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# Association between mental health and fall injury in Canadian immigrants and non-immigrants

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ABSTRACT

The study was to determine the association between mental health and the incidence of injury among Canadian immigrants and non-immigrants. We used data from 15,405 individuals aged 12 years or more, who were living in British Columbia, Canada, and participated in the 2007–2008 Canadian Community Health Survey (CCHS). We calculated a 12-month cumulative incidence of fall injury based on self-reporting. Logistic regression model was used to examine the association of the 12-month cumulative incidence of fall injury with immigration status and mental health before and after adjustment for covariates. The results show that self-reported mood and anxiety disorders were significantly associated with an increased incidence of fall injury. The adjusted odds ratios were 1.81 (95% CI: 1.37, 2.38) for mood disorder and 1.55 (95% CI: 1.12, 2.13) for anxiety disorder. Immigrant status was a significant effect modifier for the association between mental health and fall injury, with stronger associations in immigrants than in non-immigrants especially in elderly people. People with poor self perceived health were more likely to have a fall injury. Both mental health and general health were related to fall injury. There was a stronger association between mental health and fall injury in immigrants compared with non-immigrants in the elderly. More attention should be paid to mental health in immigrants associated with fall injury.



## 1. Introduction

Fall injury is an important public health concern especially for elderly people. It is estimated that one in three people 65 years of age or more fall at least once every year, a rate that increases to one in two people over the age of 80 years (Tinetti et al., 1988; O'Loughlin et al., 1993). The impact of a fall can be devastating to an elderly person. Approximately half of those who fall experience a minor injury, but between 5% and 25% sustain a serious injury, such as a fracture or a sprain (Alexander et al., 1992; Nevitt et al., 1991). Even without an injury, a fall can cause a loss in confidence, increased fear and curtailment of activities, which can lead to a decline in health and function, and may in turn lead to future falls with more serious outcomes. A serious fall injury can lead to long-term disability or even death.

Mental disorders may increase the risk of fall injury. Studies have revealed that mental illness is independently associated with the risks of unintentional injury (Wan et al., 2006) and fall injury (Finkelstein et al., 2007). Cognitive impairment predicts serious fall injuries (Tinetti et al., 1995) and fall induced fractures in elderly women (Bergland and Wyller, 2004). Immigrants experience various mental health problems related to migration, resettlement, language and culture (Kirmayer et al., 2011), and may have an impact on mental health related fall injury. In this analysis, we attempted to determine the association between mental disorders and fall injury in immigrants and non-immigrants in British Columbia, Canada.

## 2. Methods

### 2.1. Study design and population

In the present analysis, we used data from the Canadian Community Health Survey (CCHS) conducted by Statistics Canada between January and December 2007–2008 (Canadian Community Health Survey 4.1 public use microdata file. Statistics Canada, Health Statistics Division and Special Surveys Division). Since injury data were not collected in all provinces in this cycle, our analysis was only based on data from British Columbia.

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The CCHS targeted Canadian household residents aged 12 years or older. Using a multistage stratified sampling design, the survey collected information from a total of 15,903 respondents who were living in British Columbia with a response rate of 74.2%.

### 2.2. Study variables

Participants were informed that questions were asked about injuries which occurred in the past 12 months and were serious enough to limit normal activities. Participants were considered to be injured in the past 12 months if they answered "yes" to the questions: "In the past 12 months, were you injured?" If yes, a further question was asked about the most serious injury: "Was the injury the result of a fall?" Participants were also asked if they were immigrants. A total of 15,405 subjects who provided valid response to the questions were included in the analysis.

Subjects were grouped into low education (secondary school graduation or less), or high education (post-secondary school training) groups. Subjects were classified into low- (<$50,000), or high-income groups (≥$50,000). Current smokers were respondents who had smoked at least 100 cigarettes during their lifetime and reported smoking cigarettes every day or almost every day at the time of the survey. Former smokers were those who reported smoking cigarettes daily in the past but were not smoking at the time of the survey. Otherwise, subjects were classified as nonsmokers. Body mass index (BMI) was calculated: BMI = weight (kg)/height$^2$ (m$^2$). Subjects were grouped into four body mass index categories: underweight (<18.5 kg/m$^2$), normal weight (18.5–24.9 kg/m$^2$), overweight (25.0–29.9 kg/m$^2$), and obese (≥30.0 kg/m$^2$). Based on the total daily energy expenditure values (kcal/kg/day), the subjects were grouped into three categories: active (≥3), moderate active (1.5–2.9) and inactive (<1.5). Energy expenditure was calculated based on the frequency and duration of leisure time physical activity and its value of metabolic energy cost, expressed as a multiple of the resting metabolic rate.

Participants were also asked if suffering of "long-term conditions" which had lasted at lasted 6 months and had been diagnosed by a health professional, including mental disorders such as mood disorder ("Do you have a mood disorder such as depression, bipolar disorder, mania or dysthymia?") and anxiety disorder ("Do you have an anxiety disorder such as a phobia, obsessive compulsive disorder or a panic disorder?"). Self perceived general health status was asked, and categorized into three categories in the analysis: excellent/very good, good, or fair/poor.

