically ill patients may develop cognitive and functional deficits and experience reduced quality of life. Information regarding early identification of patients who are at risk of developing functional deficits is lacking. This study assessed whether cognitive screening tests, the Mini-Mental Status Exam (MMSE) and Mini-Cog, administered prior to hospital discharge predict unfavorable functional outcomes and quality-of-life at six-months, using the Independent Living Scale (ILS) and Medical Outcomes Study Short-Form 36 (SF-36).

**Participants and Methods:** Study inclusion criteria were mechanical ventilation >48 hours and patient age >18 years. Study exclusion criteria were disease states that are irreversible, central nervous system injury, and pre-existing cognitive impairment. Seventy patients (35 males and 35 females) with a mean age of 54±17 years and mean education of 13±2.1 years were administered the MMSE and Mini-Cog prior to hospital discharge.

**Results:** Twenty-three (33%) patients were impaired on the MMSE (score <24) with 32 (46%) patients impaired on the Mini-Cog. Linear regression analyses found performance on the MMSE and Mini-Cog predicted poor functional outcome on the ILS Memory/Orientation subscale, Money Management subscale, and Full-Scale Standard Score. MMSE scores predicted reduced ILS Performance/Information scores, while Mini-Cog scores predicted reduced ILS Health/Safety and Problem Solving scores. For quality of life, MMSE scores predicted lower Emotional Functioning and Mini-Cog scores predicted lower Social Functioning on the SF-36.

**Conclusions:** In critically-ill patients, the MMSE and Mini-Cog scores at hospital discharge predicted functional deficits and decreased quality-of-life for emotional and social domains at 6-months. Early detection of poor functional outcomes and quality-of-life may expedite referrals for interventions.

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**H. WOUTERS, B. APPELS, W. VAN DER FLIER, J. VAN CAMPEN, M. KLEIN, K. ZWINDERMAN, B. SCHMAND, W.A. VAN GOOL, P. SCHELTENS & R. LINDEBOOM. Measuring global cognitive ability in mild dementia more precisely: a new step.**

**Objective:** Dementia specific instruments are often imprecise in early dementia. Item Response Theory (IRT), was used to examine their appropriateness and equate them with neuropsychological tests to improve the assessment of early dementia.

**Participants and Methods:** 585 normal ageing participants, 949 demented patients and 255 mildly demented (MMSE > 23) or MCI patients had besides the MMSE, the CAMCOG, the ADAS-cog or a Neuropsychological Testbattery (NTB) with Verbal Fluency, Stroop, Trailmaking, Visual Association, and Symbol Substitution Tests administered. Despite having different items, individuals' ability levels and item difficulties (logits) could be estimated with 'common item equating' (IRT) using the MMSE items.

**Results:** NTB-tasks (M 0.75, SD 0.29) were more difficult than CAMCOG (M 0, SD 0.51) and MMSE (M -0.15, SD 0.69) items, which were more difficult than ADAS-cog items (M -0.86, SD 0.71):  $F(3,53) 20.22$ ,  $p = 0.00$ . NTB-tasks better matched ability levels of mildly demented (M 0.48, SD 0.34) and ADAS-cog items those of advanced demented (M -0.47, SD 0.53). Along the ability range (-1SD; M; +1SD) the reliability of the MMSE declined markedly: 0.82; 0.83; 0.69, whereas it remained stable for ability estimates based on the MMSE with either the CAMCOG, ADAS-cog or NTB. (0.91; 0.92; 0.93). The MMSE and NTB (AUC 0.85) detected mild dementia and MCI better than the MMSE (AUC 0.78).

**Conclusions:** Specific NTB-tasks are suitable for monitoring mild dementia, while the CAMCOG, MMSE and particularly the ADAS-cog are more suitable for monitoring advanced dementia.

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**J.C. YOUNG, B.L. ROPER & L.A. KEARNS. Predictive validity of the Henry-Heilbronner Index in Detection of Noncredible Performance and Compensation-Seeking Status in U.S. Veteran Sample.**

**Objective:** The Henry-Heilbronner Index (HHI; Henry et al., 2006) is an empirically derived MMPI-2 scale purported to have strong sensitivity and specificity in the detection of response bias for somatic and cognitive symptoms. Utilizing a veteran sample, the present study examined the HHI's utility in predicting WMT failure and presence of recent, current, or upcoming compensation evaluation.

**Participants and Methods:** Archival data was collected from 174 veterans who completed the MMPI-2 and WMT within a neuropsychological evaluation, with 49% failing the WMT. Thirty-three percent (n=58) were seen either in a compensation evaluation or within several months' proximity to such an evaluation, comprising a compensation-context (CC) group. We examined the predictive validity of HHI in contrast to existing MMPI-2 validity scales.

**Results:** WMT performance and CC status were not significantly related. HHI trended towards significance with WMT performance ( $r=.15$ ,  $p=.051$ ), but it correlated with CC status ( $r=.24$ ,  $p=.002$ ). Also, CC status significantly correlated with L ( $r=-.24$ ,  $p=.002$ ), K ( $r=-.20$ ,  $p=.01$ ), FBS ( $r=.18$ ,  $p=.015$ ), and Fb ( $r=.16$ ,  $p=.04$ ). Veterans defined as CC were significantly younger than others ( $p<.001$ ), and therefore hierarchical logistic regressions controlled for age ( $p=.0001$ ) in block 1. In block 2, HHI ( $p=.0004$ ) more closely predicted CC status than other validity scales. Mean HHI scores exceeded the recommended cutoff regardless of WMT pass/fail status. Despite HHI's association with CC status, the mean HHI score for the non-CC group was above the cutoff.

**Conclusions:** HHI showed incremental validity in predicting CC status but not WMT failure. Results suggest that HHI may predict broader aspects of compensation seeking than those associated with neurocognitive effort, but the recommended cutoff may be too low for some settings.

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## Forensic Neuropsychology

**K.C. BORJA & F. OSTROSKY-SOLÍS. Early trauma and psychopathy in adult male inmates.**

**Objective:** To determine the influence of early trauma experiences in the development of psychopathy among adult male inmates.

**Participants and Methods:** 194 adult inmates (mean age 34.5 years) were interviewed and grouped according to their degree of psychopathy using the PCL-R, yielding low(LP) (n=96), medium(MP) (n=59) and high(HP) (n=44) psychopathy. The frequency and variety of traumatic events experienced before age 18 were derived from the Early Trauma Inventory.

**Results:** An association between HP and high victimization was observed, ANOVA showed that the HP group suffered more stressful events as well as physical, emotional and sexual abuse when compared with the LP group ( $p < 0.00$ ) and the HP group experienced more early trauma events than the other groups ( $p < 0.01$ ). A regression analyses showed that emotional abuse and the totality of early trauma events contributed significantly to the PCL-R score ( $p < 0.01$ ). Finally, the MP and HP groups witnessed more stressful and violent events than the LP group ( $p < 0.01$ ), while the HP group experienced more direct abuse or punishment than the LP group ( $p < 0.04$ ).

**Conclusions:** Psychopathy is a complex conduct disorder and early trauma events may potentiate preexisting neurobiological impairments and its manifestations, including crimes and delinquency. For groups at risk of developing psychopathic traits, early intervention may be considered in order to prevent future violent and aggressive acts.

Research partially supported by CONACYT through ICYTDF422.01YTDF422.01 - 49127-H grant program.

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**M. CONSTANTINO. Suboptimal Motivation in Children diagnosed with CD or ODD.**

**Objective:** In search of psychosocial profiles hidden behind the diagnosis of suboptimal motivation children, diagnosed with conduct disorder (CD) or oppositional defiant disorder (ODD), who underwent neuropsychological evaluations, were administered the test of Memory Malingered (TOMM).

**Participants and Methods:** Children diagnosed with CD (69) or ODD (78) were administered the TOMM which was part of a neuropsychological evaluation. Their performance on the TOMM was compared with that of 90 matched children that underwent neuropsychological evaluation, but did not present with ODD or CD.

**Results:** Regression analyses and descriptive statistical showed that children diagnosed with CD or ODD are about three times more likely to

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fail the TOMM than children without either of these two diagnoses. Children diagnosed with CD were also found to be two times more likely to fail the TOMM than their peers diagnosed with ODD. Children without any of these diagnoses and failed the TOMM performed much higher than children failing the TOMM and diagnosed with CD or ODD, as well. **Conclusions:** It appears that the defiant and negative behavior that permeates the psychological profile of children diagnosed with CD or ODD may actually decrease significantly their motivation to give their best during neuropsychological evaluations. Historical information about the presence or absence of ODD or CD should be a red flag for neuropsychologists, who should evaluate the motivation of such children with care. Correspondence: *Marios Constantinou, Ph.D., Psychology, University of Nicosia, 66 Metohiou Avenue, Engomi, Nicosia 1700, Cyprus. E-mail: constantinou.m@intercollege.ac.cy*

**J.J. DAVIS, C.K. RAMOS, C.M. SHERER, D.M. BERTRAM & J.R. WALL. Use of Digit Symbol-Coding to Assess Effort.**

**Objective:** This study examined WAIS-III Digit Symbol-Coding (DSy) as an effort measure in a simulated malingering design. Classification accuracy of DSy scaled scores alone and DSy in combination with Reliable Digit Span (RDS) were compared to classification accuracy of the Test of Memory Malingering (TOMM) and Word Memory Test (WMT). **Participants and Methods:** These data were collected as part of an experimental study conducted at a Midwestern university during 2007. Undergraduates without reported neurological history were randomized to control (n=31), naïve simulator (n=34), and coached simulator (n=34) groups. The sample was 86% female, 86% Caucasian, and 92% right handed. Mean age was 20.5 years (SD = 4.3), and average educational level was 12.9 years (SD = 1.1).

**Results:** Violations of assumptions of normality and homogeneity of variances were noted on TOMM and WMT scores. Results of nonparametric and parametric analyses were comparable, so parametric results are reported. Univariate ANOVA revealed significant differences between control and simulator groups on WAIS-III, TOMM, and WMT subtests (all  $p$ 's <.001). The WMT correctly classified 100% of controls and 71% of simulators. The TOMM correctly classified 100% of controls and 38-59% of simulators. ROC analysis was used to identify an optimal cut score on DSy. DSy correctly classified 100% of controls, and 32-35% of simulators. In combination, DSy and RDS correctly classified 97% of controls, and 59-62% of simulators.

**Conclusions:** Classification accuracy of DSy improved when combined with RDS. The use of DSy as an embedded measure may warrant further study in a clinical sample.

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**J. DENBOER & S. HALL. Neuropsychological Profiles of Successful Brain Injury Simulators on the TOMM, WMT, and CARB.**

**Objective:** Dissimulation of cognitive deficits is a considerable threat to the validity of neuropsychological assessment. Although studies employing dissimulation paradigms have found that brain injury simulators, when given specific instructions on how to avoid detection, are often misclassified as controls (DiCarlo, Gfeller, and Oliveri, 2000), recent research has shown that coached brain injury simulators are capable of successfully faking neuropsychological impairment on popular and frequently-used symptom validity test (SVT's) (DenBoer & Hall, 2007). The poster will review the neuropsychological profiles of successful brain injury simulators (SBIS) on three popular symptom validity tests (SVTs): the Test of Memory Malingering (TOMM), Word Memory Test (WMT), and Computerized Assessment of Response Bias (CARB).

**Participants and Methods:** Two studies will be reviewed. Study 1 examined the ability of simulated malingerers to effectively escape detection against the most frequently-used SVT, the Test of Memory Malingering (TOMM). Study 2 examined the ability of simulated malingerers to effectively escape detection against three frequently-used SVT's: the Test of Memory Malingering (TOMM), the Word Memory Test (WMT) and the Computerized Assessment of Response Bias (CARB).

**Results:** Study 1 found that 29 brain-injury simulators (32% of the sample) successfully escaped detection by the TOMM while suppressing their scores on standard neuropsychological measures.

Study 2 found that all three tests had relatively equivalent specificity, with the CARB having higher sensitivity.

**Conclusions:** In this study successful malingering was observed on all three SVT's and successful malingering occurred whether these measures were used alone or in combination with one another. These results emphasize the use of multiple malingering detection measures and push for the further development of SVTs with greater sensitivity and specificity.

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**K.X. DIAZ & F. OSTROSKY. Frontal Neuropsychological Deficits in Psychopaths.**

**Objective:** to evaluate cognitive frontal functioning in psychopathic offenders, with a neuropsychological battery that measures different frontal areas: dorsolateral (working memory and executive functions) orbital (decision making) and anterior medial cingulate cortex (inhibition) (Flores, Ostrosky & Lozano, 2008).

**Participants and Methods:** 76 adult males: 48 inmates and 18 controls with a mean age of 35.2±10.05 and mean years of education of 10.7±3.9. Inmates were divided into psychopaths (n=27) and non psychopaths (n=31) according to Hare's Psychopathy Check List Revised (PCL-R, 2003), adapted and standardized in Mexican population (Ostrosky et al, 2008).

**Results:** ANOVA showed significant differences between psychopaths and non psychopaths and the control subjects in tasks that involve planning, mental flexibility, decision making, working memory, and inhibition processes. Correlational analysis showed that psychopaths obtained lower scores in several dorsolateral and orbital measures, making more perseverative and inhibition errors.

**Conclusions:** Psychopaths showed specific impairments in cognitive processes that are necessary for good decision making and inhibition of behavior. These results support the frontal impairment theory in psychopaths and suggest a complex brain circuit that underlies this disorder. **ACKNOWLEDGEMENTS:** This work was partially supported by the "Consejo Nacional de Ciencia y Tecnología" (CONACYT) # 49127-H, by the "Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica", Universidad Nacional Autónoma de México (PAPITT) # IN31260 and by the "Instituto de Ciencia y Tecnología del Gobierno del Distrito Federal" #PICDS08-19.

