

# Insomnia and Health Problems in Canadians

Deborah A. Sutton MSc MEd,<sup>1</sup> Harvey Moldofsky MD,<sup>2,3</sup> and Elizabeth M. Badley PhD<sup>1,3,4</sup>

<sup>1</sup>*Arthritis Community Research and Evaluation Unit (ACREU), the Arthritis and Immune Disorder Research Centre (AIDRC), The University Health Network, Toronto, Canada;* <sup>2</sup>*University of Toronto Centre for Sleep and Chronobiology, The University Health Network;* <sup>3</sup>*Faculty of Medicine, University of Toronto, Toronto, Canada;* <sup>4</sup>*Department of Public Health Sciences, University of Toronto, Toronto, Canada.*

**Study Objectives:** The objective of this study was to determine the prevalence of, and to identify the relative contribution of selected factors associated with insomnia in the Canadian population age 15 and older.

**Design:** Weighted analysis of cross-sectional data from the Canadian General Social Survey, Cycle 6, 1991. Prevalence estimates were calculated for the total and age-specific Canadian population age 15 and older. Multiple logistic regression techniques were employed to study the contribution of an array of sociodemographic, lifestyle, stress, and physical health factors to the experience of insomnia.

**Setting:** N/A

**Participants:** A representative sample of the Canadian household population age 15+ (n=11,924).

**Interventions:** N/A

**Measurements and Results:** Twenty-four percent of the Canadian population age 15+ report insomnia. The following factors were associated with insomnia in multivariate logistic regression: female gender, being widowed or single, low education, low income, not being in the labor force, ever having smoked, life stress, specific chronic physical health problems (circulatory, digestive and respiratory disease, migraine, allergy and rheumatic disorders), pain, activity limitation and health dissatisfaction. Age was not significantly associated with insomnia.

**Conclusions:** Insomnia was highly prevalent among the non-institutionalized Canadian population age 15 and older. A very stressful life, severe pain and dissatisfaction with one's health demonstrated the highest odds ratios associated with insomnia. Increasing age per se and lifestyle factors were not significantly associated with insomnia.

**Key words:** Insomnia; chronic health conditions; pain; age

## INTRODUCTION

SLEEP SERVES AN IMPORTANT ROLE IN THE MAINTENANCE OF MENTAL AND PHYSICAL HEALTH WITH APPROXIMATELY ONE THIRD OF AN INDIVIDUAL'S LIFE SPENT SLEEPING. Insomnia, a general impression of inadequate sleep, occurs when an individual reports one or more deficits in initiating or maintaining sleep.<sup>1,2</sup> Insomnia is the most common sleep disorder reported in the general population with an estimated 10%—35% reported being affected.<sup>3,4</sup>

Insomnia has a pervasive influence upon daily life function compromising social and occupational performance. The consequent performance impairment imparts costs on both the personal and organizational levels.<sup>5-8</sup> It is therefore of public health importance to understand which factors are associated with an individual experiencing insomnia.

Insomnia has been associated with a number of sociodemographic, lifestyle, somatic, and mental health factors in the literature. Sociodemographic factors include increasing age,<sup>9,10</sup> female gender,<sup>9,10</sup> lower education,<sup>11</sup> lower income,<sup>11,12</sup> and shift work.<sup>13</sup> Lifestyle behaviors associated with insomnia include being sedentary,<sup>12,13</sup> smoking,<sup>13</sup> alcohol and caffeine consumption,<sup>13-15</sup> and being overweight.<sup>9,16</sup> Pain,<sup>17,18</sup> long-term disability,<sup>3</sup> in addition to specific health conditions such as allergies,<sup>19</sup> circulatory disease,<sup>16,20,21</sup> diabetes,<sup>16</sup> digestive disease,<sup>22</sup> migraine,<sup>23</sup> respiratory disease,<sup>9,16</sup> and rheumatic disorders,<sup>16,21,24</sup> have been associated with insomnia, as have mental health fac-

tors including anxiety, depression and stress.<sup>7,8,25</sup> Clinical studies afford much of our current knowledge with few studies having examined potential correlates of insomnia in the general population. Notably, only a few studies have examined several potential associated factors together in multivariate analyses and none of these have included a comprehensive array of reported factors associated with insomnia.<sup>1,3,9,11,16,17,26-28</sup>

This paper reports on 1) the prevalence of insomnia in the Canadian population age 15 and older, and 2) identifies the relative contribution of selected factors associated with insomnia in this population. This study goes beyond that of previous research to examine in one study the multivariate association of sociodemographic, lifestyle, somatic health, and stress factors with insomnia in the general population.