### 2.3. Statistical analysis

The 12-month cumulative incidence of fall injury was calculated according to mental health status (mood disorder and anxiety disorder), self perceived health, and other factors for all and by immigration status (yes, no). Logistic regression model was used to examine the association of the 12-month cumulative incidence of fall injury with immigration status and mental health before and after adjustment for covariates. Effect modification of immigration status on the association between mental health and fall injury was first explored in stratified analysis, and further tested in logistic model after adjustment for covariates. The analysis was also stratified by age (<65 years and ≥65 years). Model parameters were estimated by using the method of maximum likelihood and were tested for significance by using the Wald statistic. All the analyses accounted for the multiple stage and stratified survey design. The effect of the complex survey design on variance estimates is summarized as a design effect and the design effect is the ratio of an estimated variance based on the survey to a comparable estimate of variance from a simple random sample of the population.

**Table 1**
Comparison of individual characteristics between immigrants and non-immigrants in British Columbia: Canadian Community Health Survey 2007–2008.

| | Immigrants | | Non-immigrants | | *P* value |
|---|---|---|---|---|---|
| | No. | %[a] | No. | %[a] | |
| Sex | | | | | |
| Male | 1697 | 47.2 | 5393 | 50.1 | 0.006 |
| Female | 2119 | 52.8 | 6196 | 49.9 | |
| Age (years) | | | | | |
| 12–24 | 305 | 12.1 | 1994 | 22.1 | <0.001 |
| 25–44 | 1042 | 31.9 | 3290 | 33.2 | |
| 45–64 | 1285 | 35.0 | 3851 | 31.4 | |
| ≥65 | 1184 | 21.0 | 2454 | 13.3 | |
| Education | | | | | |
| Low | 1005 | 21.2 | 3336 | 23.7 | <0.001 |
| High | 2614 | 72.6 | 7418 | 67.1 | |
| Unknown | 197 | 6.2 | 835 | 9.2 | |
| Income | | | | | |
| Low | 1877 | 43.0 | 4939 | 33.7 | <0.001 |
| High | 1149 | 35.0 | 4800 | 49.6 | |
| Unknown | 790 | 22.0 | 1850 | 16.8 | |
| Smoking status | | | | | |
| Current smoker | 433 | 12.0 | 2455 | 20.7 | <0.001 |
| Former smoker | 1434 | 31.6 | 4972 | 40.8 | |
| Non-smoker | 1938 | 56.1 | 4127 | 38.1 | |
| Unknown | 11 | 0.3 | 35 | 0.4 | |
| Body mass index (kg/m$^2$) | | | | | |
| <18.5 | 464 | 13.5 | 1228 | 11.2 | <0.001 |
| 18.5–24.9 | 1939 | 53.0 | 5251 | 47.9 | |
| 25.0–29.9 | 1070 | 26.1 | 3418 | 28.2 | |
| ≥30.0 | 343 | 7.4 | 1692 | 12.8 | |
| Alcohol drinking | | | | | |
| Yes | 2548 | 66.4 | 9004 | 79.3 | <0.001 |
| No | 1251 | 33.1 | 2541 | 20.3 | |
| Unknown | 17 | 0.5 | 44 | 0.4 | |
| Physical activity | | | | | |
| Active | 943 | 24.5 | 3551 | 32.2 | <0.001 |
| Moderate | 941 | 24.4 | 3008 | 26.1 | |
| Inactive | 1742 | 44.6 | 4652 | 38.0 | |
| Unknown | 190 | 6.5 | 378 | 3.8 | |
| Self-perceived health | | | | | |
| Excellent/very good | 1895 | 53.0 | 6563 | 60.1 | <0.001 |
| Good | 1321 | 33.7 | 3447 | 28.5 | |
| Fair/Poor | 589 | 13.3 | 1560 | 11.3 | |
| Unknown | 11 | 0.2 | 19 | 0.2 | |
| Mood disorder | | | | | |
| Yes | 232 | 5.1 | 1093 | 8.9 | <0.001 |
| No | 3566 | 94.5 | 10478 | 91.0 | |
| Unknown | 18 | 0.4 | 18 | 0.1 | |
| Anxiety disorder | | | | | |
| Yes | 134 | 3.3 | 743 | 6.5 | <0.001 |
| No | 3665 | 96.3 | 10829 | 93.4 | |
| Unknown | 17 | 0.4 | 17 | 0.2 | |

[a] Weighted to the general British Columbia population.

Standard errors were inflated by this average design effect (Chen et al., 1999). First, population weights were divided by the average weight for all subjects included in the analysis. The sum of these relative weights is the effective sample size. Next, we divided the relative weights by the square root of the average design effect to find analytical weights for subjects living in British Columbia. All the statistical analyses were conducted by using SAS 9.1, software (SAS Institute, Inc., Cary, North Carolina, USA).

### 2.4. Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the ethics committee of Health Canada, and there is no conflict of the ethics in this study. All informed consent had been obtained from the participants and preserved in Statistics Canada.