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**G. FRANCO, R.A. LEARK, S.L. SKIDMORE & K. BOONE. Detection of Simulated Memory Impairment in a Monolingual Male Spanish-speaking Latino Sample.**

**Objective:** There is a paucity of literature concerning the monolingual Spanish-speaking community and their ability to simulate memory impairments. As a result, test scores with this population are often compared with other ethnic groups, leading to test interpretation error. This study used a measure for malingering that incorporated computerized administration and tracked and recorded response times.

**Participants and Methods:** Two groups of 30 monolingual Spanish-speaking males ranging in ages from 18-49 (M=31.49) with 0-10 (M=6.40) years of education were administered the Positive Memory Interference Test (PMIT; Maj et al., 1991) using random assignment and counterbalanced design to test for order effects. Groups that were different only in test instruction (normal/malingering).

**Results:** Significant differences in total mean correct scores were found between the normal and malingering condition  $t(59) = -5.354, p < .01$ . Sensitivity and specificity rates were also calculated for various total scores. Setting specificity at ≥90%, the highest sensitivity (43%) was obtained through the use of a

cut-off score of  $\leq 146$  on total correct scores (trials 1-5). Further, it was found that order of administration did not affect test performance  $F(1, 58) = .398 = p > .05$  for the normal condition and malingering condition  $F(1, 58) = .518, p > .05$ . However, no significant differences were found between malingering and normal condition in terms of response latency periods.

**Conclusions:** This study demonstrates that the PMIT may be a useful measure in detecting simulated memory performance in monolingual Spanish-speaking Latino males.

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**J. HOELZLE, N.W. NELSON, K.A. MCGUIRE, S.R. SPONHEIM, A.G. FERRIER-AUERBACH & M.J. CHARLESWORTH. Secondary Gain Context Impacts Neuropsychological Performances Among OEF/OIF Veterans with Histories of Blast-Related Concussion (mTBI).**

**Objective:** Insufficient effort and symptom exaggeration are known to impact neuropsychological performances among civilians evaluated in secondary gain contexts. Whether these issues are salient among OEF/OIF veterans with histories of blast-related concussion is unclear. The current study investigated symptom validity, cognitive performance, and MMPI-2 profiles among OEF/OIF samples evaluated in secondary gain and research contexts.

**Participants and Methods:** OEF/OIF veterans with histories of blast-related concussion completed neuropsychological evaluations in secondary gain and research settings. An overall test battery mean (OTBM) was derived from multiple neuropsychological measures as an indicator of overall cognitive performance.

**Results:** The secondary gain group demonstrated a higher base rate of insufficient effort performances and exaggerated psychological symptoms on the MMPI-2. Insufficient effort and exaggerated emotional distress were negatively correlated with OTBM.

**Conclusions:** Findings are consistent with literature illustrating increased prevalence of insufficient effort and exaggerated emotional distress in secondary-gain contexts. Meaningful negative associations between cognitive performance, effort, and emotional status were observed. As in civilian settings, present findings highlight the importance of incorporating response validity measures in neuropsychological evaluations conducted in secondary gain contexts.

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**L. JASINSKI & D. BERRY. Use of the Digit Span Subtest for Malingering Detection: A Meta-Analysis.**

**Objective:** The present meta-analysis evaluated the effectiveness of the Digit Span subtest of several versions of the widely utilized Wechsler Adult Intelligence Scale (WAIS) and Wechsler Memory Scale (WMS) in detecting malingered neurocognitive dysfunction. Both the Digit Span Age-Corrected Scaled Score (DS-ACSS) and Reliable Digit Span (RDS) variants were explored, as well as methodological moderators.

**Participants and Methods:** A total of 24 papers, resulting in 26 independent contrasts, met inclusion criteria and were utilized in the analysis of effect size, while 19 contrasts were available for analysis of diagnostic accuracy statistics.

**Results:** A large mean effect size ( $d = 1.25$ ) was obtained. No significant differences were found between the effect sizes for DS-ACSS versus RDS, indicating these may be used interchangeably to detect feigning. There were no differences between versions of the WAIS or WMS, promising results in light of the newly released versions of both tests. Homogeneity statistics for the overall sample were not significant; however, theoretically advanced methodological moderators were explored. No differences were found between simulation and known-groups study

designs. For simulation designs, the presence of financial incentives for feigning resulted in larger effect sizes, while a warning to feign believably produced smaller group differences. Specificity values for the DS-ACSS (87%) and RDS (86%) were strong, with adequate sensitivity (63% and 60%, respectively).

**Conclusions:** These results are similar to dedicated symptom validity tests (SVTs), and suggest the Digit Span subtest is a promising measure of malingered neurocognitive dysfunction. Further, its potential as a screening measure awaits exploration.

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**A. MILKEY, D.E. JURECSKA, K. GATHERCOAL, W. ADAMS, M.A. PETERSON & K. GREGG. The Malingered Ignorance of Legal Knowledge (MILK): Initial Development, Validation, and Psychometric Testing of the MILK.**

**Objective:** Best practice in forensic neuropsychological evaluations requires assessing cognitive effort and response validity. This is most commonly accomplished through the use of a general assessment of effort, such as the Test of Memory Malingering (TOMM). While the TOMM and similar tests of effort are useful in determining feigning of general impairment, often examinees in forensic evaluations are motivated to feign specific impairments of legal knowledge. The Malingered Ignorance of Legal Knowledge (MILK) test is a symptom validity test with content that is specifically relevant to the legal milieu.

**Participants and Methods:** Both the TOMM and the MILK were administered to 112 prisoners with intellectual disabilities.

**Results:** Individuals whose score on the TOMM suggested exaggerated cognitive deficits did not also obtain elevated scores on the MILK.

**Conclusions:** Evidence of exaggerated cognitive impairments does not necessarily suggest feigned ignorance of legal knowledge. In forensic examination of competency to stand trial the validity of ignorance of legal knowledge should be examined directly using an instrument designed for that purpose.

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**M.S. KIM, K.B. BOONE, S.D. MARION, S. AMANO, M.E. COTTINGHAM, E.A. ZIEGLER, T. VICTOR & M.A. ZELLER. The Warrington Recognition Memory Test for Words as a Measure of Response Bias: Total Scores and Response Time Cutoffs Developed on "Real World" Credible and Noncredible Subjects.**

**Objective:** Several studies have examined the usefulness of the Warrington Recognition Memory Test for Words as a measure to detect suspect effort, although samples have generally been small and/or comprised of simulators rather than "real world" credible and noncredible patients. The current study examined the Warrington Recognition Memory Test - Words total score and response time of "real world" noncredible patients versus credible patients.

**Participants and Methods:** Noncredible patients were determined by their motive to feign, failure on  $\geq 2$  independent measures of response bias, and low cognitive scores inconsistent with normal ADLs ( $n = 190$ ), while credible patients were determined by no motive to feign and failure of  $\leq 1$  measure of response bias ( $n = 124$ ). Participants were derived from an archival database of individuals from the Harbor-UCLA Medical Center Department of Psychiatry Outpatient Neuropsychology Service and the private practice of the second author.

**Results:** Noncredible patients obtained significantly lower total scores and longer times to complete the task. A total correct cut-off of  $\leq 42$  was found to have excellent specificity (91.9%) and sensitivity (88.9%), while a time cut-off of  $\geq 207$  was associated with 90.7% specificity and 65.5% specificity, and when the time cut-score was used in combination with the total score cut-off an additional 5% of the noncredible participants were captured, raising overall sensitivity to 93.7%.

**Conclusions:** In summary, results from the present study suggest that the Warrington Recognition Memory Test – Words may be overall one of the most effective measures of response bias currently available for clinical neuropsychological practice.

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**D.S. GOLDSTEIN, L.A. SWOROWSKI & R. MADRID. Increasing the Positive Predictive Power of the Rey Fifteen Item Test in Criminal Defendants through the Use of Alternative Scoring Methods and Cutoff Scores.**

**Objective:** This investigation compared the effect on sensitivity and specificity of altered cutoff scores using both traditional and experimental scoring procedures for a commonly used effort measure, the Rey Fifteen Item Test (FIT), among criminal defendants.

**Participants and Methods:** A sample of felony defendants undergoing adjudication-related evaluation ( $n = 150$ ) was compared to a sample of post conditional offer public safety candidates undergoing psychological evaluation ( $n = 150$ ). Participants were judged to have provided good, questionable or poor effort based on extensive clinical interviews and in the forensic sample, comprehensive neuropsychological evaluation and record review. Using traditional and experimental scoring, which has been noted to differ among labs (Griffen et al, 1997), failure rates and optimal cutoff scores were calculated for both samples and changes in relative sensitivity and specificity determined. ‘Traditional Items’ earned points for correct rendition and location within the 3 x 5 matrix. ‘Experimental Items’ earned points for correct renditions irrespective of location and awarded enclosed Roman numerals (e.g., I versus II). ‘Experimental Rows’ earned points for correct item sequences irrespective of placement within the overall 3 x 5 matrix, including ‘experimental’ Roman numerals.

**Results:** Increases in sensitivity and specificity were obtained by using experimental scoring methods for both Rey Items and Rows, as well as a clinically derived cutoff score based on sample-specific performance characteristics of criminal defendants versus the traditionally recommended cutoff score of 7 on the FIT.

**Conclusions:** The use of experimental scoring and altered cutoff scores improved the positive predictive power of the Rey FIT in identifying sub-optimal effort among criminal defendants.

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**J.B. MILLER, S.J. MEACHEN, E.M. HOLCOMB, J.R. BASHEM & L.J. RAPPORT. The Patient Competency Rating Scale as a Measure of Symptom Exaggeration in a Simulator Sample.**

**Objective:** The Patient Competency Rating Scale (PCRS; Prigatano, 1986; Hart, 2000) is a 30-item self-report measure of awareness that asks traumatic brain injury (TBI) survivors to rate the level of difficulty encountered in completion of a variety of practical skills using a 5-point Likert scale. The aim of the present study was to investigate the use of the PCRS as a measure of symptom exaggeration in the context of neuropsychological evaluation.

**Participants and Methods:** Participants were 28 outpatient adults with moderate to severe TBI and 17 healthy adults coached to simulate TBI. Measures included the PCRS and several effort measures in addition to other measures of cognitive ability. All tests were administered and scored according to standardized instructions. The total score from the PCRS was analyzed via ANOVA using the total score as the independent variable and group membership as the dependent variable.

**Results:** ANOVA revealed that the PCRS total score differed significantly by group ( $F(1,40) = 38.82, p < .001$ ). Post-hoc analysis of descriptive statistics indicated that the simulator group reported significantly greater difficulty with everyday activities of daily living in comparison to the TBI group.

**Conclusions:** These initial results offer evidence to suggest that the PCRS may be an effective measure of over-reporting of TBI related symptoms. When asked to simulate a TBI, healthy adults perceived common tasks of everyday living as significantly more difficult than those with bona fide TBI. Future research should attempt to validate this measure against standard measures of symptom exaggeration.

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**S. MOONEY, J. RAIN TREE, D. MOORE, J. RIGG & D. WILKIE. Cognitive Effort Among Concussed Enlisted Soldiers Following Deployment.**

**Objective:** There is a paucity of research investigating the relative frequency of suboptimal effort and motivational approach to psychometric cognitive testing in enlisted soldiers with subjective cognitive complaints following a history of mild TBI sustained during deployment. Appreciation of cognitive effort is important regarding the strength of inferences drawn from a cognitive data set. Prior research has shown that it is highly statistically improbable to fail two or more tasks sensitive to effort across different cognitive domains (e.g., attention vs. memory). The present study examines the frequency of ‘variable’ (failing 1/2) or ‘poor’ (failing 2/2) effort across Reliable Digit Span (RDS) and CVLT-II Force Choice (FC) indicators amongst enlisted soldiers evaluated in our TBI Clinic.

**Participants and Methods:** 25 consecutive enlisted soldiers (64% Caucasian, 20% AA, 16% ‘Other’) with a self-reported history of mild TBI sustained during previous deployment(s) underwent a neuropsychological evaluation. Average(SD) age, education, and WTAR Full Scale IQ were 32(7.9), 12.9(1.4), and 100.2(7.9), respectively. Average(SD) number of deployments was 2.1(1). Average(SD) number of events resulting in LOC <30minutes in duration was 2.6(2.4) ranging between 1-7 occurrences.

**Results:** Average(SD) RDS and FC scores were 9.1(1.9) and 15.3(1.7). 20% of the sample demonstrated ‘variable’ effort. Another 16% of the sample demonstrated ‘poor’ effort.

**Conclusions:** Amongst enlisted soldiers, variable or poor effort is a common finding during the course of a neuropsychological evaluation occurring in upwards of 36% of cases. These findings are generally consistent with civilian patients with a history of chronic pain or mild TBI who are involved in litigation.

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**D.G. NEMETH, T.W. OLIVIER, L.T. WHITTINGTON & N.E. MAY. The Role of the Treating Neuropsychologist in Forensic Cases.**

**Objective:** In spite of clear position papers from various neuropsychological professional organizations, there continues to be considerable confusion regarding the role of the treating neuropsychologist in forensic cases. This confusion is not only limited to the patient, the patient’s family, and/or the referring attorney, but it often extends to the various other professionals involved in the case. The purpose of this paper will be to assist treating neuropsychologists to (a.) better understand the limitations of their roles, (b.) outline effective methods of communicating these boundaries to patients, their families, and their attorneys, and (c.) assist in clarifying expectations before treatment commences. By carefully engaging in this preliminary process, better outcomes can be achieved.

**Participants and Methods:** A literature review of current professional papers will be presented. Samples of contracts between either the patient/patient’s family or the attorney of record will be offered. The following procedures will be outlined: 1) Preparation, 2) Treatment, 3) Documentation, and 4) Deposition/Court Appearance.

**Results:** It is important to have a clear flow of information from the initial phone contact to the eventual court appearance. When the finances and costs are well understood and agreed upon before the patient is seen, the treating neuropsychologist is in a better position to offer the highest level of professional services possible.

**Conclusions:** Confusion regarding finances, roles, and expectations often lead to misinterpretations and misunderstandings. As more clinical neuropsychologists take on the role of treating neuropsychologist, rather than evaluating neuropsychologist, these issues must be addressed and clarified.