## Methods

Data for the current study were obtained from the Canadian General Social Survey, Cycle 6, (GSS6), conducted by Statistics Canada in 1991.<sup>29</sup> The General Social Survey is an ongoing national survey program with a single cycle each year. Each cycle covers a single core content area. The GSS6 addressed the core content of health, which was designed to give a comprehensive overview of the health of Canadians, as well as including factors that serve to enhance or to act as barriers to improving health status. The sample for the GSS6 was designed to be representative of the total Canadian adult population. The target population of the GSS6 included all individuals age 15 years and older from each of the 10 Canadian provinces, excluding full time residents of institutions, and residents of the Yukon and Northwest Territories.<sup>29,30</sup> The GSS6 employed a multi-stage, stratified random sampling design.<sup>29,30</sup> The primary sampling units were the 10 provinces, which were each divided into strata

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Address correspondence to: Dr. Elizabeth M. Badley, Arthritis Community Research and Evaluation Unit (ACREU), The University Health Network, 610 University Avenue, 16th Floor, Suite 704, Toronto, CANADA, M5G 2M9; Tel: (416) 946-2227; Fax: (416) 946-2291; E-mail: badley@uhnres.utoronto.ca

to ensure adequate representation of all provinces and regions of Canada.

The GSS6 employed the elimination of Non-Working Banks (ENWB) random digit dialing sampling technique. Data were collected evenly over the twelve months of 1991 to counterbalance seasonal variation in health and lifestyle information. A supplementary random sample of individuals sixty-five years of age and older was selected from the Labour Force Survey.<sup>30</sup> One individual from each household was randomly selected to complete the full survey.<sup>29,30</sup>

Data were collected by self-report telephone interview. Households without telephones were excluded from the sample and account for less than 2% of the target population. Proxy responses for reasons of illness, or inability to speak either English or French accounted for 4% (n=378) of the total person response. Eighty percent (n=11,924) of eligible individuals participated in the study. Respondents whose chronic physical health and pain status were known were included in the analyses yielding a sample size of 11,489.

### Dependent Variable

Survey respondents were asked "Do you regularly have trouble going to sleep or staying asleep?"<sup>30</sup> A dichotomous response (yes/no) was recorded. For the purpose of this study, a response of "yes" represented the presence of insomnia.

### Independent Variables

Factors hypothesized to be associated with insomnia were identified from the literature. Factors included in the survey and for which data were available were:

**A. Sociodemographic factors:** 1) age was coded in decades: 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75+; 2) gender; 3) marital status was coded as married, widowed, separated/divorced or single; 4) formal educational experience was categorized as some secondary or less, secondary graduation, some post-secondary or post-secondary degree or diploma; 5) income adequacy was coded in five discrete categories as lowest, next to lowest, middle, next to highest or highest;<sup>30</sup> 6) hours of work was designated as not in the labor force, usually work days or regular shift work.

**B. Lifestyle Behaviors:** 1) body mass index (BMI) was calculated from weight and height (kg/m<sup>2</sup>) and designated as underweight (<20), acceptable weight (20-24), possibly overweight (25-27) or overweight (28+); 2) a summary measure of leisure time physical energy expenditure was classified as sedentary, moderately active or active;<sup>29</sup> 3) alcohol consumption was dichotomized as consuming one or more drinks per month, or never having drunk or drinking less than once per month;<sup>13</sup> 4) smoking status was dichotomized as ever or never smoking cigarettes.

