

# Prevalence of Mental Disorders in a Canadian Household Population with Dementia

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**ABSTRACT: Background:** Medical and mental health comorbidity in Alzheimer's disease and other dementias presents difficult challenges for health service delivery. However, existing studies have been conducted in clinical samples and may not be informative for planning community services. The Canadian Community Health Survey (CCHS) provides an opportunity to characterize associations between dementias and mental and physical comorbidity in a household population aged 55 and over. **Methods:** Data were obtained from the 2005 CCHS-cycle 3.1. Weighted estimates for mood and anxiety disorders and other characteristics in Canadian population with dementia were calculated and were compared to those in people without the condition. **Results:** According to the CCHS, the prevalence of Alzheimer's disease and other dementia increases with age, more or less doubling every decade. The increase among women is monotonic, whereas among men in the household population the rate of dementia peaks at age 85-89 and falls thereafter. Mood and anxiety disorders were found to be substantially more frequent among people with Alzheimer's disease and other forms of dementia compared to those without the disease (mood disorders: 19.5% vs. 5.3% and anxiety disorders: 16.3% vs. 4.0%). Heart disease, stroke and obesity were associated with dementia as was a lower level of education. Furthermore, people with dementia were more likely than those without the disease to report activity restrictions. **Conclusions:** The high prevalence of mood and anxiety disorders in household population with Alzheimer's disease and other dementia demonstrates the burden of disease that is likely to worsen quality of life over time.

**RÉSUMÉ: Prévalence de troubles mentaux dans une population de ménages canadiens avec démence. Contexte :** La comorbidité médicale et mentale dans la maladie d'Alzheimer et les autres démences présente un défi important dans les soins de santé. Cependant, les études faites à ce jour l'ont été sur des échantillons cliniques et ne sont pas nécessairement utiles pour planifier les services communautaires. L'Enquête sur la santé dans les collectivités canadiennes (ESCC) fournit une occasion de caractériser les associations entre les démences et la comorbidité mentale et physique dans une population de ménages composés d'individus de 55 ans et plus. **Méthodes :** Les données ont été tirées de l'ESCC cycle 3.1 de 2005. Les estimés pondérés pour les troubles de l'humeur et les troubles anxieux et les autres caractéristiques dans la population canadienne atteinte de démence ont été calculés et comparés à ceux d'individus sans démence. **Résultats :** Selon l'ESCC, la prévalence de la maladie d'Alzheimer et des autres démences augmente avec l'âge et double plus ou moins à chaque décennie. L'augmentation chez les femmes est constante alors que chez les hommes de la population étudiée le taux de démence est le plus élevé entre 85 et 89 ans et décroît par la suite. Les troubles de l'humeur et les troubles anxieux étaient passablement plus fréquents chez les individus atteints de la maladie d'Alzheimer et les autres formes de démence par rapport à ceux qui n'avaient pas la maladie (troubles de l'humeur : 19,5% contre 5,3%; troubles anxieux 16,3% contre 4%). La maladie cardiaque, l'accident vasculaire cérébral et l'obésité étaient associés à la démence ainsi qu'un niveau de scolarité plus bas. De plus, les individus atteints de démence étaient plus susceptibles que ceux qui n'avaient pas la maladie de rapporter une activité limitée. **Conclusions :** La prévalence élevée de troubles de l'humeur et de troubles anxieux dans la population de ménages atteints de la maladie d'Alzheimer et d'autres démences démontre que le fardeau de la maladie est susceptible de diminuer la qualité de vie avec le temps.

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## THE BURDEN OF DEMENTIA

In 1994, the landmark study, the Canadian Study of Health and Aging, projected that by 2008 nearly half a million Canadians aged 65 years and older, would be living with various forms of dementia<sup>1</sup>. These projections were based on samples from both community and institutional populations. The number of people living with dementia is expected to continue to rise as the proportion of the Canadian population over 65 years continues to grow.

As a direct consequence of the baby boom from the 1940s through the 1960s, the average age of the Canadian population will increase rapidly in coming years. In all of the projection

scenarios considered<sup>2</sup>, the proportion of seniors, defined herein as aged 65 years and older, would increase rapidly over the next few decades, reaching 23% to 25% in 2031 and 25% to 30% in

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2056. In comparison, only 13% of the Canadian population was 65 years and over in 2005. In addition to a larger proportion of the population moving into the 65+ age category, the percentage of the oldest seniors (80 years and over) is also expected to grow exponentially, so that by 2056, about one out of ten Canadians will be 80 years and over, compared with about one in 30 in 2005.