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### C. ROMERO & F. OSTROSKY. Cognitive Distortions in Psychopath Offenders.

**Objective:** The present study aimed to investigate cognitive abnormalities about violence in psychopath offenders assessed by a modified Implicit Association Test (IAT). (Ostrosky, Romero & Vélez, 2009).

**Participants and Methods:** A sample of 195 inmates (mean age=36.05±10; mean years of education=9.64±3.44) divided into six groups according to their PCL-R scores and their offenses. And then divided according to their factor level of psychopathy (Factor 1: affective and interpersonal; Factor 2: antisocial and lifestyle).

A version of the IAT was developed (violent-IAT) to evaluate cognitive distortions about violence and possible disposition toward violent behavior.

**Results:** The results of ANOVA showed significant differences between psychopath-violent offenders and non psychopath-non violent offenders, and between the psychopath-violent group and the psychopath-non violent group. When the sample was divided according to factor level the ANOVA test showed differences between high factor 1 group and high factor 2 and high factor 1 and 2 groups.

**Conclusions:** Results suggest the presence of cognitive distortions about violence that can increase disposition toward violent behavior in the psychopath-violent offenders and in the offenders with high level of both components of psychopathy; the discussion also emphasizes the possibility to differentiate between two groups of psychopaths one in which the cognitive distortions are present and other group in which they are not, and the possibility of detecting by the violent-IAT, subjects at risk to commit extreme violent offences.

**ACKNOWLEDGEMENTS:** This work was partially supported by the "Consejo Nacional de Ciencia y Tecnología" (CONACYT)# 49127-H, by the "Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica, Universidad Nacional Autónoma de México" (PAPIT)#IN31260 and by the "Instituto de Ciencia y Tecnología del Gobierno del Distrito Federal" PICDS08-19.

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### R.W. SCHROEDER & P.S. MARSHALL. Validation of Multiple Effort Indices in Schizophrenic and Non-Psychotic Psychiatric Populations.

**Objective:** Recent research has indicated that many individuals with psychiatric disorders, especially psychotic disorders, perform poorly on neuropsychological tests due to their cognitive impairments. Unfortunately, there is still a lack of research on whether cognitive impairments related to psychiatric disorders can cause a failing score on symptom validity tests (SVT). This study, therefore, was conducted to determine SVT failure rates in psychiatric populations.

**Participants and Methods:** This study utilized 125 individuals diagnosed with schizophrenia and 125 individuals diagnosed with non-psychotic psychiatric disorders. These two groups were matched for age, education, and IQ. Failure rates were calculated for each SVT and for overall suspect effort classification based on 2+ SVT failures or below chance SVT performance.

**Results:** Neither psychotic nor non-psychotic psychiatric individuals produced excessively high false-positive rates of suspect effort. Further, the overall rates of suspect effort were not significantly different for either clinical group and did not differ from established neuropsychological base rates of malingering. Additionally, most of the individual SVTs

yielded specificity rates of 90% or better for both clinical groups. The only tests that did not yield adequate specificity rates were the Reliable Digit Span (for both clinical groups) and Dot Counting Test (for the non-psychotic group). Therefore, additional cutoff scores were analyzed for these tests.

**Conclusions:** Psychiatric patients do not produce an excessive number of false-positive failures on most SVTs. Furthermore, it is unlikely that an individual with a psychiatric diagnosis is going to be incorrectly identified as suspect effort based on SVT performance.

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### J. SPECTOR & A.G. LEWANDOWSKI. Significant rate of SVT failure in a sample of early childhood, low-level lead exposure litigants.

**Objective:** Malingering occurs in about 30% of cases of litigated mTBI or alleged toxic exposure. This approximate rate has been reported across settings and age groups. Low level lead exposure in early childhood is reported to be associated with a modest and inconsistent pattern of deficits in neuropsychological functioning. It was hypothesized that a significant portion of lead exposure litigants might also exhibit evidence of exaggerated cognitive impairment.

**Participants and Methods:** Subjects were 200 inner city residents aged 12-24 involved in lawsuits over their low level (10-30 µg/dl) childhood lead exposures. All underwent comprehensive neuropsychological evaluation following Defense referral, including administration of two symptom validity procedures: the Word Memory Test and the Victoria Symptom Validity Test. Exaggeration was determined when a claimant's performance fell below cutoffs on both the WMT and the VSVT.

**Results:** 36% of litigants failed both SVTs. The oldest subjects were more than twice as likely to fail SVTs as were the youngest ones. Modest correlations between low level lead exposure and neuropsychological impairment dissipated when invalid data sets were eliminated.

**Conclusions:** SVT failure occurs in subjects involved in litigation over low level lead exposure about as frequently as it does in other groups involved in lawsuits over similarly disputed conditions. Research purporting to demonstrate a relationship between childhood lead exposure and neurocognitive outcome should be held to the same standards as have become common in mTBI and similar conditions. The present data suggest that the modest and inconsistent relationship between blood lead level and neurocognitive functioning may dissipate further when subjects who exaggerate impairment are eliminated from analysis.

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### C.M. TUSSEY & B. MARCOPULOS. The Utility of Trial 1 of the TOMM in an Inpatient Population.

**Objective:** Given the need for effort testing in neuropsychological evaluation, a condensed version of the Test of Memory Malingering (TOMM) may be useful. Prior research has indicated that Trial 1 of the TOMM may be an effective screener for effort (e.g., Gavett et al., 2005; O' Bryant et al., 2007). To date, research on Trial 1 has not been conducted in an inpatient setting. It is hypothesized that Trial 1 will be a sensitive and specific test to be used as a screener in this population.

**Participants and Methods:** Archival data were utilized (n=470; 58% male). Given that Trial 1 is not used in the standard decision rule for overall TOMM performance, the TOMM was viewed as two separate tests: 1) results of Trial 1 and 2) overall TOMM results (based on Trial 2, using the recommended cutoff score of 45 as the criterion for failure of the TOMM). The sample was divided into those suspected of insufficient effort and those not based on their performance on Trial 2. Diagnostic utility tests were conducted.

**Results:** Trial 1 of the TOMM was found to have a sensitivity rate of 94% and a specificity rate of 70% with a Positive Predictive Value (PPV) of 0.41 and a Negative Predictive Value (NPV) of 0.98.

**Conclusions:** The current data suggests that Trial 1 of the TOMM in an inpatient setting may be a sensitive, though less specific, screener for poor effort. Also, the PPV of Trial 1 suggests less than ideal precision. Additional research is needed to further validate this screener among inpatients.

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**E. GAMMADA, E. JEFFAY & K. ZAKZANIS. On the Relationship Between Feigned Cognitive Impairment and Psychological Presentation.**

**Objective:** The present study examined the predictive utility of multiple neuropsychological Symptom Validity Tests (SVTs) as it relates to psychological presentation as indexed by way of an omnibus measure of psychopathology. More formally, we set out to determine if performance on neuropsychological SVTs predict psychological symptom credibility and which specific neuropsychological SVTs were most predictive of non credible psychological presentation.

**Participants and Methods:** Archival records from 59 litigating patients deemed to be feigning within the context of a neuropsychological examination were utilized.

**Results:** Our results illustrate that neuropsychological SVTs were indeed predictive of psychological symptom credibility and that specific neuropsychological SVTs were most predictive of psychological symptom credibility while others were not.

**Conclusions:** We conclude that neuropsychological SVTs do have predictive utility as it relates to credibility of psychological presentation and that these constructs do share variance reciprocally in clinically meaningful ways. Hence, to place clinical opinion on firmer scientific grounds within the context of a neuropsychological examination, multiple cognitive SVTs in hand with psychological test instruments that include validity indexes are essential to derive opinion that is indeed based on science rather than faith in the instance of litigation when an incentive to manifest disability, for the sake of an external reward (i.e., disability benefits) holds probable.

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## Genetics/Genetic Disorders

**M. ACOSTA-PUENTES, W.S. KARIN, P. KARDEL, R. KUTNERUF, T. BOUTON, G. VEZINA & R. PACKER. Cognitive Profile in Patients with Neurofibromatosis type 1 (NF1) with and without Major Brain Malformations: Are Learning Disabilities an Expression of an Early Deficit in Brain Organization?**

**Objective:** Neurofibromatosis type 1 (NF1) is associated with a higher frequency of learning disabilities. Loss of neurofibromin results in increased RAS activity, leading to proliferation of neural tissues and tumorigenesis. Morphological variations in brain structure have also been described in NF1. The significance of these findings related to clinical manifestations is unknown. Chiari I malformations and hamartomas are common incidental findings on MRI in this population, thought to be of no clinical significance.

**Participants and Methods:** Thirty-six NF1 patients with and without brain malformations were compared on intellectual and academic abilities.

**Results:** Ages ranged from 4 to 27 years ( $M = 11.6$ ;  $SD = 11.00$ ). Males accounted for 69% of the sample ( $n = 25$ ). Nine had hamartomas, 3 with Chiari-I, 4 with other malformations and 20 without malformations. Those patients with hamartomas demonstrated below average intellect (Median = 83), while patients with Chiari I and those without malformations performed in the average range (Median = 90 and 96, respectively). Those with other malformations were highly variable, but median IQ was in the low average range (Median = 85). No group differences were observed in academic skills.

**Conclusions:** Our results suggest a possible relationship between specific brain malformations and altered neurocognitive development. This may indicate a relationship between neurofibromin and RAS pathway alterations, expressed in non-homologous gain-of-function and neurocognitive difficulties. Understanding RAS pathway defects in brain development will help to understand the pathophysiology of neurocognitive disabilities and contribute to earlier identification and intervention.

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**M.E. AXELRAD, J.K. KATZENSTEIN, D.D. SCHWARTZ & K. GRIPP. Neurocognitive Functioning in Costello Syndrome.**

**Objective:** Costello syndrome (CS) is a rare genetic disorder characterized by heart abnormalities, increased risk of rhabdomyosarcoma, non-cancerous tumors, facial differences, delayed development, and poor feeding, resulting from a mutation in the HRAS gene. This research evaluated the neurocognitive functioning of individuals with CS.

**Participants and Methods:** Twenty-eight individuals with CS were evaluated at the biannual Costello syndrome family conference, ranging in age from 31- months to 32-years ( $M = 12.65$  years,  $SD = 7.4$  years). They were administered measures of neurocognitive functioning appropriate for their age, including the Leiter International Performance Scales – Revised (Leiter-R), Peabody Picture Vocabulary Test – Fourth Edition (PPVT-IV), and subtests of the NEPSY- Second Edition (NEPSY-II).

**Results:** On average, Leiter-R Brief IQ scores ranged from 36 to 83 ( $M = 60.10$ ,  $SD = 15.98$ ), with 3 individuals falling in the low average range, 4 in the borderline range, 8 in the mild mental retardation range, and 7 in the moderate mental retardation range. NEPSY-II Memory for Faces scaled scores generally fell in the extremely low range ( $M = 3.00$ ,  $SD = 2.44$ ), with borderline range delayed recall of the faces ( $M = 4.44$ ,  $SD = 2.22$ ). NEPSY-II Affect Recognition scores fell in the extremely low range as well ( $M = 3.94$ ,  $SD = 2.88$ ). PPVT-IV scores ranged from 20 to 97 ( $M = 60.40$ ,  $SD = 19.11$ ).

**Conclusions:** Overall neurocognitive scores generally fell in the extremely low range, consistent with the developmental delay observed in these children. Continued evaluations of these individuals over time will assist with understanding of the developmental course of this genetic disorder.

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**V. BORDES, K. BJORAKER & E. SHAPIRO. Consequences of Prematurity Confounds Treatment Decisions in Adrenoleukodystrophy.**

**Objective:** Adrenoleukodystrophy (ALD) is an x-linked genetic disorder with several phenotypes; the cerebral form (C-ALD) leads to demyelination and death. Hematopoietic cell transplantation (HCT) can halt disease progression. MRI and neuropsychological criteria guide eligibility decisions. However, specific guidelines may not hold when a history of other cerebral insults confounds the assessment of C-ALD severity, illustrated by this case study of twin boys.

**Participants and Methods:** Twin boys (ALD1 and 2) born at 28 weeks with different degrees of intraventricular hemorrhage (IVH) at birth developed C-ALD. ALD2 had developmental delays, shunt placement, and seizures. To determine their eligibility for HCT, MRI and neuropsychological findings were compared with our database of typical C-ALD boys.

**Results:** In ALD1, the pattern of moderate MRI hyperintensities in the corpus callosum and internal capsule was typical. ALD2 also had these findings, but additionally had atypical asymmetric hyperintensities in the right parietal and temporal lobes. ALD1 had typical slowed visual processing and normal intelligence. ALD2 was moderately MR, an atypical finding in C-ALD, along with memory and visual-motor deficits likely associated with long-standing right parietal and temporal lobe damage.

**Conclusions:** Twin siblings with IVH developed C-ALD. Although ALD1 was eligible for HCT, ALD2 might not have qualified for treatment based on usual guidelines. Separating the effects of early brain damage from that of C-ALD was possible because of knowledge of typical patterns of demyelination on MRI and deficits on neuropsychological testing. Thus despite cognitive impairment and extensive MRI abnormality due to IVH complications, ALD2 was eligible for treatment.

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**E. CACCAPPOLO, R. ALCALAY, L. CLARK, H. MEJIA-SANTANA, E. LOUIS, S. FAHN, S. FRUCHT, B. FORD, L. COTE, M. TANG, R. OTTMAN, C. WATERS, L. ROSADO, H. ANDREWS & K. MARDER. Effect of Parkin Gene Status on the Neuropsychological Performance of Subjects with Early Onset Parkinson's Disease and Unaffected Relatives.**

**Objective:** To investigate whether parkin mutations are associated with poor neuropsychological performance in subjects with Early onset Parkinson's disease (EOPD), defined as age at onset of PD<50 or their unaffected family members.