**C. Somatic Health:** 1) presence or absence (yes/no) of specific chronic physical health conditions was ascertained by asking respondents if they had each of the following health problems: allergies (hay fever, skin or other allergies); circulatory disease (history of high blood pressure, heart attack, angina, heart failure or rheumatic heart disease); diabetes; digestive disease (stomach ulcer or other digestive problem); migraine headaches; respiratory disease (asthma, emphysema, chronic bronchitis, per-

sistent cough or shortness of breath); or, rheumatic disorders (arthritis, rheumatism, or bursitis); 2) respondents who reported experiencing trouble with pain in general were asked to rate the usual intensity of pain they experienced as mild, moderate or severe; 3) activity limitation at home, work, or school due to a long-term physical condition or health problem signified the presence of a long-term disability; 4) health perception was assessed with respondents reporting they were either satisfied or dissatisfied with their health.

**D. Stress:** Respondents were asked to describe their life as: very, somewhat, not very, or not at all stressful.

### Statistical Analysis

Statistical analyses were conducted using SAS software (version 6.08). (SAS Institute Inc., 1990) Estimates of the prevalence of insomnia in the Canadian population (15+) were calculated. Bivariate and multivariate logistic regression analyses were employed to estimate the probability of an individual experiencing insomnia in the presence of the independent variables. We calculated bivariate odds ratios to estimate the risk of experiencing insomnia with each of the variables hypothesized to be associated with insomnia. All the independent variables were then entered into a multivariate direct logistic regression to obtain estimates of the risk of experiencing insomnia for each independent variable adjusted for the presence of all other independent variables in the model. As potential independent factors were selected on the basis of previous literature reports, an a priori decision was made to include all independent factors in the multivariate analyses. Interaction terms were not included as previous research did not support their inclusion.<sup>31</sup>

Data for the survey interviews were used to generate estimates representative of the household population of Canada (15+) by the application of a weighting factor. The weighting additionally adjusted for the number of telephones in the household, the number of individuals in the household age 15+, and non-response. This inflated the effective sample size from 11,489 to the household population of Canada (20,322,000). For statistical testing weights were rescaled so that the average weight equaled one. This did not affect parameter estimates such as odds ratios but allowed for confidence intervals to reflect the true sample size while accounting for the unequal probability of case selection.<sup>30</sup> Ninety-nine percent confidence intervals were used to adjust for the design effect and clustering in the sample.

## RESULTS

### Prevalence of Insomnia

Respondents with missing data for any of the independent or dependent variables were excluded yielding a sample size of 10,702 respondents for bivariate and multivariate analyses. Table 1 presents the estimated total and age-specific prevalence of insomnia for the Canadian population (age 15+). Twenty four percent of the total Canadian population age 15 and older reported experiencing insomnia. As expected the prevalence of insomnia increased with age, from one fifth of those age 15 to 24 years to slightly more than one third among those 75 years and older.

**Table 1**—Age-specific prevalence\* of insomnia in the Canadian adult population, General Social Survey, 1991

Age	Insomnia n (%) (No. in thousands)	Total n(%) (No. in thousands)
15-24	728 (20)	3726 (100)
25-34	974 (21)	4628 (100)
35-44	880 (21)	4167 (100)
45-54	654 (23)	2834 (100)
55-64	659 (29)	2245 (100)
65-74	533 (31)	1719 (100)
75-99	363 (36)	1003 (100)
Total Population 15+	4790 (24)	20322 (100)

\*Number and percent based on Statistics Canada weighted values and rounded to the nearest thousand; %=percent of total row.

## Factors Associated with Insomnia

The bivariate unadjusted odds ratios for each independent variable and insomnia are presented in Table 2 (Column A). All of the independent variables were significantly associated with insomnia, with the exception of alcohol consumption. Alcohol consumption was retained in the subsequent multivariate analysis as alcohol dependency is classified as a disorder with a primary complaint of insomnia.