Dementias, such as Alzheimer's disease and vascular dementia, are predominantly disorders of aging populations and place a heavy and growing burden on both the acute and long term healthcare system<sup>3</sup>. According to the World Health Organization, the burden of Alzheimer's disease and other dementia, will continue to grow as a result of an aging global population<sup>4</sup>.

In 2006, the World Health Organization projected that Alzheimer's disease and other dementias would be the leading neurological contributors to disability-adjusted life years (i.e., total number of lost years of healthy life or years living with disability in neurological diseases). Alzheimer's disease and other dementias were projected to account for 0.75% of the global disability-adjusted life years in 2005, 0.91% by 2015 and 1.20% by 2030. Neurological disorders in the neuropsychiatric category (Alzheimer's disease and other dementia, Parkinson's disease, multiple sclerosis, migraine and epilepsy) collectively accounted for 6.3% of disability-adjusted life years followed by HIV/AIDS (5.5%), malignant neoplasms (5.3%), ischaemic heart disease (4.2%), and respiratory diseases (4.0%). Among neuropsychiatric disorders, 12% of the burden in disability-adjusted life years is expected to be due to Alzheimer's disease and other dementias<sup>4</sup>.

The objectives of our analysis were to: (1) describe the health status of people with Alzheimer's disease or other forms of dementia in the Canadian population 55 years or older living in private households in comparison to those without the condition; (2) examine the magnitude of the comorbidity due to mood and anxiety disorders in Alzheimer's disease and other forms of dementia. The epidemiologic pattern of health status in household residents with Alzheimer's disease or other dementia is important for policy and planning services for this population. Comorbidity is common in the general population and it influences a broad range of health outcomes, including disease severity and disability. Comorbidity also has important implications for health policy and service planning.

## METHODS

### Data sources

The data used in this study are from cycle 3.1 of the Canadian Community Health Survey (CCHS, Statistics Canada) which was conducted from January to December, 2005. Data were collected from a sample of 132,947 individuals with an overall response rate of 79%. The CCHS uses a computer-assisted personal interview to collect cross-sectional information regarding the health of Canadians every two years. It uses a rigorous methodology that ensures standardized interviews and randomized, stratified sampling. It covers the non-institutionalized household population aged 12 years and older in all provinces and territories except residents of First Nations reserves, Canadian Forces bases and some remote areas. The sample was weighted to the 2005 Canadian population aged 12

years or older. More detailed descriptions of the design, and sample and interview procedures for the CCHS are available in a published report<sup>5</sup>.

The present analysis focuses on 48,219 respondents who were aged 55 and over during 2005<sup>6,7</sup>. Respondents were asked if they had a long-term condition such as Alzheimer's disease or other forms of dementia that had been diagnosed by a health professional. Similarly, survey items eliciting information about a mood or an anxiety disorder that was diagnosed by a health professional were also included in the CCHS interview. Mood disorders were determined by asking, "Do you have a mood disorder such as depression, bipolar disorder, mania or dysthymia?" that had been diagnosed by a health professional while anxiety disorder was determined by asking, "Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?" that had been diagnosed by a health professional. For the CCHS 3.1, proxy responses about Alzheimer's disease or other dementias were accepted based on necessity. In cases where the selected respondent was, for reasons of physical or mental health, incapable of completing an interview, another knowledgeable member of the household supplied information about the selected respondent. While proxy interviewees were able to provide accurate answers to most of the survey questions, the more sensitive or personal questions, such as "self-perceived mental health status," were beyond the scope of knowledge of a proxy respondent. This resulted in some questions from the proxy interview being unanswered.

### Analysis

When the population weights were applied, there were an estimated 79,971 people aged 55 years and older with Alzheimer's disease or another form of dementia that had been diagnosed by a health professional and lived in community households in 2005.

Weighted cross-tabulations were used to estimate the frequency of Alzheimer's disease and other dementias. As well, cross-tabulations were used to determine the rates of mood and anxiety disorders and other known risk factors among people with Alzheimer's disease or other dementias and those without the disease. This was followed by univariate analyses to determine the individual influence of mental disorders and other risk factors on a diagnosis of Alzheimer's disease or other dementias. We assessed, for comparison, the likelihood of having been diagnosed with a mood or anxiety disorder in those with other neurological conditions such as epilepsy or migraine in the same community household population.