**Participants and Methods:** Neuropsychological test scores were collected on 90 non-demented EOPD subjects (MSE>24) and 123 unaffected first-degree family members of parkin carriers. Subjects were divided into 3 groups based on parkin gene mutation status: non-carriers, heterozygotes, and a combined group of homozygotes and compound heterozygotes.

Raw scores were transformed to z-scores using means and SDs of the sample to create composite scores for 3 domains: memory, visuospatial, and executive functioning. Composite scores were created by averaging the mean z scores of tests selected as representative of each domain. Generalized estimating equations (GEEs) were used to evaluate the effect of family relationship on test performance with domain scores as the dependent variables, family relationship as an independent variable, and age and education included as covariates for relatives. For probands, additional covariates included disease duration and UPDRS-III score, a measure of motor severity.

**Results:** Results:

Probands: homozygotes/compound heterozygotes (n=20) obtained lower memory and executive function domain scores than non-carriers (n=51) (memory p=.005, exec p=.002) and heterozygotes (n=23)(memory p=.000, exec p=.001).

Relatives: No differences were found among carrier groups on the different domains.

**Conclusions:** Probands who are homozygous/compound heterozygous mutation carriers of parkin scored lower on tests of memory and executive functioning than non-carriers and heterozygous carriers, suggesting that two mutations may predispose EOPD patients to cognitive dysfunction, but not in non-PD carriers, e.g. relatives.

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**J.S. CHANG, J. SHOFFNER & R.D. MORRIS. Neuropsychological Outcomes and Adaptive Functioning of Children Identified with Mitochondrial Disease.**

**Objective:** Mitochondrial Disease (MD) are disorders of function in cellular oxidative phosphorylation (also called Oxphos Disease) caused by diverse nuclear DNA and mtDNA mutations and seen in 1/5,000 births. A critical problem in understanding Mitochondrial Disease (MD) is quantifying all their clinical manifestations due to the large spectrum of symptoms presented. Given the frequency to which brain abnormalities and cognitive deficits are clinically reported, surprisingly few studies evaluated neuropsychological functioning. This ongoing study examined the effect encephalopathy has on the functioning of children with MD.

**Participants and Methods:** Children (ages 4-13 years) were recruited from Medical Neurogenetics, a research clinic focused on neurogenetic disorders. Participants with and without encephalopathy (N=10) were administered subtests from DAS-II, NEPSY-II, and WIAT-II. The BAS-II Parent Rating Form and Vineland-2 Survey Interview were completed.

**Results:** Independent-sample t-tests were conducted. Results show significant differences (p<.05) between subjects with and without encephalopathy in mean scores in working memory (DAS WM Cluster), visuospatial (DAS Pattern Construction), fine motor (NEPSY Imitating Hand Positions), and attention/executive functioning (NEPSY Design Fluency/Inhibition), with children with encephalopathy performing worse. Similar significant differences were found on academic achievement (WIAT Numerical Operations) and on the Vineland for the two groups.

**Conclusions:** Preliminary findings suggest that encephalopathy differentially impacts the neurobehavior of children with MD particularly in areas of adaptive skills, academic achievement, visuospatial, attention and executive functioning, and fine motor; implications for future research are presented.

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**M.L. GUNTHER, J.C. JACKSON, P. PANDHARIPANDE, A. MORANDI, M.H. HAHN, J.W. BUCKHOLTZ, B. ENGLISH, R.D. BLAKELY, J. THOMPSON, E.W. ELY & T.D. GIRARD. Genetic Risk Factors for Long-Term Cognitive Impairment After Critical Illness.**

**Objective:** Critical illness is associated with significant long-term cognitive impairment (LTCI) in 25%-75% of survivors. To examine genetic risk factors for LTCI in intensive care unit (ICU) survivors, we evaluated several genetic polymorphisms associated with cognition in other populations.

**Participants and Methods:** We enrolled 127 medical ICU patients in a prospective cohort study and genotyped APOE, MAOA, DRD3, COMT, NET & BDNF. We assessed 76 survivors 3 and 12 months after discharge using 9 tests. Scores were adjusted for age, education, and gender, converted to T-scores, and averaged to summarize overall cognitive function, as well as processing speed, executive function, and delayed memory. We used linear mixed-effects models to analyze associations between the polymorphisms and cognitive outcomes, adjusting for age, severity of illness, education, premorbid cognitive function, sepsis, and sedative exposure.

**Results:** "A" homozygotes for the NET -3081(A/T) polymorphism (SLC6A2) had worse overall cognitive function throughout follow-up (p<0.02). Also, "A" homozygotes for the COMT 3' polymorphism (rs165599) had worse overall cognitive function (p<0.02) and worse executive function (p<0.04) throughout follow-up. No genotype (including NET and COMT) was associated with processing speed or delayed memory, and other genotypes assessed were not associated with overall cognitive function.

**Conclusions:** In this hypothesis-generating study, "A" homozygotes for NET and COMT polymorphisms had worse long-term cognitive outcomes after critical illness. Limitations include small sample size and lack of premorbid cognitive testing. Future genetic association studies are needed to confirm and understand these findings.

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**J. THOME, S.J. HUNTER, T. DROSSOS & C. CASNAR. Open-Lip Schizencephaly: Neurobehavioral Presentation Of An 8-Year Old Boy.**

**Objective:** Schizencephaly is a rare, congenital disorder of uncertain etiology characterized by a cerebrospinal fluid-filled cleft extending laterally from the lateral ventricular surface to the pial surface at the cerebral periphery. The cleft, resulting from a neuronal migrational error,

is lined by gray matter and can be fused (closed-lip schizencephaly type I) or separated (open-lip schizencephaly type II). Specific neurobehavioral deficits are associated with the disorder, including seizures, hemiparesis, and developmental disability. Due to its uncommon occurrence, existing research is sparse and findings regarding neurobehavioral presentation in open-lip schizencephaly are varied.

**Participants and Methods:** We report on a patient diagnosed with open-lip schizencephaly at age 6, with co-occurring seizure disorder and hydrocephalus. Neuroimaging data and results from a comprehensive neuropsychological testing were obtained and reviewed, to understand this individual's pattern of deficits.

**Results:** Neuroimaging data revealed agenesis of the corpus callosum, enlarged ventricles, poorly formed gyri, mild colpocephaly, frontal lobe dysmorphia, and a left hemisphere cyst. Comprehensive neuropsychological assessment highlighted significant variability, ranging from low average to deficient performance. Severely impaired executive functioning as well as disorganization and impulsivity were observed. These latter difficulties have manifested as aggression towards family members and peers.

**Conclusions:** Difficulties in functioning and regulation observed behaviorally and during testing are broadly consistent with existing research, reflecting the impact of structural anomalies observed on imaging. Treatment has been multidisciplinary. We discuss the importance of pharmacotherapy, psychotherapy, and systems-based interventions in this case, as an example of the benefit of multimodal intervention with this disorder.

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#### **K.M. JANKE, L.A. KAIS & B.P. KLEIN-TASMAN. Cognitive and Early Learning Profile of Preschool Age Children with NF-1.**

**Objective:** Neurofibromatosis-1 (NF-1) is a genetic neurocutaneous disorder affecting 1 in 3,000 people. Individuals with NF-1 are at an elevated risk for cognitive and learning difficulties (North, 1998). Some children with NF-1 have reading or language difficulties, and impairment of visual-spatial and psychomotor abilities is also fairly common. Most literature focuses on older children and adults; therefore, the purpose of the present study was to characterize the neuropsychological profile of young children with NF-1.

**Participants and Methods:** Participants were 15 children ages 3-6 (M age = 4.27, SD = 1.28). Each were administered the Differential Ability Scales – Second Edition (DAS-II) and select subtests of the NEPSY – Second Edition to assess visuospatial and fine-motor skills.

**Results:** Performance on overall intellectual functioning [ $t(14) = -4.23$ ,  $p = .001$ ], verbal tasks [ $t(14) = -3.33$ ,  $p = .005$ ], nonverbal tasks [ $t(14) = -4.78$ ,  $p < .001$ ], and spatial tasks [ $t(11) = -2.53$ ,  $p = .028$ ] was significantly lower than expected based on the normative distribution. Although a majority of the participants fell in the average range for the Verbal (60%) and Spatial (58.3%) clusters, most of the children fell in the low average range for the Nonverbal cluster (73.3%). Performance on Imitating Hand Positions was significantly lower than the standardized mean [ $t(13) = -3.10$ ,  $p = .008$ ].

**Conclusions:** The verbal, nonverbal reasoning, and visuospatial difficulties observed in older children and adults with NF-1 are also present in some young children, at approximately the same rates. Additional implications and directions for future research will be discussed. This research was supported by a UWM Research Growth Initiative grant.

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#### **K.M. JANKE, K.S. HOLMAN, B.P. KLEIN-TASMAN & M.M. GARWOOD. Role of Executive Functioning in Academic Achievement for Adolescents with NF-1.**

**Objective:** Neurofibromatosis (NF-1) is a neurocutaneous disorder with an estimated incidence of 1 in 3,000. Many children and adolescents

with NF-1 not only suffer significant medical complications but also deficits in cognitive and academic functioning (Hyman et al., 2005; North et al., 1998). Executive functioning (EF) deficits have also been described (Ferner et al., 1996; Zoller et al., 1997) that may contribute to academic difficulties. The purpose of the current study is to examine relations between intellectual, academic, and executive functioning.

**Participants and Methods:** Participants were 26 adolescents ages 12-18 (M age = 13.65, SD = 1.88), predominantly Caucasian (88.5%), and about half (53.8%) female. Each completed a measure of cognitive functioning (Kaufman Brief Intelligence Test – Second Edition), select subtests of the Wechsler Individual Achievement Test – Second Edition to assess academic achievement, and tasks examining response inhibition and cognitive flexibility (Delis-Kaplan Executive Function System).

**Results:** Mean scores generally fell in the average range, and performance on measures of academic achievement and cognitive flexibility was significantly and positively correlated with IQ. Partial correlations were used to examine the relations between EF and academic achievement controlling for IQ. Response inhibition performance was significantly related to word reading, reading comprehension, math, and spelling ability. Inhibition and cognitive flexibility together were significantly related to performance on reading comprehension.

**Conclusions:** Response inhibition and cognitive flexibility appear to play a role in academic ability above and beyond the role of intellectual functioning. Additional implications and directions for future research will be discussed.

This research was supported by grant from the Children's Research Institute of the Children's Hospital of Wisconsin.

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#### **S.A. LANGENECKER, K.E. HAZLETT, B.J. MICKEY, M.T. RANSOM, H. AKIL, E.A. YOUNG, M. BURMEISTER & J. ZUBIETA. Serotonin Transporter Genotype and Neuropsychological Measures Adversely Affected by Major Depressive Disorder.**

**Objective:** There have been numerous studies suggesting that a significant genetic contributor to interindividual variability in serotonergic neurotransmission, and potential risk for psychiatric illness, is the short allele of the serotonin transporter (5-HTT) gene, 5-HTTLPR. Little attention to date has been addressed toward understanding the role of the s allele of the 5-HTTLPR polymorphism in cognitive tasks that have been associated with major depressive disorder.

**Participants and Methods:** Fifteen unmedicated participants with MDD and 17 healthy control subjects were recruited with informed consent and approval of the University of Michigan Medical Center. The groups were screened using SCID-IV. Genomic DNA was purified from blood using standard methods and consistent with prior work by our group (Sen et al., 2004). The neuropsychological measures included auditory and visual learning and memory, attention, working memory, set-shifting, problem solving, and inhibitory control, as well as emotion processing and fine motor dexterity.

**Results:** The depressed group performed more poorly on Trail Making Test, part B. There was worse performance for those with the s allele on inhibitory processing speed (parametric Go/No-go response time), and conceptual reasoning (Wisconsin Card Sort, correct). There was also an interaction between group and serotonin transporter on the Stroop Color-Word test; the s allele was associated with worse performance in the healthy control group and better performance in the MDD group.

**Conclusions:** There were significant effects of depression, the serotonin transporter, and an interaction between depression and the serotonin transporter, with strong relationships to measures of executive function that include processing speed, set-shifting, and conceptual reasoning.

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**S. NAZARIAN & D. BAKER. Neuropsychological Profile of a 7 year-old with Late-Onset Combined Methylmalonic Acidemia and Homocystinuria, Cobalamin-C Type.**

**Objective:** Late-onset combined methylmalonic acidemia and homocystinuria, cobalamin-C (cblC) type is a rare metabolic disorder. There are two distinct clinical phenotypes of cblC (vitamin B12) deficiency, early-onset and late-onset, with vast variability in clinical presentation, survival and prognosis. Late-onset cblC deficiency is less common and has a less severe presentation and a more favorable outcome, if treated. There are reports of 11 late-onset cblC cases from ages 10 to 44 years-old, with various combinations of neuropsychiatric symptoms such as: seizures, psychosis, dementia, problems in sensory, motor, executive, and speech/language functions, behavioral changes, mood problems, and learning difficulties. While studies present the neurological effects of these cases and suggest reversible cognitive functions after appropriate treatment, only one study provides neuropsychological evaluation results (Boxer et al., 2005).

**Participants and Methods:** We present a child with late onset cblC deficiency who experienced acute neurocognitive regression at 6 1/2 years of age. The patient was evaluated at age 7 years and 4 months. Neuropsychological evaluation results are presented.

**Results:** Results suggest notable difficulties with attention, executive functions, perceptual reasoning, working memory, processing speed, rapid word retrieval, phonological skills, visual-spatial abilities, visual memory, as well as notable mood and behavioral changes. Average functioning was detected in verbal skills, reading comprehension, verbal reasoning, and verbal memory.

**Conclusions:** We present an extremely unique case illustrating detailed neuropsychological findings of a young boy with late onset cblC deficiency. While little information exists regarding the neurocognitive profile of such cases, our findings appear to be consistent with the literature on cblC deficiency sequelae.

