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Objective: Identifying individuals at the earliest stages of Alzheimer's Disease (AD) would enable development and study of interventions prior to onset of symptoms. However, differentiating age-related cognitive changes from subtle pathological changes remains a challenge in the field. Methods that would enable earlier detection of AD in elders with no subjective or objective cognitive concerns (i.e., individuals in the preclinical stage) would be of great interest. Community detection, a metric founded in graph theory, offers an alternative approach for characterizing subtle heterogeneity within aging samples and has the potential to inform cognitive variability in aging.
Participants and Methods: Using a hierarchical community detection, we examined whether cognitive subtypes could be identified in 226 cognitively normal older adults (from the Alzheimer's Disease Neuroimaging Initiative [ADNI] study). Cognitive profiles of each community were characterized first using MANOVAs to examine the relationship between community membership and 12 age-, gender-, and education-corrected neuropsychological variables. Pair-wise comparisons were examined for significant main effects. We then examined whether these subtypes were related to biomarkers (cortical volumes, fluorodeoxyglucose (FDG)-positron emission tomography (PET) hypometabolism) or clinical progression. All p values were corrected for multiple comparisons.
Results: Three communities (i.e., cognitive subtypes) were identified within the healthy aging sample. The first and largest community identified (N = 106) was characterized by a relative weakness on a single measure visuospatial executive function. Both the second (N = 76) and third community (N = 44) scored significantly lower on immediate, delayed, and recognition memory relative to the first community. The third community was characterized by a relative weakness in category fluency and speeded visual sequencing as well ($p < .000$). The three communities did not differ on age, gender, education, race, or ethnicity. Community membership was associated with entorhinal volume (with the second and third communities having significantly smaller entorhinal volumes than the first community), though community membership was not significantly associated with other biomarkers examined. Conversion rate reached trend level significance at 12 month follow up (more converters in the third community).
Conclusions: Hierarchical community detection is an alternative method for characterizing neuropsychological variation and it appears sensitive to relatively small differences that may be observed in a normal aging sample. While the sample size was relatively small, this approach shows promise for potentially leading to earlier detection of cognitive decline among individuals classified to be aging normally (e.g., community 3).

Categories: Aging
Keyword 1: aging (normal)
Keyword 2: aging disorders
Keyword 3: mild cognitive impairment
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2 Higher White Matter Hyperintensity Load Adversely Affects Pre-Post Proximal Cognitive Training Performance in Healthy Older Adults

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Objective: Cognitive training has shown promise for improving cognition in older adults. Aging involves a variety of neuroanatomical changes that may affect response to cognitive training. White matter hyperintensities (WMH) are one common age-related brain change, as evidenced by T2-weighted and Fluid Attenuated Inversion Recovery (FLAIR) MRI. WMH are associated with older age, suggestive of cerebral small vessel disease, and reflect

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decreased white matter integrity. Higher WMH load associates with reduced threshold for clinical expression of cognitive impairment and dementia. The effects of WMH on response to cognitive training interventions are relatively unknown. The current study assessed (a) proximal cognitive training performance following a 3-month randomized control trial and (b) the contribution of baseline whole-brain WMH load, defined as total lesion volume (TLV), on pre-post proximal training change.
Participants and Methods: Sixty-two healthy older adults ages 65-84 completed either adaptive cognitive training (CT; n=31) or educational training control (ET; n=31) interventions. Participants assigned to CT completed 20 hours of attention/processing speed training and 20 hours of working memory training delivered through commercially-available Posit Science BrainHQ. ET participants completed 40 hours of educational videos. All participants also underwent sham or active transcranial direct current stimulation (tDCS) as an adjunctive intervention, although not a variable of interest in the current study. Multimodal MRI scans were acquired during the baseline visit. T1- and T2-weighted FLAIR images were processed using the Lesion Segmentation Tool (LST) for SPM12. The Lesion Prediction Algorithm of LST automatically segmented brain tissue and calculated lesion maps. A lesion threshold of 0.30 was applied to calculate TLV. A log transformation was applied to TLV to normalize the distribution of WMH. Repeated-measures analysis of covariance (RM-ANCOVA) assessed pre/post change in proximal composite (Total Training Composite) and sub-composite (Processing Speed Training Composite, Working Memory Training Composite) measures in the CT group compared to their ET counterparts, controlling for age, sex, years of education and tDCS group. Linear regression assessed the effect of TLV on post-intervention proximal composite and sub-composite, controlling for baseline performance, intervention assignment, age, sex, years of education, multisite scanner differences, estimated total intracranial volume, and binarized cardiovascular disease risk.
Results: RM-ANCOVA revealed two-way group*time interactions such that those assigned cognitive training demonstrated greater improvement on proximal composite (Total Training Composite) and sub-composite (Processing Speed Training Composite, Working Memory Training Composite) measures compared to their ET counterparts. Multiple linear regression showed higher baseline TLV associated with lower pre-post change on Processing Speed Training sub-composite (β = -0.19, p = 0.04) but not other composite measures.
Conclusions: These findings demonstrate the utility of cognitive training for improving post-intervention proximal performance in older adults. Additionally, pre-post proximal processing speed training change appear to be particularly sensitive to white matter hyperintensity load versus working memory training change. These data suggest that TLV may serve as an important factor for consideration when planning processing speed-based cognitive training interventions for remediation of cognitive decline in older adults.

Categories: Aging
Keyword 1: aging (normal)
Keyword 2: cognitive rehabilitation
Keyword 3: neuroimaging: structural
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3 Associations Between Exercise Type, Fluid Intelligence, and Processing Speed in the Oldest-Old

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Objective: Exercise elicits a variety of physiological responses in the body. In the brain, exercise can modulate levels of neurotransmitters and other neurochemicals as well as sparking neurogenesis and structural changes. Downstream psychological effects of exercise include changes in mood and cognition. These changes vary depending on the type of exercise conducted (e.g., running versus strength training). While much is known about the effects of exercise in animals and adult humans, literature on the oldest-old (>= 85 years

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