Multivariate logistic regression models that controlled for demographic characteristics, other known risk factors, and other indicators of health status were used to assess whether mood and anxiety disorders were independently associated with having Alzheimer's disease and other dementias. Factors found to be statistically significant in relation to dementia in the univariate analyses (age, sex, chronic conditions, self-perceived health status, perceived stress in daily life, activity restrictions and body mass index [BMI]) were included in the multivariate logistic models. In developing policy and planning services for people with dementia it is important to determine the extent to which health outcomes are specifically associated with dementia as opposed to non-specific effects of age and the general impact of

illness. For this reason, the models included adjustments for demographic variables. In addition, a series of analyses for epilepsy and migraine were made to gain a sense for the specificity of the associations for dementia.

To account for the sample design effects in the CCHS, the bootstrap technique was used to calculate confidence intervals, coefficients of variation, for testing the statistical significance of differences between the estimates and for calculation of the final odds ratios<sup>8-10</sup>. A significance level of  $p < 0.05$  was applied in all cases. The bootstrap technique allows for weights adjustment in the analysis of data from complex and large-scale surveys such as the CCHS. The CCHS uses stratified multi-stage cluster sampling, resulting in dependencies among sample elements, and unequal probabilities of selection, and to unequal design weights. Accounting for these survey design features and performing weight adjustments is, therefore, necessary to avoid drawing incorrect inferences from the analysis. The bootstrap procedure employed in this analysis is based on a set of 500 replicate bootstrap sampling weights.

## RESULTS

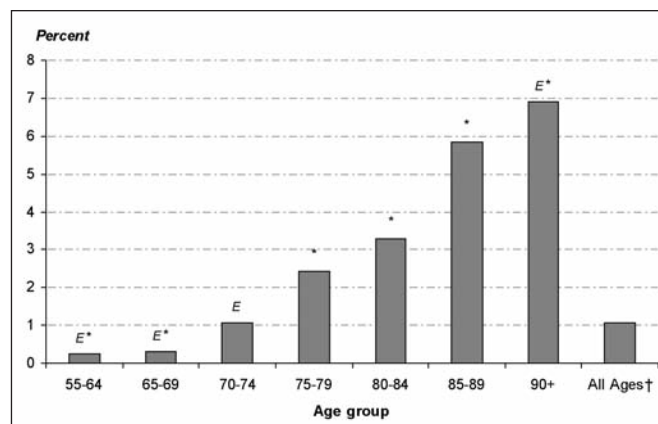
### Prevalence of Alzheimer's and other forms of dementia

In 2005, an estimated 80,000 people aged 55 years and older reported that they had been diagnosed with Alzheimer's disease or other forms of dementia. This corresponds to a weighted prevalence of 10.7 per 1,000 persons (95% CI: 9.3 - 12.1) in the population living in private households. The rates for male and female population were 10.4 per 1000 and 11.0 per 1000 respectively.

The prevalence of dementia increased exponentially with age and nearly doubled every decade after age 65 (Figure). Among men, the prevalence of dementia peaked between ages 85-89, but dropped thereafter. Among women, the pattern was more monotonic ranging from less than 1% among those under 70 years to 8% for those aged 90 years and over. After adjusting for age, however, the rates of dementia among male and female populations were similar (Table 1).

### Mental health

In 2005, just over 5% of individuals aged 55 years and older reported having mood disorders such as depression, bipolar disorder, mania or dysthymia and about 4% reported having an



**Figure:** Age-specific prevalence of Alzheimer's disease or other dementia in community household populations aged 55 years and over, Canada, excluding territories, 2005. † Reference category; \* Rate is significantly different from that of the reference category ( $p < 0.05$ ). E Coefficient of variation equals 16.6%-33.3% (interpret with caution). Source: Canadian Community Health Survey (CCHS), Cycle 3.1, 2005

anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder. By comparison, the prevalence of mood disorders was 19.5% or 195 per 1,000 persons (95% CI: 115-207) among people with Alzheimer's disease or other dementias. Anxiety disorders affected 16.3% or 163 per 1,000 persons (95% CI: 83 - 168) with dementia (Table 2). The associations with mood and anxiety disorders were not specific for dementia, but were also seen in respondents with epilepsy and migraine (Appendix: Tables A & B).