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**J. PRICE, J. STRONG, T. MCQUEENY, B. BUDION & K.L. MEDINA. Serotonin Transporter Gene (5-HTTLPR) Risk Classification and Visual and Verbal Memory: Implications For Future Research.**

**Objective:** The short (S) allele of a serotonin transporter gene polymorphism (5-HTTLPR) is associated with fewer transporters and decreased serotonin reuptake compared to the long (L) allele. Further, LA carriers for the rs25531 single nucleotide polymorphism (A/G variant) within the L/G polymorphism display higher serotonin expression while LG carriers function similarly to S carriers. Functional impact of genotype on memory is inconsistent, possibly due to lack of A/G variant inclusion. This study compared S/L and A/G risk status on visual and verbal memory in the same population.

**Participants and Methods:** 5-HTTLPR L/S and A/G genotypes were collected from 39 subjects (22 female) ages 18-25. Memory variables were merged into reliable composite scores (Cronbach's alpha > .60). S/L classification was no risk: LL (n=16) vs. risk: SL, SS; A/G classification was no risk: LALA (n=12) vs. risk: all others.

**Results:** After controlling for past-year nicotine, gender, genotype, and gender/genotype interaction, carriers of the S genotyping had better CVLT-II delay and recognition ( $t=-2.04$ ,  $\beta=-.33$   $p<.05$ ;  $t=-2.11$ ,  $\beta=-.34$ ,  $p<.04$ ). Gender marginally moderated the relationship between genotype and WMS-III Faces performance, with men demonstrating a stronger relationship between S/L risk and better memory ( $t=-2.04$ ,  $\beta=-.33$   $p<.05$ ;  $t=-1.94$ ,  $\beta=-.31$ ,  $p<.06$ ). For A/G genotype, 25% of subjects changed risk status, and there were no longer significant predictions by genotype.

**Conclusions:** Surprisingly, S carriers performed better than L carriers on visual and verbal memory; however, results are consistent with some previous studies that did not include A/G genotype. Future research should examine potential genetic moderators for the relationship between memory and related neuro-circuits (e.g., hippocampus).

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**D.P. ROELTGEN & J. ROSS. An Extra X are or Y Chromosome: Contrasting the Cognitive Phenotype in Childhood in Boys with 47,XYY or 47,XXY (Klinefelter Syndrome).**

**Objective:** To expand the description of the cognitive phenotype in boys with 47,XYY (XYY) karyotype and boys with 47,XXY karyotype (Klinefelter syndrome, KS), who share an extra copy of the X-Y pseudoautosomal region but differ in their dosage of strictly sex-linked genes.

**Participants and Methods:** 21 boys with 47,XYY and 93 boys with 47,XXY (KS), ages 4-17 years, and 36 age-matched control boys. Neuropsychological evaluation of general cognitive ability, language, memory, attention, visual-spatial abilities, visual-motor skills, and motor function.

**Results:** Both the XYY and KS groups commonly performed less well than the controls on tests of general cognitive ability, achievement, language, verbal memory, some aspects of attention and executive function, and motor function. The boys with XYY on average had more severe and pervasive language impairment, at both simple and complex levels, and the boys with KS on average had greater motor impairment in gross motor function and coordination, especially in running speed and agility.

**Conclusions:** The results from these large XYY and KS cohorts have important neurocognitive and educational implications. From the neurocognitive standpoint, the difficulties present represent an opportunity to gain insights into brain development in boys with XYY or KS. From the educational standpoint, it is critical that boys with XYY or KS are provided with appropriate educational interventions that target their learning challenges in school. These findings also provide important information for counseling clinicians and families about this disorder. Correspondence: *David P. Roeltgen, MD, Neurology, Georgetown University Hospital, PHC 7, 3800 Reservoir Rd, Washington, DC 20007, United States. E-mail: droeltgen@hotmail.com*

**J.H. SANZ, P. LIPKIN & M. MAHONE. Developmental Profile and Trajectory of Neuropsychological Skills in Kabuki Syndrome: A Longitudinal Case Study.**

**Objective:** Kabuki Syndrome (KS) is a rare genetic syndrome (>400 cases reported) involving dysmorphic facial features, and reports of Intellectual Disability (ID). Among published reports, cognitive evaluation is limited to a one-time assessment of IQ or developmental quotients. One study suggested a relative strength in verbal skills, with a relative weakness in visuospatial/constructional skills. Our objective was to examine the developmental trajectory of a child with KS to better understand the cognitive profile in this syndrome.

**Participants and Methods:** We present a case of KS and associated bilateral hearing impairment seen for neuropsychological assessments at ages 4, 6, 7, 9, and 11 years. Medical history is presented, along with longitudinal test data.

**Results:** Examination of raw and standardized scores suggest that language-based skills "keep pace" developmentally, and are in the average range across assessments. In contrast, by age 9 years, there is evidence for slowed progress and plateau in the acquisition of visually-based skills, resulting in a decrease in standard scores in these areas. Executive function difficulties are also reported across assessments. Mood symptoms emerged between ages 9 and 11 years.

**Conclusions:** ID has been described as a core feature of KS; however, many patients who present with composite scores in the borderline to mild range on composite measures may in fact not meet diagnostic criteria for ID, and may be better described as having specific deficits in nonverbal skills. Longitudinal evaluation of children with KS is warranted to understand the true prevalence of ID versus specific developmental cognitive impairments and psychiatric symptoms in this population.

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**J. SNOW, E. WIGGS, C. O'SHEA, L. MYERBERG & M. PAO. Neurocognitive Features of Very Rare Genetic Disorders.**

**Objective:** Neuropsychologists tend to be familiar with the neurocognitive features of higher prevalence genetic disorders (such as phenylketonuria, Down, Fragile-X, etc.), but are generally less familiar with many rarer genetic disorders, such as Methylmalonic Acidemia (MMA), Cobalamin C (cblC), Neonatal Onset Multisystem Inflammatory Response (NOMID), Xeroderma Pigmentosum (XP), Trichothiodystrophy (TTD), Proteus Syndrome (PS), and Bardet-Biedl Syndrome (BBS), each of which has known genotypes. As part of the NIH's mission to study rare diseases, its Intramural Programs studies subjects with these genetic disorders. We investigated the neurocognitive effects of these rare genetic disorders.

**Participants and Methods:** Our sample included 36 MMA, 15 cblC, 27 NOMID, 19 XP, 16 TTD, 12 Proteus, and 38 Bardet-Biedl patients who were assessed using an age appropriate Wechsler intelligence test and other neurocognitive measures.

**Results:** Mean IQ values were in the intellectually disabled range for cblC (Mean=55.4+/-13.5), borderline for MMA (Mean=79.9+/-23.3), TTD (Mean=71.3+/-17.9), and BBS (Mean=75.8 +/- 15.9); low average for NOMID (Mean=87.5+/-13.5) and XP (Mean=89+/-17.3); and average for PS (Mean=109.9+/-17.3). However, considerable variability was found within each disorder and was dependent upon further genetic subtyping. Reported means do not take into account patients that were untestable (due to severe impairment), but whose behavior was quantified using adaptive functioning measures.

**Conclusions:** Many of the rare genetic disorders being studied at NIH have significant neurocognitive effects that have not been thoroughly examined previously. Neuropsychological phenotyping of these genetic disorders has the potential to shed light on the genetic basis and mechanisms for mental retardation and on normal cognition, more generally.

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**J. MARTONE, P. DUQUETTE, K.S. WALSH, F. MITCHELL & M. ACOSTA. The impact of familial versus spontaneous inheritance of Neurofibromatosis type 1 (NF1) on neurocognitive profiles in children.**

**Objective:** Neurofibromatosis type 1 is one of the most common disorders in children, affecting 1 out of 3,500 births. It has an autosomal dominant pattern of inheritance, with a relatively high rate of spontaneous mutation. In half of the cases, the altered gene is inherited from an affected parent, while the remaining cases result from new mutations in the NF1 gene, with no familial history. Modeling prior research in the combined role of genetics and environment on symptomatology in AD/HD, this study evaluates the relationship between genetics and environment in NF1. We predict that children with familial inheritance may have greater difficulties with attention, memory and executive functions than those with spontaneous mutations due to environmental factors.

**Participants and Methods:** A group of forty-four NF1 patients assessed at Children's National Medical Center, ages 6-27 years, were evaluated for this study. Clinical assessment data was used to assess the following domains: general cognitive ability (WASI), memory and learning skills (CVLT-C; CVLT-II), attentional control (TEA-CH) and executive functioning skills (BRIEF). In the group, 40% of the patients were females, 28% demonstrated familial inheritance, 66% demonstrated spontaneous mutation, and 4% of the patients had unknown genetic histories. This sample demonstrates a slight overrepresentation of spontaneous cases of NF1.

**Results:** No significant group differences were obtained for general cognitive ability, memory/learning, attentional control, or executive functioning skills. The groups also did not differ in the proportion of cases showing clinically significant (>1 SD below mean) findings on these measures.

**Conclusions:** These findings suggest that there are no significant neurocognitive differences between children with spontaneous and familial NF-1 based on preliminary data. Additional research is needed to confirm these findings.

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**D.D. ZADE, A. BEISER, R. MCGLINCHEY, R. AU, S. SESHADRI, C. PALUMBO, P.A. WOLF, C. DECARLI & W. MILBERG. apoE4 Genotype Modifies Relationship of Waist-To-Hip Ratio to Cognition and Brain Morphology.**

**Objective:** To determine whether waist to hip ratio (WHR), a measure that is sensitive to the presence of visceral adiposity and a potential marker of metabolic dysregulation and insulin resistance, could be used to index changes in cognition and brain structure, and, if so, whether these relationships are modified by the apoE4 allele.

**Participants and Methods:** 1,995 participants from the Framingham Offspring Cohort participants underwent neuropsychological testing and structural MRI in 1999-2002; all were screened for prevalent stroke and dementia.

**Results:** Multivariate linear regression revealed significant interactions between the presence of apoE4 and the relationship of WHR with 1) Logical Memory-Delayed Recall (p=0.014); 2) Visual Reproduction-Delayed Recall (p=0.102); 3) Trails B (p=0.087); 4) frontal lobe volume (p=0.098); 5) lateral ventricular volume (p=0.103), and 6) white matter hyperintensities (p=0.039). The nature of the interaction in most instances was to exacerbate the negative relationships for those with the apoE4 allele. The exception was frontal lobe volume where the effect with WHR was weaker among those with the apoE4 allele. Further, a significant relationship between WHR and Logical Memory-Delayed Recall was unique to those who were apoE4+.

**Conclusions:** These findings suggest that the presence of the apoE4 allele in combination with high WHR may produce synergistic effects with respect to both cognition and neuroanatomical changes.

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## Hemispheric Asymmetry/Laterality/Callosal Studies

**M. BONDY, O. CHU & C.A. ABEARE. Degree of Handedness and Episodic Memory: Evidence from the California Verbal Learning Test-II.**

**Objective:** Handedness has been found to be associated with performance on various memory tasks. Previous research has found that right-handers with a family history of left-handedness have greater episodic memory than those without a family history of left-handedness. This is thought to be due to greater interhemispheric interaction among those with familial left-handedness. The present study further explored this difference in memory related to handedness by using the California Verbal Learning Test-II (CVLT-II), a commonly used measure of verbal memory. The degree of handedness was assessed, because it has been found to predict size of corpus callosum and lateralized language representation in right-handers.

**Participants and Methods:** The CVLT-II was administered to 126 participants. Handedness was assessed using the Montreal Neurological Institute Handedness Questionnaire (MNI). Handedness groups were created by a median split on MNI scores.

**Results:** The results demonstrated that inconsistent-handers performed better than consistent-handers on the short and long delay, free and cued recall trials and the recognition trial of the CVLT-II.

**Conclusions:** The results of this study extend previous findings in the literature using a clinically used measure of verbal episodic memory. Results are consistent with the hemispheric encoding/retrieval asymmetry (HERA; Tulving, Kapur, Craik, Moscovitch, & Houle, 1994) model as well as the findings of Christman and Propper (2001) who suggest that episodic memory is positively related to interhemispheric interaction. Inconsistent-handers have been found to have greater interhemispheric interaction and more bilateral language representation than consistent-handers. Increased interhemispheric interaction may lead to greater recall and recognition of verbal episodic memories.

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### M. HENDRIKS, M. VAN ZUNDERT & W.C. ALPHER. Language Dominance in Temporal Lobe Epilepsy: Testing the Crowding Hypothesis.

**Objective:** The prevalence of atypical language dominance in epilepsy patients is more frequent. A language shift to the right hemisphere and subsequently poor performance on nonverbal tests after early damage to the left hemisphere, represents the crowding hypothesis. In this study we re-examined the effects of language dominance, focus localisation, seizure onset and hand preference on the crowding hypothesis.

**Participants and Methods:** 238 Patients with Temporal Lobe Epilepsy (TLE) referred for surgical treatment were included and language representation was determined with the intra-arterial sodium amytal test. All patients completed a full neuropsychological assessment, including subtests Vocabulary and Information of the WAIS and a Naming task for verbal functions and Block Design and Object Assembly and Rey's Complex Figure for visuospatial abilities.

**Results:** Atypical language dominance is observed in 11% of the total population but significantly more in left handed patients, and occurs more frequent in LTE patients (15%) compared to RTE (7%). MANOVA's with neuropsychological measures revealed no significant main effects of language dominance, lateralization of focus, age at onset, hand preference and gender. Our results firmly showed that atypical language dominance may occur at any age after seizure onset. Only two subjects with seizure onset before 1 year of age showed a cognitive profile that meets the criteria for the crowding hypothesis.

**Conclusion:** In conclusion, LTL and left handedness independently are risk factors for atypical language dominance, while, age of seizure onset and sex are not associated with language dominance. The crowding effect of verbal and visuospatial abilities does not exist in this population.

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### A.K. HOLLAND, J.E. CARMONA, D.W. HARRISON, J. HARDIN, F. TUCKER & M. SCOTT. Differences in Cerebral Lateralization of Time Estimation Abilities and Cardiovascular Reactivity in Diabetic and Non Diabetic Older Adults.