Adjusted odds ratios from the multivariate logistic regression analysis are shown in Table 2 (Column B). The odds ratios for many of the independent variables are generally lower than those obtained in the bivariate analysis indicating the collinearity of the variables in the model. For example, the odds ratios for activity limitation and health perception decrease from 3.46 and 3.90 to 1.42 and 1.88, respectively, when other variables are controlled for in the model. There was a significant association between sociodemographic variables and insomnia in the multivariate analysis with the exception of age. Female gender, and being widowed or single were associated with an increased risk of insomnia. Low socioeconomic status, reflected by having some secondary education or less, lowest income adequacy, and not being in the labor force, were also associated with the presence of insomnia.

None of the lifestyle behaviors were significantly associated with insomnia with the exception of current or past smoking status.

Life stress and specific chronic physical health problems and other health variables were all associated with insomnia in the multivariate analysis with the exception of diabetes. The three highest odds ratios were reporting a very stressful life, severe pain, and dissatisfaction with one's health, respectively.

## DISCUSSION

This paper reports on the prevalence of insomnia and represents the first simultaneous examination of sociodemographic, lifestyle, somatic health, and stress factors with reported insomnia in a national sample of the Canadian population age 15 and

older. This study reaffirms the high prevalence of reported insomnia in the non-institutionalized population (15+). Prevalence estimates reported in the literature have varied as a result of lack of standardization of sleep questions, response categories and differing time intervals. Despite these methodological differences the 24% percent prevalence rate of insomnia in the Canadian population age 15 years and older identified in our study falls within the mid range of prevalence rates reported in population based studies published between 1979—1999.<sup>8,32</sup>

To our knowledge this is the first study to examine the association of insomnia with a comprehensive array of potential explanatory factors. Our findings afford a new perspective on the relationship of potential explanatory factors for insomnia. Lifestyle and age were anticipated to be associated with insomnia but were not. The association of insomnia with increasing age as a natural consequence of the normal neurobiological ageing process is supported by bivariate studies to date.<sup>10,11,16</sup> Multivariate analyses undertaken in previous studies have predominantly identified a positive association between increasing age and insomnia,<sup>9,11,27</sup> but our study concurs with the findings of Roberts and associates (1999)<sup>1</sup> who identified no association between age and insomnia in a multivariate analysis of Alameda County California adults 50 years and older. The results of the present study demonstrate that age is not associated with insomnia after adjusting for a range of sociodemographic, lifestyle, stress, and physical health risk factors. Moreover, in this study an independent association between six of seven chronic physical health conditions and insomnia was identified which adds to the findings of Roberts et al. (1999)<sup>1</sup> who found an association between one or more chronic conditions and insomnia. Given the knowledge that the prevalence of chronic physical health conditions increases with age, we suggest that the relationship between chronic physical health problems and age may account for the apparent association of age and insomnia at the bivariate level.<sup>16,17,33,34</sup>

Studies of sleep difficulty agree that pain imparts a negative effect upon the sleep experience. In our study increasing levels of pain severity were associated with higher risks for insomnia. Earlier population studies have examined the association between insomnia and chronic physical health problems, but in a less comprehensive fashion. In this national population sample of non-institutionalized Canadians (age 15+), an independent association was identified for six chronic physical health problems and insomnia. Studies have stated that the pain associated with specific chronic conditions is responsible for the association of these conditions with insomnia. However, the results of our study delineate an independent contribution for each of the six specific chronic physical health problems in addition to pain.

The increased risk of experiencing insomnia for individuals who were not in the labor force identified by Ford and Kamerow (1989)<sup>15</sup> (OR 1.76, 95% CI 1.4-2.2) was also confirmed in this study. Unexpectedly, an association between insomnia and shift work was not identified in the current study even though shift work is classified as a disorder of the sleep-wake schedule. One possible explanation for this finding is the healthy worker effect, whereby shift workers with insomnia have voluntarily exited from this work schedule. Alternatively, shift workers may accept insomnia as an invariable consequence of their work schedule resulting in an under-reporting of insomnia and a lack of association in the present data.