### Physical health

Persons with dementia were more likely to report poorer self-perceived general health compared to those without the disease (Table 2). About six in ten of those who had been diagnosed with Alzheimer's or other forms of dementia reported poorer self-perceived health status. Having Alzheimer's disease or other forms of dementia also had a severe impact on activities of daily living and social activities. Nearly 90% of men and women with

**Table 1: Prevalence of Alzheimer's disease and other forms of dementia, by sex, community household population aged 55 years and over, Canada, excluding territories, 2005**

	Weighted Estimate	%	cv*	p-value
Men†	36,625	1.04	10.39	
Women	43,475	1.10	8.61	0.67
Both Sexes	79,971	1.07	6.58	

† Reference category; Source: Canadian Community Health Survey (CCHS), Cycle 3.1, 2005;

\*coefficient of variation.

**Table 2: Age-adjusted health related characteristics and other risk factors among people with and without Alzheimer's disease or other dementias, community household population aged 55 years and over, Canada, excluding territories, 2005**

	Has Alzheimer's disease or other dementia			Has no Alzheimer's disease or other dementia		
	Rate (%)	95% Confidence interval		Rate (%) †	95% Confidence interval	
<b>Comorbidity</b>						
Anxiety disorder	16.3* <sup>E</sup>	8.3	16.8	4.0	3.7	4.2
Mood disorders	19.5* <sup>E</sup>	11.5	20.7	5.3	5.0	5.6
<b>General health</b>						
Self-perceived health						
Excellent, very good, good	38.5*	27.5	49.4	78.5	77.9	79.0
Fair, poor	61.6*	50.6	72.5	21.5	21.0	22.1
Self-perceived mental health						
Excellent, very good, good	50.9*	38.5	63.4	95.1	94.8	95.4
Fair, poor	49.1*	36.6	61.5	4.9	4.6	5.2
<b>Activity restrictions (overall)</b>						
Difficulty with social situations	88.7*	83.1	94.4	46.0	45.3	46.7
with making new friends	60.9*	49.5	72.3	5.0	4.7	5.4
interacting with new people	37.8*	27.2	48.3	3.0	2.7	3.2
to start a conversation	50.2*	38.1	62.3	2.7	2.5	3.0
Needs help with various tasks	54.4*	43.3	65.5	2.8	2.6	3.1
preparing meals	84.2*	75.1	93.2	27.0	26.4	27.6
making appointments	61.8*	49.9	73.7	4.7	4.4	5.0
housework	69.8*	58.7	80.8	10.2	9.9	10.6
heavy chores	61.4*	49.6	73.2	10.6	10.2	11.0
personal care	77.8*	67.7	87.9	24.8	24.2	25.3
moving inside home	53.6*	41.1	66	3.3	3.0	3.5
managing finances	18.5* <sup>E</sup>	10.9	26.1	2.2	1.9	2.4
Difficulty with activities	60.0*	47.6	72.4	4.5	4.3	4.8
reduced activities, other	33.3 <sup>E</sup>	19.4	47.2	19.7	19.1	20.2
reduced activities, other	9.9 <sup>E</sup>	5.1	14.7	12.7	12.2	13.1
<b>Physical activity</b>						
Active	81.4	72.7	90	88.2	87.8	88.6
<b>Disease risk factors</b>						
Effects of stroke	13.0* <sup>E</sup>	8.6	17.3	2.9	2.7	3.2
Heart disease	20.8*	15.1	26.6	13.8	13.3	14.2
Diabetes	25.2 <sup>E</sup>	11.4	39.1	12.4	12.0	12.9
High blood pressure	48.2	36.2	60.3	37.4	36.8	38.0
Digestive diseases	16.0* <sup>E</sup>	9.9	22.2	8.9	8.5	9.2
Bowel incontinence	2.5* <sup>E</sup>	0.9	4.0	0.4	0.3	0.5
Respiratory diseases	20.1 <sup>E</sup>	10.8	29.4	11.4	11.0	11.9
Musculoskeletal diseases	45.2	34.6	55.9	49.9	49.2	50.6
Cancer	19.0 <sup>E</sup>	11.7	26.3	13.8	13.3	14.3
Glaucoma/cataracts	21.3	15.1	27.5	16.5	16.0	16.9
<b>Other risk factors</b>						
Normal weight (BMI = 18.5 - 24.9)	40.1	28.9	51.3	39.4	38.7	40.0
Overweight (BMI = 25.0 - 29.9)	22.5*	16.1	28.9	38.9	38.3	39.5
Obese BMI >= 30.0)	31.0* <sup>E</sup>	18.2	43.8	17.6	17.1	18.1
Alcohol consumption, regular drinker	29.1* <sup>E</sup>	18.8	39.3	54.8	54.2	55.5
Type of smoker-occasional smoker	9.1* <sup>E</sup>	5.4	12.9	15.3	14.7	15.8
Type of smoker-ever daily smoker	60.6	50.9	70.3	52.8	52.1	53.4
Marital status (Single, divorced, separated)	43.6	30.5	56.7	30.6	30.0	31.2
Education (Lower education)	66.1*	54.1	78.1	46.7	46.0	47.4