**Objective:** The right hemisphere has been associated with time urgency and accurate time estimation. Changes in glucose metabolism commonly seen in diabetic individuals have been demonstrated to differentially alter right hemisphere function. In the current experiment, diabetic individuals were expected to show diminished capacity in the right hemisphere after undergoing right-lateralized cognitive stress, leading to less accurate estimations and increased heart rate.

**Participants and Methods:** Seven right-handed men and women were identified as diabetic (M=59.84 years) and 13 as non diabetic (M=56.33

years), as indicated by responses on a medical history questionnaire. Participants completed 30-second and 60-second time estimations without the use of timepieces. Participants then completed the Ruff Figural Fluency Test which served as a cognitive stressor, followed by a second measure of time estimation.

**Results:** A main effect for Diabetes was found ( $F(1, 18)=4.38, p=.05$ ), indicating less accurate time estimations for diabetic participants in the pre and post stress conditions. Further, a Diabetes x Condition interaction was found ( $F(1, 39)=4.27, p=.05$ ), indicating a decrease in accuracy of the 30-second time estimation for diabetic participants after undergoing cognitive stress, whereas non diabetic participants demonstrated an increase in accuracy. For heart rate, a main effect was found for Diabetes ( $F(1, 19)=6.25, p<.05$ ), indicating heightened heart rate for diabetic participants.

**Conclusions:** We found a decrease in time estimation abilities in diabetic individuals with moderate levels of cognitive stress whereas age-matched non diabetic individuals demonstrated enhanced ability to estimate time. Diabetic individuals showed a diminished capacity to accurately estimate time concurrent with maintaining sympathetic tone after undergoing stress. These findings indicate potentially altered right hemisphere function in diabetic individuals.

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### K.A. KAPLOUN, C.A. ABEARE, A.M. COPPENS & E. GARDIZI. Does Handedness Influence Speed of Interhemispheric Transfer?

**Objective:** The current study compared interhemispheric transfer time (IHTT) among handedness groups based on four handedness classification methods: 1) Right-handers (RHs) vs Left-handers (LHs); 2) Strong-handers (SHs) vs. Mixed-handers (MHs); 3) Strong Right-handers (SRHs), Weak Right-handers (WRHs), Strong Left-handers (SLHs), and Weak Left-handers (WLHs); 4) Consistent Right-handers (CRHs), Consistent Left-handers (CLHs), and Inconsistent-handers (IHs). It was expected that handedness would influence IHTT, with either the three- or four-factor model best capturing between-group differences.

**Participants and Methods:** The Poffenberger paradigm (a lateralized simple reaction time task) and the MNI handedness questionnaire were completed by 122 undergraduate participants. Method 1 classified participants into two groups based on writing hand. In Method 2, MNI scores were divided into quartiles; those in the first and fourth quartiles were SHs, while MHs were those in the middle two quartiles. Method 3 separated individuals into four quartiles: SRHs, WRHs, SLHs, and WLHs. In Method 4, three equal groups were created: the top third were CRHs, the middle third were IHs, and the bottom third were CLHs.

**Results:** In all four classification methods, all participants, regardless of handedness, responded significantly faster to targets presented in the LVF (right hemisphere) when responding with their right hand; when using their left hand, no VF differences were found.

**Conclusions:** The present study did not support the prediction that between-group differences in IHTT would be observed within the handedness classification methods, suggesting that neither degree or direction of handedness affects SRT. This suggests two possible theoretical interpretations: 1) that handedness does not affect interhemispheric interaction; or 2) IHTT is not related to interhemispheric interaction. However, based on previous research, the later interpretation seems most plausible. That is, IHTT is likely a poor measure of interhemispheric interaction.

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### N. LACHNER & M. HISCOCK. Effect of High- and Low-Frequency Noise on the Perception of Words Presented in Dichotic Competition.

**Objective:** Ivry and Robertson's (1998) double filtering by frequency (DFF) theory offers a general explanation for perceptual asymmetries.

The theory postulates that the left and right hemispheres are biased, respectively, toward the processing of high- and low-frequency information. We tested a prediction of the DFF theory by combining dichotic stimuli with noise and then filtering the noise so that it interfered selectively with either low- or high-frequency components of the speech signal.

**Participants and Methods:** Forty-eight right-handed university undergraduates (36 females, 12 males) heard 360 trials of dichotic words pairs from the Halwes Fused Dichotic Words Test (FDWT) as digitized and formatted by Dr. Daniel Voyer. Ninety pairs were presented in each of four noise conditions: (1) no noise, (2) white noise, (3) low-pass filtered noise, and (4) high-pass filtered noise. Signals and noise were presented at an intensity level of 80 dB(A). The filtered noise was rolled off either below or above 1250 Hz. Within each noise condition, participants divided attention equally between the ears for 30 trials, attended to the left ear for 30 trials, and attended to the right ear for 30 trials.

**Results:** A robust right-ear advantage (REA) was obtained in the no noise condition,  $p < .0001$ . White noise eliminated the REA, but the REA remained statistically significant with both low-pass-filtered noise,  $p < .05$  and high-pass-filtered noise,  $p = .01$ . A significant selective attention effect, i.e., an Attention x Ear interaction, was obtained only in the no noise condition,  $p < .0001$ .

**Conclusions:** Contrary to predictions based on the DFF model, disrupting speech frequencies above or below 1250 Hz had comparable effects on the REA for fused dichotic words. The REA was attenuated but not eliminated in both instances. White noise, however, nullified the REA. All three categories of noise seemed to preclude selective attention to one ear or the other.

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#### **P.E. MOES, M. HARRIS & J. YONKER. The Influence of Menstrual Cycle Phase on Hemisphere Interaction for Emotion and Gender Perception.**

**Objective:** Studies have found changes in hemisphere specialization and interaction across menstrual cycle phases. Participants in the present study compared two faces displaying same or different emotions. We predicted that the menstrual phase would influence hemisphere function and interaction for face processing and that the phase would interact with face-emotion (happy vs. angry) and face-gender.

**Participants and Methods:** Twenty females completed testing during the follicular stage and during menstruation. The task required a match (same emotion) vs. no-match (different emotion) response to two faces presented for 200 msec. Repeated measures IV's included menstrual phase (follicular vs. menstruating); face-emotion (angry vs. happy), face-gender (male vs. female), and visual field (LVF, RVF, or "bilateral").

**Results:** The follicular stage produced a significantly larger bilateral field advantage (BFA) - compared to menstruation - with the BFA for angry faces showing the greatest change. Menstrual phase did not interact with field (LVF vs. RVF). Happy faces produced the same average RT's across phases, but angry face displays were related to faster RT's during the follicular stage. Face-gender did interact with the field of presentation (LVF vs. RVF), and with the emotion expressed, but did not interact with phase.

**Conclusions:** Hormonal phases appeared to impact interhemispheric interaction for emotional perception - especially for anger expression, but did not alter hemisphere specialization. Despite being a "distractor" condition, gender of the face appeared to be salient - influencing the field advantage and interacting with the emotion expressed. However, contrary to expectations, the hormonal phases did not significantly interact with face-gender.

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#### **P.E. MOES, H. CARLSON & R. SELLES. Gender Differences in Hemisphere Specialization for Non-literal Language ("Jokes") Processing.**

**Objective:** Compared to literal language processing, greater right hemisphere activation has been found for non-literal language, such as idioms and jokes. Participants in the present study responded to lateralized presentations of the final word in a sentence creating literal or non-literal ("joke") endings. We predicted that the words creating joke endings would show greater right hemisphere processing compared to non-joke endings, with females showing even greater symmetry of processing than males.

**Participants and Methods:** 18 males and 19 females listened to recorded sentences - minus the final word - while viewing a corresponding image designed to strengthen an expected meaning for the sentence. The final word of the sentence, projected left or right of fixation, completed the sentence in one of 3 ways: a joke ending (unexpected meaning and low probability), a non-joke ending (expected meaning but low probability), or "filler" ending (expected meaning and high probability). Participants responded with a forced choice, "joke/non-joke" identification.

**Results:** Compared to non-joke and filler endings, joke endings significantly reduced (but did not reverse) the normally strong RVF-Left Hemisphere advantage for both RT and percent correct (PC). For PC data, field of presentation interacted with sentence type and gender, with females showing significantly less RVF-Left Hemisphere advantage for joke endings as compared to males.

**Conclusions:** The previously studied reduction in left hemisphere advantage that occurs with non-literal language processing appears to be more evident in females than males. Implications for consideration of gender when examining clinical populations who experience difficulty with non-literal language are discussed.

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#### **C. NIKI, T. MARUYAMA, Y. MURAGAKI & T. KUMADA. Hemispheric differences of the mechanism of the time orientation.**

**Objective:** It was suggested that disorientated patients after brain damage fail to recognize information including "ongoing reality" (Schneider, et al. 2002). Although it is considered that ongoing reality pertains information of "now", the mechanism of the time orientation related to ongoing reality has not yet elucidated. This study analyzed results of the time orientation task of the Mini-mental state examination (MMSE), and investigated mechanism of time orientation in terms of ongoing reality.

**Participants and Methods:** 72 patients who suffered brain tumor participated. Patients with dementia and delirium were excluded. From one to two weeks after tumor resection, MMSE was administered. Two sub-tasks of MMSE, time orientation and word delay recognition tasks were analyzed.

**Results:** There were 17 patients who showed failure in both time orientation and recognition tasks. Two patients showed failure only the time orientation task, and 44 patients showed failure of only the recognition task. Error analysis indicated that patients with the left hemisphere damage failed in "year" orientation, on the other hand, patients with the right hemisphere damage failed in "date" orientation.

**Conclusions:** Time orientation of date is dissociable from that of year. Recollection of date information may include searching for not only retrograde information but also for prospective memory, while year information would be recollected mainly from past information. It is considered that information of ongoing reality is related to processing of orientation of date rather than that of orientation of year. It is suggested that process of the date orientation, mainly associated in the right hemisphere is related to ongoing reality processing, while process of year orientation, dominant for the left hemisphere, associates with retrograde recall processing.

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#### **S.E. PARLOW. An Investigation of Self-reported Mirror Movements in Neurologically Intact Adults.**

**Objective:** Mirror movements are unintended synergistic movements of similar musculature on the opposite side of the body during volitional

movements. Considered to be a sign of neurological dysfunction in clinical samples, mirror movements can be experimentally induced in healthy adults. Rarely, healthy adults report being adversely affected by mirror movements in their daily lives. In this study, we attempted to validate this self-perception using experimental laboratory techniques.

**Participants and Methods:** We recruited 20 university students (15 females;  $M = 19.81$  yr); each reported mirror movements during daily activities. Most frequently affected were manual skills (typing, playing a musical instrument, writing). A control group of 21 students was matched for gender, age and handedness. Four tasks were administered: rapid finger tapping, rhythmical finger tapping, finger-spreading, finger-lifting. Frequency data were analyzed using non-parametric (Chi-square) tests.

**Results:** Mirror movements were more frequent in the target group, particularly for finger lifts (45.0% vs. 9.5%), followed by rhythmic tapping (45.0% vs. 28.7%). Unexpectedly, more mirror movements were observed among controls for finger spreads (42.9% vs. 30.0%). Nine participants in the target group (45.0%) reported a history of broken or sprained fingers compared to only 2 in the control group (9.5%).

**Conclusions:** As expected, mirror movements were more likely in the target group, up to 3x the comparison rate. Frequent finger injuries suggest that mirror movements during daily activities may represent a risk factor for personal or work-related injuries in a neurologically intact population. To our knowledge, this is the first study to investigate this population.

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#### **J.S. SANKAR & E. HAMPSON. Associations Between Handedness and Spatial Reasoning in Men: Possible Influence of Androgen Receptor Gene Polymorphism.**

**Objective:** Previous studies have shown that accuracy on spatial reasoning tests may be subject to complex interactions between sex and handedness. Effects of prenatal testosterone on patterns of brain development may be the common denominator; greater testosterone exposure in utero has been associated with improved visual-spatial ability in clinical studies (Hampson et al., 1998; Resnick et al., 1986) and has been linked, theoretically, with stronger right hand preference in men (Witelson, 1991).

**Participants and Methods:** In the present study, we evaluated the performance of 64 right-handed and 42 non-right handed men (Mean age = 18.77 years) on four tests of spatial reasoning. The activity of the androgen receptor, the receptor through which testosterone exerts its physiological effects, was assessed by collecting DNA for quantification of CAG repeat length.

**Results:** Right-handed men were significantly more accurate than non-right-handed men on three of the four spatial tests, but not on control tests of other cognitive functions. Right-handed men were found to have a significantly shorter CAG repeat length than non-right handed men, suggesting greater androgen receptor activity in right-handed men.

**Conclusions:** These data raise the possibility that greater responsiveness to testosterone or other androgens may exist in right-handers than in non-right-handers. The findings are consistent with Witelson's (1991) hypothesis that right-handed males may experience higher operative levels of testosterone than left-handed males in utero.

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#### **J. WILLIAMSON, G. LEWIS, G. STEBBINS, C. MURPHY, M. HANDELMAN, E. HARDEN, D. NYENHUIS, P. GORELICK & S. PORGES. Left hemisphere white matter integrity is related to neural regulation of the autonomic nervous system in a stroke population.**

**Objective:** The present study explores the relationship between white matter integrity and neural regulation of the autonomic nervous system (ANS) in response to cognitive and physical stressors in patients with ischemic stroke.

**Participants and Methods:** 22 patients completed MRI 3 – 6 months after ischemic stroke and for four years subsequent. Diffusion Tensor Imaging (DTI) scans were performed on a 1.5T GE MRI with LX upgrade using a diffusion weighted single-shot spin-echo echo-planar sequence with two diffusion weights:  $b = 0$  and  $b = 800$  s/mm<sup>2</sup>. DTI-fractional anisotropy (FA) masks were generated for and left and right hemisphere regions. Electrocardiogram (ECG) was continuously recorded, from which the amplitude of respiratory sinus arrhythmia (RSA) and slower rhythms in heart rate variability were derived. Cognitive stressors include verbal and nonverbal fluency. The physical stressor was a hand dynamometer. Correlations and multivariate regression models were used to examine the relationship of regional DTI-FA to autonomic response to the stressors.