**Table 2**—Insomnia in the Canadian population age 15+; logistic regression analysis, bivariate and multivariate odds ratio\*, 99% confidence interval, Canadian General Social Survey, 1991

			<b>Insomnia</b>	
<b>Factor</b>	<b>(Reference Category)</b>		<b>A</b> <b>Bivariate Unadjusted</b> <b>Odds Ratio* (99% CI)</b>	<b>B</b> <b>Multivariate Adjusted</b> <b>Odds Ratio* (99% CI)</b>
<b>SOCIODEMOGRAPHIC</b>				
Age	(15-24 years)	Age group (in decades)	1.14 (1.10, 1.18)	1.01 (0.96, 1.07)
Gender	(Male)	Female	1.59 (1.41, 1.79)	1.28 (1.11, 1.48)
Marital Status	(Married)	Widowed	2.61 (2.08, 3.27)	1.63 (1.24, 2.15)
		Not currently married	1.54 (1.22, 1.95)	1.08 (0.83, 1.41)
		Single	1.02 (0.88, 1.17)	1.21 (1.01, 1.45)
Education	(Post secondary degree or diploma)	Some secondary or less	1.61 (1.40, 1.86)	1.31 (1.10, 1.55)
		Secondary	1.03 (0.85, 1.24)	1.12 (0.92, 1.37)
		Some post secondary	1.06 (0.88, 1.28)	0.98 (0.80, 1.19)
Income Adequacy	(Highest income)	Lowest income	4.09 (2.96, 5.65)	1.79 (1.23, 2.60)
		Next to lowest income	2.27 (1.74, 2.98)	1.24 (0.91, 1.70)
		Middle income	1.42 (1.15, 1.76)	1.04 (0.82, 1.31)
		Next to highest income	1.19 (0.95, 1.50)	1.04 (0.82, 1.32)
Work Status	(Working days)	Shift work	1.14 (0.97, 1.35)	1.13 (0.95, 1.35)
		Not in labor force	2.01 (1.76, 2.29)	1.28 (1.07, 1.52)
<b>LIFESTYLE</b>				
Alcohol Consumption	(Occasional/never)	Current drinker	0.77 (0.68, 0.87)	1.10 (0.95, 1.26)
Body Mass Index	(20-24)	<20	1.22 (1.03, 1.45)	1.11 (0.92, 1.34)
		25-27	0.88 (0.73, 1.05)	0.83 (0.69, 1.01)
		28+	1.05 (0.91, 1.22)	0.90 (0.77, 1.06)
Physical Activity	(Active)	Sedentary	1.85 (1.59, 2.17)	1.13 (0.94, 1.35)
		Moderately active	1.16 (1.08, 1.24)	1.02 (0.94, 1.10)
Smoking Status	(Ever smoked)	Never smoked	1.29 (1.15, 1.45)	1.20 (1.05, 1.37)
<b>STRESS</b>				
Life Stress	(Not at all stressful)	Very stressful	2.78 (2.19, 3.53)	2.40 (1.83, 3.16)
		Somewhat stressful	1.43 (1.19, 1.71)	1.58 (1.29, 1.93)
		Not very stressful	1.19 (0.99, 1.44)	1.28 (1.05, 1.57)
<b>HEALTH</b>				
Chronic Physical Health Problem	(No health problem)	Allergy	1.35 (1.19, 1.54)	1.11 (0.96, 1.28)
		Circulatory Disease	1.77 (1.54, 2.03)	1.21 (1.02, 1.43)
		Diabetes	1.61 (1.19, 2.17)	1.03 (0.73, 1.45)
		Digestive Disease	2.67 (2.26, 3.15)	1.61 (1.34, 1.94)
		Migraine	2.41 (2.01, 2.87)	1.65 (1.35, 2.02)
		Respiratory Disease	2.10 (1.78, 2.48)	1.22 (1.01, 1.48)
		Rheumatic Disorders	2.45 (2.15, 2.80)	1.30 (1.10, 1.55)
		Pain	(No pain)	Mild
		Moderate	2.99 (2.50, 3.59)	1.45 (1.17, 1.80)
		Severe	5.73 (4.41, 7.46)	1.99 (1.45, 2.73)
Activity Limitation	(No limitation)	Limitation	3.46 (2.93, 4.09)	1.42 (1.16, 1.75)
Health Perception	(Satisfied)	Dissatisfied	3.90 (3.33, 4.57)	1.88 (1.55, 2.28)

\*Estimated number in the population based on sample n=10702; Statistical parameters based on rescaled weights.