† Reference category; \* Value is significantly different from that of the reference category ( $p < 0.05$ );

... Not applicable; <sup>E</sup> Coefficient of variation equals 16.6% to 33.3% (interpret with caution);

Source: Canadian Community Health Survey (CCHS), Cycle 3.1, 2005.



Alzheimer's disease or other forms of dementia reported experiencing activity restrictions sometimes or often (95% CI: 83.1%, 94.4%). Over 80% indicated that the disease had a direct impact on activities of daily living such as personal care, preparing meals and managing their own finances (95% CI: 75%, 93%). Nearly 2/3 of the people with Alzheimer's disease or other forms of dementia had difficulty with social situations such as with making new friends, interacting with new people or starting a conversation (61%, 95% CI: 51%, 73%) (Table 2).

In 2005, the age-adjusted prevalence of suffering from effects of a stroke in people with Alzheimer's disease or other dementias living in the community was 13.1% (95% CI: 8.6% - 17.3%) compared to only 2.9% (95% CI: 2.7% - 3.2%) among those without the disease. Furthermore, individuals who reported having dementia were twice as likely to report having heart disease (Table 2). There was also an increased frequency of high blood pressure and diabetes among persons with Alzheimer's disease or other forms of dementia, although the degree of precision was not sufficient to confirm at the 95% level of confidence that the underlying population frequencies differed. As well, those with Alzheimer's disease and other dementias had a higher likelihood of reporting having been diagnosed with a digestive disease, particularly bowel incontinence.

#### *Other health status measures*

About 40% of people with or without dementia had normal weight with a self-reported BMI ranging between 18.5-24.9. Although only 22.5% of people with dementia reported height and weight that were consistent with being overweight ( $25 \leq \text{BMI} < 30$ ), while 31% reported being obese with a self-reported BMI of 30 or greater. By comparison, the corresponding rate among those without dementia was only 17.6%, (95% CI: 17.1%-18.1%).

Among people with Alzheimer's disease and other dementia, alcohol consumption and tobacco use were considerably lower compared to those without the disease. About 29% of those with the disease reported that they regularly drink alcohol and 9% were occasional smokers compared to 55% and 15% respectively, among those without the disease.

People with dementia generally had lower levels of education compared to those without the disease. Nearly 70% of those with dementia reported having only a secondary school education or less, compared with less than 50% of those who did not have dementia. The effect of a lower level of education appears to be more severe for older individuals and for females than males. Among males, about 48% of those aged 65 years and over with Alzheimer's disease or other dementia had less than a secondary school graduation/diploma, compared to 55% of females.

#### *Multivariate analysis*

In multivariate analyses, the relationship between Alzheimer's disease or other forms of dementia and mental disorders persisted. After adjusting for demographic characteristics and other health status measures, the odds ratios of having been diagnosed with a mood or an anxiety disorder in those with Alzheimer's disease or other dementias, were 2.23, (95% CI: 1.43, 3.48) and 2.99, (95% CI: 1.77, 5.06) respectively. Similarly, the likelihood of suffering from the effects of a stroke

in dementia also remained high. Those with Alzheimer's and other dementias were more than twice as likely to have suffered a stroke (OR=2.28, (95% CI: 1.47, 3.52)). By contrast, the strength of the association of heart disease with Alzheimer's disease or other dementias diminished (OR=0.85, 95% CI: 0.62, 1.16), while high blood pressure emerged as being negatively associated with dementias (OR=0.70, 95% CI: 0.52, 0.93). Similarly, musculoskeletal conditions such as arthritis, back pain, and fibromyalgia were also unrelated to a diagnosis of Alzheimer's or other forms of dementia (OR=0.54, 95% CI: 0.38, 0.77).

