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Depression — a common disorder across a broad spectrum of neurological conditions: a cross-sectional nationally representative survey☆

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ABSTRACT

Objective: To estimate the prevalence of depression across a range of neurological conditions in a nationally representative sample.
Methods: The data source was the Survey of Living with Neurological Conditions in Canada (SLNCC), which accrued its sample by selecting participants from the Canadian Community Health Survey. The point prevalence of depression was estimated by assessment of depressive symptoms with the Patient Health Questionnaire, Brief (Patient Health Questionnaire, 9-item).
Results: A total of $n=4408$ participated in the SLNCC. The highest point prevalence of depression (>30%) was seen in those with traumatic brain injury and brain/spinal cord tumors. Depression was also highly prevalent (18–28%) in those with (listed from highest to lowest) Alzheimer's disease/dementia, dystonia, multiple sclerosis, Parkinson's disease, stroke, migraine, epilepsy and spina bifida. The odds ratios for depression, with the referent group being the general population, were significant (from highest to lowest) for migraine, traumatic brain injury, stroke, dystonia and epilepsy.
Conclusions: All neurological conditions included in this study are associated with an elevated prevalence of depression in community populations. The conditions with the highest prevalence are traumatic brain injury and brain/spinal cord tumors.

1. Introduction

Major depression is frequently comorbid with a diverse range of chronic medical conditions. Examples of such conditions include pain [1], diabetes [2], heart disease [3], rheumatoid arthritis [4] and Parkinson's disease [5]. The relationship between depression and chronic conditions is reciprocal. Although depression is often assumed to be a consequence of chronic conditions, depression can increase the risk of a number of chronic conditions including heart disease, arthritis, asthma, back pain, bronchitis, hypertension and migraines [6]. Furthermore, higher levels of depression predict faster progression of Parkinson's disease [7]. Accurate assessment of depression is therefore pertinent both before and after the onset of chronic conditions.

Depression is known to be elevated in of neurological conditions including epilepsy, multiple sclerosis (MS), Parkinson's disease and traumatic brain injury, a finding that has been substantiated by recent reviews [8–11]. However, these systematic reviews have identified considerable heterogeneity in the estimates. Such heterogeneity is likely due to different sampling and measurement procedures. For example, different depression assessment tools have been applied, and many of the samples are from clinical populations (see Discussion). This consideration leads to uncertainty about the relative prevalence in different neurological populations. Recently, a study called the Survey of Living with Neurological Conditions in Canada (SLNCC) was launched. This study explores a broad range of experiences and outcomes addressing Canadians' experiences with chronic neurological conditions in a population-based sample. Among a number of important outcomes (i.e., the economic impact of having a neurological condition), the study provides an opportunity to estimate depression in persons with a range of neurological conditions with consistent sampling and

☆ Disclaimer: This research and analysis were based on data from Statistics Canada, but the opinions expressed do not represent the views of Statistics Canada.

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measurement procedures. This is unique in that this is, to our knowledge, the first time estimates of depression can be generated and compared across many neurological conditions and in a community-based cohort, using a validated depression questionnaire, the Patient Health Questionnaire, Brief [Patient Health Questionnaire, 9-item (PHQ-9)] [12].

The PHQ-9 is a commonly used instrument for assessing depressive symptoms and can be scored both categorically and dimensionally. This instrument maps directly onto the depressive symptoms of the *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition* (*DSM-IV*) that has been validated in a number of settings including the general population [13,14], in patients with epilepsy [15] and in patients with MS [16]. Due to overlap of symptoms between depression and neurological disorders, concerns have been expressed about possible contamination of responses to the PHQ-9 when used in neurological conditions. For example, for patients with Parkinson's disorder, the Geriatric Depression Scale-15 showed a higher sensitivity than the PHQ-9 in assessing depressive symptoms due to its reduced focus on somatic symptoms [17]. In contrast, a study of patients with MS found that exclusion of the fatigue and concentration items on the PHQ-9 did not impact prevalence estimates [18]. Taken together, these studies suggest that overlap of symptoms may impact depression estimates in some, but not all, neurological conditions.

The importance of understanding the prevalence of depression in neurological disorders has several aspects. For example, depression can exacerbate neurological symptoms [19,20], reduce treatment adherence [21,22], erode quality of life [23–26] and interfere with self-management, leading to accelerated disease progression [20]. Of great concern is that depression contributes significantly to elevated suicide rates in neurological patients [27–30].

The objective of the current study was to establish the prevalence of depression across a range of neurological conditions in the general population, using the same sampling and assessment methods and using data drawn from the SLNCC.