Lifestyle behaviors are purported to have a substantive effect upon insomnia. In our analysis, a modest (OR 1.20) association was identified for only one lifestyle behavior: smoking. This result supports the anticipated pharmacologic effects of smoking, and contrasts with the findings of Dodge and associates (1995),<sup>9</sup> who found no association between smoking and insomnia in the Tucson Epidemiologic Study of Obstructive Airways Disease.

In the current study an association between BMI and sleep difficulties was not detected although the literature had identified one.<sup>35</sup> The present study's lack of association with BMI may be attributable to the possibility that the process of weight gain or loss was associated with insomnia in earlier studies in contrast to static BMI as reported in the GSS6.

Our study confirms the findings of Henderson et al. (1995)<sup>3</sup> who reported no relationship between a sedentary lifestyle and

insomnia in their study of elderly community dwelling Australians. Although a physically active lifestyle which includes daily aerobic exercise is a necessary component of general well being a significant association between physical activity and insomnia was not observed.

The highest odds ratio associated with insomnia was for life stress. This concurs with the findings of Hall and associates (2000)<sup>25</sup> who report that stress is a significant correlate of sleep even in the absence of current psychiatric disorders. Stress may be related to fundamental psychological difficulties that interfere with sleep, and/or be a product of physical health concerns.

### Strengths and Limitations

Thanks to a high response rate (80%) and representative nature of the GSS6 sample our results can be generalized to the non-institutionalized Canadian population aged 15+. The design of this telephone survey also enhanced the collection of complete responses to all questions.

A major study limitation was that there was no information on mental health, including anxiety and depression, in the survey. Anxiety and depression have been associated with insomnia in the literature. However, it is unclear to what extent insomnia is a consequence or a cause of these mental health problems. Alternatively, insomnia may act as a mediator in the relationship between an as yet unspecified factor and mental health. Future studies should examine the relationship between insomnia and depression and anxiety in a prospective manner with clear diagnostic criteria. The lack of mental health information means that we may have overestimated the effect of stress and perhaps chronic physical health conditions. Nevertheless, this cannot explain the observed lack of association between age, lifestyle behaviors, and insomnia. The intent of this national survey was to examine a broad range of factors which affect the overall health of Canadians, and as such did not include clinical variables such as past history of insomnia and/or sleep disorders such as sleep apnea.

The study examines the current self-report of insomnia and did not address the chronicity of the insomnia experience, nor differentiate between acute, transient, and chronic states of insomnia. The latter may be particularly relevant for the association with chronic health conditions and pain where report of insomnia may be affected by current symptoms. Although insomnia was self-reported in this survey the prevalence found reflects values reported in the literature. Further, self-report may be valuable to capture the breadth of the experience of insomnia outside of the clinical purview. Finally, the cross-sectional design precludes causal conclusions; a longitudinal study will be necessary to establish the direction of a cause-effect relationship.

### Conclusion

This is the first study reporting on the association of insomnia with a comprehensive array of potential risk factors using a large nationally representative sample of households. The high prevalence of insomnia in the non-institutionalized Canadian population age 15 years or older agrees with values reported previously. Age per se was not significantly associated with insomnia. Insomnia should therefore not be considered a normal component of the ageing process. The presence of circulatory, digestive and

respiratory disease, allergy, migraine, and rheumatic disorders show the highest associations with insomnia together with pain, life stress, and health dissatisfaction. These findings emphasize the importance of recognizing and addressing chronic physical health conditions, pain, and life stress issues in the diagnosis and treatment of insomnia.

Further research is indicated to replicate these findings. Longitudinal data will facilitate examination of the chronicity and severity of insomnia and its relationship with each of the identified explanatory factors.

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