**Results:** There is a significant relationships between the left hemisphere mask and RSA change in response to verbal fluency and grip strength when accounting for stroke volume and total number of strokes ( $p < .05$ ).

**Conclusions:** Severity of left hemisphere white matter integrity loss in patients with ischemic stroke predicts cardiovascular response to cognitive and exertional stressors. This laterality effect is discussed in the context of neural regulation of the ANS. Decrements in neural regulation of the ANS may have functional consequences including cognitive, behavioral, and physical performance and may also influence the course of cerebrovascular disease (potentially increasing risk for cerebrovascular events).

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### **Symposium 13: Novel Applications of Reliable Change Methodology to Clinical Neuropsychology Research and Practice**

**Chair: Gerard Gioia**

**Discussant: Gordon Chelune**

**10:45 a.m.–12:15 p.m.**

#### **G.A. GIOIA, G. CHELUNE, G. CHELUNE, J. HOLDNACK, W. BARR, G. GIOIA & C. VAUGHAN. Novel Applications of Reliable Change Methodology to Clinical Neuropsychology Research and Practice.**

**Symposium Description:** As the field of clinical neuropsychology continues to evolve from assessment to treatment and outcome monitoring, greater emphasis is placed on detecting and tracking clinically meaningful change in functioning. Reliable change (RC) methodologies have become more central to these efforts by providing a solid empirical basis. Traditionally, change has been conceptualized and measured statistically between two different inter-session time points, using the test-retest interval as its basis. In a novel application, RC methodology also can be generalized beyond the test-retest interval to detect other types of "change" such as within a test session but across cognitive demand conditions to examine clinically meaningful change. This symposium presents different applications of RC methodology in pediatric and adult populations. Dr. Chelune reviews RC concepts and methods followed by four novel data-based applications. Dr. Holdnack presents the application of hierarchical regression-based RC methodology to traditional intelligence and memory assessment paradigms with the WAIS-IV/WMS-IV. Dr. Barr compares the sensitivity of different RC computational approaches in predicting the presence of neuropsychological impairment in a collegiate athletic concussion sample. Dr. Gioia describes a novel application to detecting reliable change in the individual's response to increasing working memory load across an N-Back test battery. Dr.

Vaughan presents a clinical illustration of a novel application of the RC methodology examining within-session change to establish fatigue effects on a speeded cognitive task. Dr. Chelune discusses the implications of these applications for future neuropsychological research and clinical practice.

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#### **J. HOLDNACK. Development of Reliable Change Scores for the WAIS-IV/WMS-IV.**

**Objective:** The current study applies hierarchical multivariate regression to identify the best prediction equations of change in WAIS-IV/WMS-IV indexes and subtests scores between two test sessions in healthy adults.

**Participants and Methods:** Samples of healthy adults were administered the WAIS-IV ( $n=298$ ) or the WMS-IV ( $n=244$ ) on two separate test sessions at intervals ranging from 8 to 84 days. Hierarchical multiple regression was used to determine the best prediction of time 2 performance based on time 1 variables. The prediction variables, in hierarchical order, included: time 1 performance on the index or subtest being predicted, time 1 GAI, length of retest interval, age, education level, and sex. Non-significant predictors were dropped from the final prediction equation.

**Results:** WAIS-IV index scores equations yielded  $R^2$  values from .74 (PSI) to .91 (FSIQ). Subtest equations had lower  $R^2$  values, ranging from .53 (VP) to .85 (INF). The WMS-IV Indexes had  $R^2$  values from .69 (VMI) to .73 (IMI) and the subtests ranged from .44 (VRII) to .66 (VPA). All the equations yielded multiple predictors except VCI and FSIQ. Intellectual functioning at time 1, age, testing interval, and sex were identified as significantly related to change in performance.

**Conclusions:** Hierarchical multiple regression is an effective procedure for estimating reliable change scores in serial assessments. For the WAIS-IV/WMS-IV, the accuracy of the predicted change in performance and the significant predictors of change varied by measure. Comparing predicted from actual change in performance to base rates and cut-offs for statistical significance enables examiners to reliably identify change in cognitive functioning.

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#### **G. CHELUNE. Origins and Trends in the Application of Reliable Change (RC) Methods in Neuropsychology.**

**Objective:** This brief introductory presentation discusses the origins and trends in the application of reliable change (RC) methods in neuropsychology research and assessment, providing a context of for the innovative applications to be presented in this symposium. RC refers to a family of statistical methods that attempts to quantify the dispersion of observed change scores derived from assessments along a common metric that is applicable to variables with the goal of identifying retest scores that are statistically rare and hence potentially clinically meaningful and not likely due to error or expected practice effects. Most RC approaches can be classified along two dimensions: a) methods that use estimates of the dispersion of change scores versus methods based on observed indexes of dispersion; and b) categorical classifications versus continuous measures of deviations from expected change. These procedures have become widely used in outcomes research such as epilepsy surgery, cardiac procedures, traumatic brain injury, post-operative cognitive dysfunction, and aging. Because RC methods can be applied at the level of the individual, they are excellent candidate procedures for evidenced-based clinical practice and outcomes research. In recent years, RC regression approaches have begun to move beyond studying basic test-retest change toward the study of cognitive trajectories over multiple time points. The presentations to follow describe cutting edge applications of RC methods and novel applications of RC concepts to test development and design.

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#### **W. BARR, M. MCCREA, C. RANDOLPH & K. GUSKIEWICZ. Diagnostic Accuracy of Various Methods of Computing Reliable Change: Findings From the NCAA Concussion Study.**

**Objective:** Much attention has focused on the use of the Reliable Change Index (RCI) versus a Standardized Regression Based (SRB) approach for identifying the presence of neuropsychological impairment in sports concussion studies. Discussion has focused on what is the optimal time interval used to calculate these indices. The goal of this study was to compare the sensitivity of different RCI and SRB computational approaches in a large collegiate athletic sample.

**Participants and Methods:** A brief battery of paper/pencil tests was administered to 85 concussed athletes and 45 matched controls enrolled in a large-scale prospective study designed to assess the natural course of recovery from sports concussion. Tests were administered at baseline and at 2, 7, and 90 days following injury. Eight scores from five tests were used to compute a global neuropsychological index, which was in turn used to calculate SRB and RCI values. The presence of cognitive impairment was identified as a change in the global index score exceeding 90% confidence-intervals.

**Results:** SRB indices were more sensitive to identifying impairment in injured athletes and provided fewer false positives in controls than RCIs. The highest sensitivity and specificity values for Day 7 and Day 90 assessments were obtained using SRB's based on changes from baseline as opposed to difference scores generated from subsequent time points.

**Conclusions:** SRB methods based on measurement of relative changes from baseline performance on a global neuropsychological index provide greater sensitivity and specificity than traditional RCI methods for identification of concussion related cognitive impairment in collegiate athletes.

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#### **G.A. GIOIA, P. ISQUITH, C. VAUGHAN & L. MONETA. Detecting Response to Working Memory Load Demands with a Novel Application of SRB Reliable Change Methods in Children.**

**Objective:** The current study examined diagnostic group differences in response to increased working memory demand using a novel application of standardized regression based (SRB) reliable change (RC) methods.

**Participants and Methods:** 89 participants with recent mild TBI, 16 with ADHD-Inattentive Type (ADHD-I), 31 with ADHD-Combined Type (ADHD-C) and 162 typically developing children aged 8-18 completed the TEC, a computer administered n-back task combined with a go/nogo task to steadily increase working memory load (0-, 1-, 2-Back). SRB change scores for accuracy, response time (RT) and variability (ICV) were calculated for the 0- to 1-Back (SRB0-1) and 1- to 2-Back (SRB1-2) working memory load intervals.

**Results:** Manova's revealed significant diagnostic group differences in response to the first increase in working memory load (i.e., SRB0-1 scores). ADHD-C, ADHD-I and mTBI groups showed greater decline than controls in accuracy, and the ADHD-C and mTBI groups showed greater change in ICV from 0B to 1B. From 1B to 2B, the ADHD-C and mTBI groups again showed greater change in ICV but not in accuracy. **Conclusions:** This study illustrates a novel application of SRB change score methodology to facilitate comparison of actual change with expected change in response to increased working memory demand within a single test rather than between two administrations of the same test. In this case, SRB change scores were sensitive to differences in response to increasing working memory load between controls and children diagnosed with ADHD or recent mTBI. This method can guide the clinician in understanding clinically meaningful intra-individual neurocognitive profiles.

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**C. VAUGHAN, G. GIOIA & P. ISQUITH. Detecting Cognitive Fatigue via Standardized Regression Based Reliable Change Methodology within a Computerized Cognitive Test Battery.**

**Objective:** Neurocognitive change following concussion often involves increased fatigue on neuropsychological measures. The goals of this study were to employ standardized regression based (SRB) reliable change (RC) methodology to examine intra-individual within session change in response time in a large sample of typically developing children and to provide several illustrative case examples of the utility of this method in children with concussions.

**Participants and Methods:** A brief computerized neurocognitive battery was administered to typically developing children (n=566) age 5 to 12. Stepwise linear regression identified typical boundaries of change in response time from a cognitive speed task administered at the beginning and end of the battery. SRB values were calculated as z-scores for three concussed children ages 6, 10, and 11 (evaluated 10 to 20 days post-injury). Changes in response time beyond an 80% confidence interval ( $z > 1.28$ ) were considered to be significant.

**Results:** SRB reliable change methodology identified an atypical decrease in response time in two of the three concussed children (ages 6 and 11). Using this method applied towards intra-individual change enabled greater identification of fatigue effects, allowing for better identification of fatigue in response to cognitive exertion.

**Conclusions:** SRB reliable change methodology provides a novel approach to looking at intra-individual change within a same session neurocognitive test battery. These novel methods enabled better characterization of the neurocognitive and neurobehavioral sequelae of this injury, presumably associated with the neurometabolic changes underlying the concussive injury. Identification of these exertional effects provides an important opportunity for better concussion management.

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**Invited Symposium Presented by SLAN:  
The Use Of Magnetic Resonance Imaging For The  
Study Of Healthy Aging And Diseases Related To  
The Elderly.**

**Chair: Oury Monchi**

**Discussant: Thomas Jubault**

**10:45 a.m.–12:15 p.m.**

**O. MONCHI, T. JUBAULT, J. ANSADO, K. MARCOTTE & N. GONZALEZ. The use of Magnetic Resonance Imaging for the study of healthy aging and diseases related to the elderly.**

**Symposium Description:** During the last few years Resonance Magnetic Imaging (MRI) has contributed a great deal to the study of the anatomo-functional origins of the cognitive decline observed in healthy aging and to the diseases associated with it. This symposium aims to expose recent and representative studies of the use of MRI in those declines. The presentations will address the effect of complexity in healthy aging, anomia in stroke, the effect of repetitive Transcranial Magnetic Stimulation on the motor symptoms in Parkinson's disease (PD) and cognitive deficits in PD. This symposium will allow researchers and clinicians in Neuropsychology to keep up to date with some of the most recent work in functional and anatomical MRI studies in aging, stroke, and movement disorders.

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**J. ANSADO, O. MONCHI, N. ENNABIL & Y. JOANETTE. Resources mobilization and cognitive reserve to cope with increasing complexity in aging.**

**Objective:** Neurofunctional reorganization is thought to occur for many cognitive components or abilities in successful aging to cope with important changes of the brain's anatomy and physiology in aging (Hemispheric Asymmetry Reduction in Older Adults, Cabeza et al., 2002; Posterior-Anterior Shift in Aging, Davis et al., 2007). Recent model of Cognitive Reserve (Stern, 2009) suggest that the brain actively attempts to cope with age neural related changes by using pre-existing cognitive processes (neural reserve) or by enlisting compensatory processes (neural compensation). The purpose of the current study, is to test in aging, how these neural mechanisms are solicited in the context of visual selective attention processing, when task demand is manipulated. Thirty-two (32) participants respectively divided into a group of sixteen young adults and a group of sixteen seniors performed a letter-matching and control task while being scanned using functional Magnetic Resonance Imaging (fMRI). The letter-matching task had several levels of complexity based on a "high" and "low" cognitive level for both modalities, computational complexity and attentional load. The computational complexity was varied using the number of computational steps (i.e., perceptual identity (A-A) vs., semantic identity (a-A). The complexity of processes was manipulated by varying attentional load (i.e., concurrent charge of treatments) relating to the number of stimuli to be treated (i.e., low: 3 letters vs., high: 5 letters). Results show two different mechanisms depending on types of matching judgment, demand levels and age groups. First, in the 3-Perceptive condition, supporting the neural compensation hypothesis of CR, the regions underlying task performance differed in the younger vs. the older group. The older group recruited more bilateral frontal superior gyrus (BA8, BA9) than the younger one, similarly to PASA phenomena. Second, the intergroup comparison between the high and the low load level for the perceptive judgment (5P-3P) revealed more activation in the superior parietal gyrus in both groups. This latter result is consistent with the neural reserve hypothesis of CR, which states that the young and elderly may use the same regions to cope with increasing task demands and that the elderly may use concurrently compensation and neural reserves to cope with task demands for perceptive judgment. Finally, the intergroup comparison between the high and the low load level for the semantic judgment (5S-3S) show that the older group needs to recruit more bilateral frontal regions (BA 6, 9, 10) to successfully perform the task, while the younger one recruit more bilateral occipital regions (BA19). These latter findings indicate a load-dependant Posterior-Anterior Shift in Aging, supporting compensatory models for the most complex task level. In conclusion, taken together, these results suggest that the neural mechanisms of "cognitive reserve", compensation and reserve, are flexible, adaptive and are deployed according to the cognitive demand and the type of the required processing.