Even when potentially confounding factors (notably a high prevalence of suffering from effects of stroke, heart disease, high blood pressure, and musculoskeletal conditions) were taken into account, compared to those without dementia, those with dementia had increased odds of poorer self-perceived health (OR= 1.86, 95% CI: 1.31, 2.64). They were also five times more likely to report activity restrictions such as difficulty with social situations, and feeling that they sometimes or often needed help with various activities of daily living.

Furthermore, when other factors were taken into account, the relationship between dementia and lower education remained. People with only a secondary school graduation or less had a significantly higher likelihood of reporting having been diagnosed with dementia compared to those who had a higher level of education (OR=0.60, 95% CI: 0.44, 0.83).

#### **DISCUSSION**

The household population with Alzheimer's disease or other forms of dementia is a population that has not been well-studied in Canada. Planning services to meet the needs of this population require information about their health status. This study helps to delineate several dimensions of health care needs in the household population with dementia.

The prevalence of mood disorders and anxiety disorders were substantially elevated in Alzheimer's disease and other dementias. The extent of unmet need associated with mood and anxiety disorders cannot be determined from the CCHS data, since those who were undiagnosed would not have been detected. It is of note that the analyses presented here indicate that the association between these mental and neurological disorders is not unique to dementia, but is also evident for migraine and epilepsy (Appendix: Tables A & B)<sup>11-13</sup>. The population with Alzheimer's disease and other dementias was also found in this analysis to have poor overall health status and important health care needs.

As a cross-sectional survey, the CCHS cannot differentiate etiologic factors from other factors that determine prevalence such as mortality. Theoretically, factors that are protective against mortality could lead to an increased prevalence. However, many of the variables that were found to be associated with dementia in this analysis (mood disorders, fair or poor perceived health, cardiovascular conditions) tend to be associated with increased mortality<sup>14-19</sup>. Therefore, these health status indicators provide important information about the health care needs of this population. The apparently negative association of high blood pressure with dementia should be interpreted with caution since this could arise from an effect on mortality or institutionalization.

**Table 3: Adjusted odds ratios relating mood and anxiety disorders and other characteristics to Alzheimer's disease or other dementias, population aged 55 years and over, Canada, excluding territories, 2005**

Correlates of dementia	Odds ratio	95% Confidence Interval (CI)		p-value
<b>Sex</b>				
Male	1.21	0.85	1.71	0.28
Female †	1.00	...	...	
Age (continuous)	1.10*	1.09	1.12	0.00
<b>Education (Respondent)</b>				
More than high school graduation	0.60*	0.44	0.83	0.00
High school graduation or less †	1.00	...	...	
<b>Self-perceived general health</b>				
Fair or poor	1.86*	1.31	2.64	0.00
Excellent, very good or good †	1.00	...	...	
<b>Amount of stress in own life</b>				
A bit - extremely stressful	1.03	0.73	1.47	0.85
Not at all or not very stressful †	1.00	...	...	
<b>Activity restrictions</b>				
Sometimes	1.74	0.92	3.32	0.09
Often	4.51*	2.46	8.25	0.00
Never †	1.00	...	...	
<b>Comorbidity</b>				
Has an anxiety disorder(s)				
Yes	2.99*	1.77	5.06	0.00
No †	1.00	...	...	
Has a mood disorder(s)				
Yes	2.23*	1.43	3.48	0.00
No †	1.00	...	...	
Has migraine				
Yes	0.83	0.48	1.43	0.50
No †	1.00	...	...	
Has epilepsy				
Yes	2.11	0.46	9.66	0.34
No †	1.00	...	...	
Suffers effects of stroke				
Yes	2.28*	1.47	3.52	0.00
No †	1.00	...	...	
Has heart disease				
Yes	0.85	0.62	1.16	0.30
No †	1.00	...	...	
Has a musculoskeletal disease(s)				
Yes	0.54*	0.38	0.77	0.00
No †	1.00	...	...	
Has high blood pressure				
Yes	0.70*	0.52	0.93	0.01
No †	1.00	...	...	
Has a respiratory disease(s)				
Yes	0.84	0.58	1.22	0.37
No †	1.00	...	...	
Has a digestive disease(s)				
Yes	1.15	0.79	1.68	0.46
No †	1.00	...	...	
Has diabetes				
Yes	1.33	0.89	1.99	0.17
No †	1.00	...	...	
Has or ever had cancer				
Yes	0.89	0.63	1.26	0.51
No †	1.00	...	...	
Has Glaucoma or Cataracts				
Yes	0.86	0.56	1.33	0.49
No †	1.00	...	...	
Has thyroid disease				
Yes	0.93	0.54	1.58	0.78
No †	1.00	...	...	