2. Methods

2.1. Surveys

The SLNCC is a cross-sectional study that adopted a sampling strategy linked to a large general health survey called the Canadian Community Health Survey (CCHS) [31]. The CCHS selected a probability sample of approximately 286,000 residents from 130,000 households in 2010–2011 and used a complex multistage sampling procedure to obtain a representative sample of the Canadian population. First, geographical clusters are selected, then households are selected within the clusters and finally one respondent per household is selected. The CCHS includes questions about professionally diagnosed long-term (at least 6 months) medical conditions, as well as a measure of major depression (see below). In order to support the SLNCC, the CCHS interview included questions about 18 neurological conditions and participants with affirmative responses were invited to participate in the SLNCC. Survey respondents were also asked whether there were household members with one or more of the same list of conditions, and those identified were also asked to participate. In order to produce the most reliable estimates possible, every household that contained at least one person with a neurological condition, except for the two most prevalent conditions (stroke and migraine), was selected. Then a sample of households containing only persons reported to have either the effects of stroke or migraine headaches was also selected. It was possible that more than one person in a household reported being diagnosed with a neurological condition, and it was also possible that some respondents had more than one condition. However, only one person per household was selected, giving a higher chance of being selected (i.e., oversampling) to those with a more rare condition than to those with stroke or migraine headaches. Oversampling was required to yield sufficiently large samples of those with rare conditions so that reasonably precise estimates could be made. Individuals who reported having multiple neurological conditions were also given a higher chance of being selected. Exclusions included living in the three territories (Nunavut, Northwest Territories and the Yukon), living on an aboriginal reserve or settlement, being a full-time member of the Canadian Armed Forces, living in certain remote regions (Région du Nunavik and Région des Terres-Cries-de-la-Baie-James) and residing in an institution. In total, these exclusion apply to approximately 3% of the Canadian population 15 years of age and older in the 10 provinces. Data collection interviews for the SLNCC were conducted between September to October 2011 and February to March 2012 and included a total of 8200 (raw sample size) people 15 years of age and older living with neurological conditions. The estimated response rate for the 2011 SLNCC was 81.6% [31]. Subjects found to be dead, to have moved to an institution, to have moved outside Canada or to not actually have the condition reported were classified as "out of scope" and were not included in the calculation of this response rate.

2.1.1. Selected neurological conditions

Eighteen neurological conditions were included in the SLNCC, but some of these could not be included in the analysis reported here due to limited sample size. The excluded conditions were cerebral palsy, hydrocephalus (both of which mainly affect young children), muscular dystrophy, Tourette's syndrome, amyotrophic lateral sclerosis and Huntington's disease. We excluded spinal cord injury whose prevalence (0.4%) is likely overestimated perhaps due to inclusion of other spinal conditions such as lower back pain, e.g., see estimate of 0.2% [32]. We also excluded brain injury, which is an imprecise term that respondents would likely include both traumatic brain injury and stroke. The 10 conditions that were included were migraine, MS, epilepsy, dystonia, Parkinson's disease, spina bifida, Alzheimer's disease and related dementia, stroke, brain/spinal cord tumor and traumatic brain injury (Table 1).

The SLNCC included the PHQ-9, a widely scale use to assess depressive symptoms [12–14]. This scale asks questions about depressive symptoms in the preceding 2 weeks (i.e., point prevalence) and functions as a symptom severity measure; however, it is closely aligned to the *DSM-IV* definition of major depression. For purposes of prevalence estimation, a cut point of 10 on the PHQ-9 is usually interpreted as indicating the presence of depression, scores of 8–11 all showing similar sensitivity and specificity [13]. A metaanalysis showed that, at a cut point of 10, the pooled sensitivity and specificity of the PHQ-9 for detecting depression is 85% and 89%, respectively [13]. It is important to note that we cannot conclude that patients have major depression per se without a diagnostic interview; rather, we use the term "depression" to indicate the presence of significant depressive symptoms. The depression data and other data collection elements were collected by computer-assisted telephone interviewing after extensive qualitative testing by Statistics Canada's Questionnaire Design Resource Centre.

Other data collected in the SLNCC included age, sex, province, provincial health care number, preferred language, age at first diagnosis, reasons the neurological disorder is better, years lived with the disorder, education, formal assistance received, general health, income, health utility index, informal assistance received, medication use for neurological conditions (not depression), out-of pocket expenses, restriction of activities, stigma, social support and work activities.

2.1.2. Statistical analysis

The analysis reported here consisted of estimating the overall prevalence of depression with 95% confidence intervals (95% CI) in those with the 10 neurological conditions noted above. In order to account for design effects (including undersampling of stroke and migraine), initial sampling weights from the CCHS were refined for the SLNCC by Statistics Canada and provided to researchers as a set of bootstrap weights. Employment of a bootstrapping procedure results in estimates weighted to the general household population and that provide an accurate estimate of variance.