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**K. MARCOTTE1, D. TREJO, B. DAMIEN4, M. DE PRÉAUMONT4, S. GÉNÉREUX, M. HUBERT & A. ANSALDO. Neurobiological correlates of 'Semantic Feature Analysis' in chronic aphasia.**

**Objective:** Anomia is one of the most frequent and persistent deficits in chronic aphasia. Semantic feature analysis (SFA)1 aims at the activation of the word's semantic representations, in order to facilitate access to the corresponding phonological form. Its efficacy has been proven in single-case studies on chronic aphasia recovery2, but no multiple single-case study on SFA efficacy has been reported yet. Further, the neurobiological basis of SFA-induced anomia recovery has never been examined up-to date.

**Aim:** To describe therapy-induced behavioural and neurobiological changes observed in five participants with chronic and severe aphasia, following intensive therapy with SFA.

**Participants and Methods:** CM, DB, BR, AC and MB had all suffered from a single left hemisphere stroke between 4 to 25 years prior to this study. Participants were right-handed, and presented moderate to severe non-fluent aphasia. They all received intensive language therapy with SFA, aiming to improve naming of 20 nouns and 20 verbs. Participants underwent an fMRI session during overt picture naming, before and after therapy. Efficacy and generalization of therapy effects were statistically tested. Neuroimaging data analysis provided activation maps on therapy induced neuroplastic changes associated with recovery from chronic anomia.

**Results:** A significant improvement in oral naming for all 5 participants was observed following therapy with SFA ( $p < 0.01$ ). Significantly activated areas across participants included the MTG bilaterally, the right IFG, and the left or right precentral gyrus. Single-case analysis showed differences in terms of network contraction or expansion across subjects and word categories.

**Conclusions:** Despite long time elapsed after stroke, SFA can trigger adaptive brain plasticity to sustain the recovery from chronic and severe anomia. Therapy-induced neuroplastic changes observed across subjects relate to the semantic nature of the therapy provided; further, post-therapy activation differences across subjects may be related to individual differences in pre-therapy activation and aphasia patterns. Correspondence: *Oury Monchi, Montreal Geriatric's Institute, University of Montreal, 4565 Queen Mary Rd, Montreal, QC H3W 1W5, Canada. E-mail: oury.monchi@umontreal.ca*

**N. GONZÁLEZ, J. SOTO, D. TREJO, R. DRUCKER COLÍN & J. ARMONY. Parkinson's disease and rTMS: An fMRI longitudinal study.**

**Objective:** Parkinson's disease (PD) is a movement disorder whose principal symptoms are tremor, rigidity, bradykinesia and postural instability. Initially, drugs like L-dopa or dopaminergic agonists are able to control these symptoms, but with the progress of the disease these drugs become less effective. Previous studies have reported that repetitive transcranial magnetic stimulation (rTMS) can improve these motor symptoms. The objective of this study was to investigate the neural mechanisms by which 25 Hz rTMS may improve motor symptoms in PD.

**Participants and Methods:** In a double-blind placebo-controlled study, we evaluated the effects of 25 Hz. rTMS in 10 PD patients. Fifteen rTMS sessions were performed over the primary cortex (M1) on both hemispheres (one after the other) during a 12-weeks period. The patients were studied using fMRI during performance of a simple tapping and a complex tapping task, one week before the administration of the first rTMS session and just after the last rTMS session.

**Results:** rTMS improved bradykinesia, and post-TMS patients had different cortical patterns in prefrontal cortex than pre-TMS patients when performing complex tapping. Furthermore, the improvement in bradykinesia correlated positively with right inferior frontal cortex activity. Finally, we observed a relative change in functional connectivity between the prefrontal areas and the supplementary motor area (SMA) in patients after receiving rTMS.

**Conclusions:** These results show a potential beneficial effect of rTMS for the improvement of bradykinesia in PD that is substantiated by neural changes observed with fMRI.

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**T. JUBAULT, K. MARTINU & O. MONCHI. The contribution of functional and anatomical MRI in understanding the pathophysiology of Parkinson's disease.**

**Objective:** The degeneration of nigrostriatal neurons as the quasi-unique origin of Parkinson's disease (PD) pathophysiology has recently been challenged. Furthermore, postmortem studies suggest that this nigrostriatal degeneration is only an intermediary stage of a process that would start much before diagnosis in the brain stem. Finally, the effects of L-Dopa therapy on the cognitive deficits of PD are not well understood.

**Participants and Methods:** We initially compared patients at the early stages of PD (off medication) with control participants using fMRI during the performance of the Wisconsin Card Sorting Task. More recently, we used the same fMRI protocol on PD patients that were scanned twice, once taking their usual dose of dopaminergic medication and another time following overnight removal of medication. In a last study novel anatomical MRI methods are being used to identify anatomical differences between PD patients and healthy individuals.

**Results:** The results of the fMRI study showed that the cortical activity in PD depends on the striatal involvement for the task, with less cortical activation than healthy individuals if the striatum is solicited and more if it is not [1]. Furthermore, L-Dopa has significantly more effect on motor cortico-striatal regions such as the premotor cortex and the putamen, than on cognitive areas such as the prefrontal cortex and the caudate nucleus [2]. The first anatomical MRI results show a significant reduction in tissue intensity in the brain stem of PD patients vs. healthy participants using optimized VBM, in accordance with post-mortem studies suggesting this region as the first damaged site in the disease pre-symptomatically.

**Conclusions:** These results suggest that the cognitive deficits in PD do not solely result from the nigrostriatal degeneration but that malfunctioning of the meso-cortical dopamine pathways also play an important role. Furthermore, they explain why, at the neuronal level, L-Dopa is much more effective for motor-symptoms than cognitive deficits. Finally the anatomical studies suggest that MRI may have an important role to play in the future in the pre-symptomatic diagnosis of PD.

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**Paper Session 8:  
Traumatic Brain Injury**

**10:45 a.m.–12:15 p.m.**

**S. MCDONALD, S. LI, A. DE SOUSA, J. RUSHBY, A. DIMOSKA, C. JAMES & R. TATE. Loss of automatic mimicry to angry faces following severe traumatic brain injury.**

**Objective:** Adults with severe traumatic brain injury (TBI) frequently experience poor recognition of emotional facial expressions in others, especially negative expressions although the neuropsychological mechanisms are, as yet, poorly specified. This study aimed to determine whether the automatic mimicry that normally accompanies viewing of facial expressions was impaired in this group and whether mimicry was associated with emotion recognition.

**Participants and Methods:** 21 adults (17 male) with a severe TBI (mean duration of post traumatic amnesia = 80.1 days; mean time post injury 11.9 years) and 20 adults (12 males) without injuries viewed both static and dynamic portrayals of happy and angry facial expressions while muscle activity of the corrugator (brow) and zygomatic (cheek) muscles was monitored using EMG. They also performed a task of matching the 6 basic facial expressions.

**Results:** The TBI group were impaired matching faces, especially negative expressions. They showed normal activation of the cheek when viewing happy expressions whether portrayed as a static photo or dynamically. They did not show any activation of the brow when viewing angry expressions. There was no association between muscle activity and face matching accuracy.

**Conclusions:** The lack of response to angry expressions in adults with TBI is consistent with the view that ventral frontal regions subserve an early empathic response to (especially negative) facial expressions. The lack of association between mimicry and matching accuracy raises questions regarding the role of mimicry in emotion perception but highlights another aspect of social communication that is impaired following TBI

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**M. GREENHAM, M. SPENCER-SMITH, L. COLEMAN, P. ANDERSON, R. LEVENTER & V.A. ANDERSON. Social Functioning in Children With Brain Insult.**

**Objective:** Until recently, the impact of early brain insult (EBI) has been considered to be less significant than for later brain injuries, consistent with the notion that the young brain is more flexible and able to reorganize in the context of brain insult. This study aimed to evaluate this notion by comparing social outcomes for children sustaining EBI at different times from gestation to late childhood.

**Participants and Methods:** Children with focal brain insults (N=164) were categorized according to timing of insult: Congenital, Perinatal, Infancy, Preschool, Middle Childhood and Late Childhood. Groups were similar on injury and demographic factors. Teachers completed the Strengths and Difficulties Questionnaire and Walker McConnell Scale of Social Competence and School Adjustment.

**Results:** Regardless of age at insult, children with EBI were at increased risk for social impairment compared to normative expectations. EBI before age 2 years was associated with most significant social impairment, while children with EBI in the preschool years and in late childhood recorded scores closer to normal. Lesion location and laterality were not predictive of social outcome, and nor was social risk. In contrast, presence of disability (seizures) and family function were shown to contribute to aspects of social function.

**Conclusions:** EBI is associated with residual social problems, which impact on children's relationships and social networks. Both insult and environmental factors contribute to social dysfunction

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**T.D. VANNORS DALL, V. RAO, N.G. CASCELLA, B. GORDON & D.J. SCHRETLEN. A Morphometric Analysis of Neuroanatomic Correlates of Cognitive Dysfunction Following Traumatic Brain Injury.**

**Objective:** We previously demonstrated that long-term cognitive impairments of attention, psychomotor speed and memory correlate with global white matter (WM) atrophy in traumatic brain injury (TBI) survivors. Here we use voxel based morphometry (VBM) to explore the association between cognitive dysfunction and region-specific WM and gray matter (GM) abnormalities in the same sample.

**Participants and Methods:** Participants included 12 adults who sustained a moderate or severe TBI at least one year earlier, and 24 carefully matched healthy adults. All participants underwent brain magnetic resonance imaging and cognitive testing. Images were processed with statistical parametric mapping software (SPM5). We conducted multiple regression analyses of the combined samples to correlate regional WM and GM densities with performance on cognitive tests that showed the largest differences between the TBI and normal groups. All analyses controlled for age, sex, and handedness, and used a clusterwise false discovery rate correction of  $p < 0.05$ .

**Results:** Widespread reductions in WM density correlated with poorer performance on tests of attention, psychomotor speed, and verbal learning/memory, but not visuospatial learning/memory. Slower psychomotor speed was also associated with localized reductions in GM densities. Many regions showing tissue density-cognition associations are consistent with those previously found to differ between the groups.

**Conclusions:** Poorer performance on tests that differentiate TBI survivors from healthy adults also correlate with greater reduction of region-specific tissue densities, particularly involving large WM tracts. These findings underscore the contribution of WM changes to long term cognitive dysfunction, especially involving attention and processing speed, following moderate and severe TBI.

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**S. SORG, N. LUC, E. LANNI, M.W. BONDI, A.J. JAK, S. DEV, Y. CHANG, D. SCHIEHSER, D.C. DELIS, L.R. FRANK & L. DE-LANO-WOOD. Diffusion Tensor Imaging of Frontal White Matter in Veterans with Traumatic Brain Injury (TBI): Associations with Executive Functioning.**

**Objective:** Veterans of Iraq and Afghanistan are at high risk for TBI and concomitant executive dysfunction. Few diffusion tensor imaging (DTI) studies have been done in this vulnerable population, and the relationship between WM microstructural integrity and executive functioning in TBI remains unclear. We examined whether WM integrity of frontal and callosal regions is related to executive dysfunction in OEF/OIF veterans with mild-moderate TBI.

**Participants and Methods:** Nineteen patients (blunt or blast force TBI; 17 male; mean age=30; mean education=13 yrs) were administered the Wisconsin Card Sorting Task (WCST). 3T DTI scans were collected (61 directions) and Tract-Based Spatial Statistics was used to extract mean fractional anisotropy (FA) values for tract centers of the following TBI predilection sites: corpus callosum (genu[CCg], body[CCb], and splenium[CCs]), dorsal prefrontal WM(DPFWM), and ventral prefrontal WM(VPFWM).

**Results:** WCST T-score for total errors significantly correlated with FA of the CCg ( $r=0.61$ ,  $p=0.006$ ), DPFWM ( $r=0.80$ ,  $p<0.001$ ), and VPFWM ( $r=0.67$ ,  $p<0.002$ ). Additionally, WCST T-score for perseverative responses significantly correlated with FA of the CCb ( $r=0.52$ ,  $p=0.02$ ), and DPFWM ( $r=0.52$ ,  $p=0.02$ ). Finally, adjusting for age and education, WCST categories completed significantly related to FA of the DPFWM ( $r=0.59$ ,  $p=0.01$ ) and VPFWM ( $r=0.60$ ,  $p=0.01$ ). CCs revealed no significant WCST associations.

**Conclusions:** Findings show that WM integrity in regions sensitive to neurotrauma is strongly associated with problem solving ability and cognitive flexibility in this sample of OEF/OIF veterans. Results further suggest that DTI assessment of frontal WM integrity may play a role in disentangling the complexities of the polytrauma (e.g., TBI, PTSD, etc) common to OEF/OIF veterans.

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**V.A. ANDERSON, C. CATROPPA, C. GODFREY & J. ROSENFELD. Intellectual ability 10 years after traumatic brain injury in infancy and childhood: What predicts outcome? Intellectual ability 10 years after traumatic brain injury in infancy and childhood.**

**Objective:** To compare intellectual abilities at 10 years post-TBI across severity groups and age at insult, and investigate risk of long-term intellectual impairments

**Participants and Methods:** Children with a diagnosis of TBI between 2 and 12 years ( $n=76$ ) were recruited, on admission to the Royal Children's Hospital, Victoria, Australia, divided according to injury severity (mild, moderate, severe) and age at insult (2-7 years, 8-12 years) and assessed acutely, and at 12, 30 months and 10 years post-injury on a standard measure of intellectual ability. Recruitment was consecutive admissions and the study was prospective and longitudinal, with a between factor design, with injury severity and age at insult as the independent variables.

**Results:** Analyses of group differences identified a significant effect of injury severity for all cognitive measures, with more severe TBI associated with poorer outcome. Time since injury impacted outcomes for verbal skills only, and stable performances were observed between 30 months and 10 years post-TBI across all cognitive domains. Regression analyses showed that social risk and age at injury were important predictors of 10 year outcomes.

**Conclusions:** This study has confirmed the high risk of persisting and global deficits associated with severe TBI in childhood. Contrary to previous speculation about 'growing into deficits', children with severe TBI have more protracted recovery periods, but do not continue to lose ground. By 30 months post-insult recovery appears to stabilize and children begin to make appropriate developmental gains.

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