† Reference category; \* Value is significantly different from that of the reference category ( $p < 0.05$ );  
 ... Not applicable; Source: Canadian Community Health Survey (CCHS), Cycle 3.1, 2005.

We have no direct evidence of the validity of self-reported, professionally diagnosed dementia. This approach to assessment of prevalence may be insensitive because early stages of dementia may not always be detected. A lack of specificity is also possible since in some cases, depression or other causes of cognitive impairment may be incorrectly diagnosed as dementia.

The associations of cardiovascular disease, diabetes, obesity and low education may reflect etiologic effects, although this cannot be confirmed with cross-sectional data. Cross-sectional data have limited applicability to etiological assessment since they cannot clarify temporal relationships. However, educational achievement in particular is unlikely to be affected by Alzheimer's disease, such that it is a safe assumption that low education preceded the onset of the disease. Some of the comorbidities identified (e.g. digestive diseases) are of uncertain significance from the perspective of etiology, but provide valuable descriptive data about the burden of ill-health in this population. Furthermore, obesity may be a determinant of adverse health outcomes in this population and is a potential target of intervention. The CCHS provides an opportunity to evaluate trends over time in the household population.

The information on Alzheimer's disease and other forms of dementia, and other chronic conditions used in the study were self- or proxy-reported; and therefore, there remains the likelihood of under- or over-reporting. For example, the diagnosis of Alzheimer's disease or other forms of dementia or mental disorders were not validated against clinical records. Nonetheless, respondents who participated in the survey, were specifically asked to report only those chronic conditions that were long-term, and which had been diagnosed by a health professional.

The estimates derived for Alzheimer's disease and other dementia, mood and anxiety disorders and other chronic conditions represent residents in private households only. Individuals residing in institutions such as long term care or acute care hospitals were excluded from the sampling frame. For conditions such as Alzheimer's disease and other dementias that increase exponentially after age 65, this represents a significant exclusion. While the proportion of individuals aged 65 years and over residing in health care institutions is estimated to be around 7-8% overall, for those aged 85 years and over 30-37%, this percentage is nearly five times greater (Appendix Table C). On the other hand, whereas residents of institutions may be provided with psychosocial and medical supports through institutional programs, access to such services for community residents may follow a different pattern and may be more difficult to regulate and monitor. The CCHS survey is repeated every two years and provides a valuable opportunity to monitor changes over time.

Unfortunately, it was not possible to provide regional estimates due to a small sample size of people with Alzheimer's disease or other dementias in the CCHS, 2005.

## CONCLUSIONS

This analysis provides evidence, based on a national probability sample, that the prevalence of mental disorders among people with Alzheimer's disease and other dementias is substantial, independent of other health conditions and other known risk factors such as age. Overall, individuals who had been diagnosed with any form of dementia were more likely to have also received a diagnosis of a mood or an anxiety disorder, consistent with other chronic illnesses. Understanding the psychiatric correlates of Alzheimer's disease and other dementia is important to adequately manage this patient population and to guide public policies and health care costs.

These results are the most recent describing the status of Alzheimer's disease and other dementia in the non-institutionalized Canadian population aged 55 years or older. Further in-depth research would be useful to determine whether the mental disorders precede or develop simultaneously with Alzheimer's disease and other forms of dementia. The CCHS provides an opportunity to monitor various aspects of health status in a population that may otherwise be missed by regulation and quality improvement measures that apply in health-care institutions.

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## APPENDIX

**Table A: Prevalence of mood and anxiety disorders among people diagnosed with migraine, household population aged 12 years and over, Canada, 2005**

Mood disorders	Number of people	%	P-value	Anxiety disorders	Number of people	%	p-value
No†	2,475,402	9.68		No†	2,557,718	9.88	
Yes	382,347	25.27*	0.00	Yes	300,253	25.35*	0.00
Total	2,857,507	10.55		Total	2,856,124	10.55	

† Reference category; \* Estimate is significantly different from reference category,  $p < 0.05$ ; Source: Canadian Community Health Survey (CCHS) Cycle 3.1, 2005.

**Table B: Prevalence of mood and anxiety disorders among people diagnosed with epilepsy, household population aged 12 years and over, Canada, 2005**

Mood disorders	Number of people	%	P-value	Anxiety disorders	Number of people	%	P-value
No†	140,670	0.55		No†	137,227	0.53	
Yes	18,764	1.24*	0.00	Yes	20,386	1.72*	0.00
Total	159,829	0.59		Total	159,755	0.59	

† Reference category; \* Estimate is significantly different from reference category,  $p < 0.05$ ; Source: Canadian Community Health Survey (CCHS) Cycle 3.1, 2005.



**Table C: Percentage of population aged 65 or older living in health care institutions, Canada, 1981, 1986, 1991, 1996, 2001 (custom tabulation)**

	1981	1986	1991	1996	2001
<b>Total 65+</b>	1.20%	1.30%	1.30%	1.30%	1.30%
65-74	2.30%	2.20%	2.00%	1.80%	1.70%
75-84	10.40%	10.00%	9.10%	8.20%	7.50%
85+	34.50%	36.80%	34.70%	32.30%	30.10%
<b>Population</b>					
65-74	1,477,745	1,650,090	1,895,065	2,061,935	2,161,015
75-84	689,445	819,730	991,565	1,128,835	1,341,891
85+	193,785	227,760	283,335	337,075	420,156
<b>Institutionalized</b>					
65-74	34,505	36,505	37,640	36,675	36,425
75-84	71,475	81,940	89,955	92,210	100,715
85+	66,945	83,825	98,195	108,865	126,600
65+ pop	2,360,975	2,697,580	3,169,965	3,527,845	3,923,062
65+ inst	172,925	202,270	225,790	237,750	263,740
%	7.3	7.5	7.1	6.7	6.7
	<b>1981</b>	<b>1986</b>	<b>1991</b>	<b>1996</b>	<b>2001</b>
65+ pop	2,360,975	2,697,580	3,169,965	3,527,845	3,923,062
65+ inst	172,925	202,270	225,790	237,750	263,740
%	7.3	7.5	7.1	6.7	6.7
% increase 1981 to 2001					34.43

Source: Statistics Canada. Census of Canada. 1981, 1986, 1991, 1996 and 2001.

**Table D: Selected characteristics of household and institutional population from the National Population Health Survey, population aged 65 years and over, Canada**

	Households			Institutions		
	Sample Size	Estimated Population '000	Prevalence %	Sample Size	Estimated Population '000	Prevalence %
<b>Total</b>	2,851	3,488	100	1,711	185	100
<b>Sex</b>						
Men	1,108	1,518	43.5	457	50	27.2
Women	1,743	1,970	56.5	1,254	135	72.8
<b>Age Group</b>						
65 to 74	1,539	1,999	57.3	261	28	15.2
75 to 84	1,037	1,222	35	603	64	34.8
85 or older	275	266	7.6	847	93	50
<b>Education</b>						
Less than secondary graduation	1,473	1,748	50.2	1,104	120	69.7
Secondary graduation	1,374	1,734	49.8	481	52	30.3
<b>Proxy response</b>						
Yes	317	522	15	1,013	111	60
No	2,534	2,966	85	698	74	40
<b>Current medication use</b>						
Yes	2,181	2,642	76.3	1,582	171	96.7
No	652	821	23.7	56	6	3.3
<b>Multiple medication use</b>						
Yes	367	445	12.8	876	94	53.1
No	2,466	3,018	87.2	762	83	46.9

Note: Details may not add to totals because of missing values for some variables; Source: 1998-1999 National Population Health Survey (NPHS), Cross-Sectional Sample, Household Component; 1996-1997 National Population Health Survey (NPHS), Cross-Sectional Sample, Health Institutions Component.