A decade's difference: 10-year change in insomnia symptom prevalence in Canada depends on sociodemographics and health status

Sheila N. Garland, PhD [a,b,*], Hillary Rowe, BSc [a], Lily M. Repa, BSc [a], Ken Fowler, PhD [a], Eric S. Zhou, PhD [c], Michael A. Grandner, PhD, MTR [d]

[a] Department of Psychology, Faculty of Science, Memorial University, St. John's, NL, Canada
[b] Division of Oncology, Faculty of Medicine, Memorial University, St. John's, NL, Canada
[c] Department of Pediatrics, Harvard Medical School, Boston, MA, USA
[d] Department of Psychiatry, University of Arizona, Tucson, AZ, USA

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ABSTRACT

Introduction: Insomnia is recognized as a public health issue. The objectives of this study were to characterize and compare the prevalence of insomnia symptoms in the Canadian population in 2002 and 2012, and to identify sociodemographic and psychosocial predictors of trouble sleeping.
Methods: Data from adult participants in the Canadian Community Health Survey–Mental Health cycles 2000-2002 (n = 34,118) and 2011-2012 (n = 23,089) were used. Participants responded to the question "How often do you have trouble going to sleep or staying asleep?", with those who indicated "most of the time" or "all of the time" classified as having insomnia symptoms. Logistic regressions, adjusted for covariates, were used to examine differences between cycles.
Results: The unadjusted prevalence of insomnia symptoms increased from 15.6% to 17.1% between 2002 and 2012, representing an absolute increase of 1.5%. The likelihood of insomnia symptoms was significantly influenced by age, sex, education, physical health, and mental health status. A 3-way year-age-sex interaction was statistically significant such that women aged 40-59 demonstrated approximately 29% increased likelihood of insomnia symptoms from 2002 to 2012. This was reduced to 24% when adjusted for physical and mental health. There were no significant differences for men across age groups.
Conclusion: Over a 10-year period, the prevalence of insomnia symptoms increased in Canada. This trend appears to be driven in part by greater levels of insomnia symptoms among middle-aged women.

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Introduction

Sleep of insufficient quality and/or duration is a prevalent and concerning health issue in North America.[1,2] Individuals who report poor sleep or "trouble sleeping" most often experience symptoms of insomnia characterized by difficulty initiating and/or maintaining sleep, despite having adequate opportunity for sleep, and feel that this causes significant daytime impairment. When these sleep disturbances happen more than 3 times per week for at least 3 months, individuals may meet the diagnostic criteria for insomnia disorder.[3] Individuals with insomnia symptoms are at higher risk for many physical health problems, including diabetes,[4] obesity,[5] and cardiovascular diseases (e.g., stroke, hypertension, and heart attack).[6] In addition to the impact on physical health, poor sleep adversely impacts mental health. Sleep of insufficient quality and/or duration has been linked to mood and anxiety disorders,[7,8] higher levels of perceived stress,[9] and impaired cognitive functioning.[7]

Sleep problems have severe economic consequences for the individual and society at large.[10] Insomnia symptoms have been linked to impaired work performance, increased disability and absenteeism, and increased use of health care services.[7] It is estimated that the annual cost of insomnia is $6.6 billion (CAN), which includes the direct costs of insomnia-motivated health care use, prescription medications, and over-the-counter medications. The estimated annual per-person costs (both direct and indirect) of individuals with insomnia ($5010) and individuals with some insomnia symptoms ($1431) are far greater than those who obtain good quality sleep ($421).[7]

* Corresponding author at: Department of Psychology, Memorial University of Newfoundland, 232 Elizabeth Ave, St. John's, Newfoundland, A1B 3X9. Tel.: +1 709 864 4897; fax: +1 709 864 2430.
E-mail address: sheila.garland@mun.ca (S.N. Garland).

The majority of the annual financial loss, though, is attributable to the indirect expenses of work absenteeism and loss of productivity associated with insomnia.[7]

Common risk factors for insomnia include older age, female sex, low socioeconomic status, depression, anxiety, chronic health conditions, smoking, and substance use.[11,12] Previous studies have postulated that the increasing prevalence of insomnia symptoms may be due in part to the many societal changes that have occurred in recent years, particularly the development of a 24-hour society, growing frequency of technology use, higher rates of obesity and diabetes, increases in irregular work hours, and work stress.[1,13,14] It is likely that there have been changes at the population level in behavioral, psychosocial, and health-related risk factors for insomnia in the aforementioned areas, but further research is required to understand the causal pathways of these relationships.

Although the increasing prevalence of insomnia has been documented in several other industrialized countries,[1,13–15] this phenomenon has not yet been examined in the Canadian population. The objectives of this study were to:

1. Characterize and compare the prevalence of insomnia symptoms in the Canadian population between 2002 and 2012;
2. Identify sociodemographic and psychosocial predictors of trouble sleeping.

A better understanding of the factors related to trouble sleeping is necessary to effectively identify groups at risk for insomnia disorder and to inform the development of future prevention and intervention initiatives.

Methods

Participants

This study used data from the Canadian Community Health Survey–Mental Health (CCHS-MH) 2002 and 2012 cycles. The CCHS-MH is a national, cross-sectional survey that evaluated the mental health status of Canadians, with emphasis on mental health disorders, access to care and service use, level of functioning, potential relationships between sociodemographic variables and mental health, and assessment of changes over time.

Participants were chosen for the CCHS-MH in 3 stages. First, geographical regions known as clusters were selected. Households were then selected within each cluster, and 1 member of each household was selected at random. The number of households selected in each province was proportionate to the population of that province. Individuals from the 10 Canadian provinces over the age of 15 were eligible for participation. The following groups were excluded from the survey: inhabitants of the 3 territories, those living on reserves and other Aboriginal settlements, full-time members of the Canadian Forces, and individuals who were institutionalized. These excluded individuals represented approximately 3% of the target population in the 2012 cycle.

Data collection

The CCHS-MH was administered using computer-assisted personal interviewing. This method was chosen to allow for the customization of interviews based on each participant's characteristics and survey responses, as well as automatic correction for inconsistent or out-of-range responses. Interviews were conducted in person or by telephone, with the majority occurring in person. Proxy interviews were not used for this survey.

Data were collected from May to December 2002 for the 2002 cycle of the CCHS-MH. The total sample size was 36,984 with a response rate of 77%. For the 2012 cycle, data collection occurred between January and December 2012. The overall response rate for the survey was 68.9%, providing a total sample of 25,113 individuals. The present study examined adults aged 20 years or older, resulting in the exclusion of younger respondents.

Minimizing nonresponse

Before the interviewer made any contact with participants, each selected respondent was sent a letter and brochure that explained the survey's importance and the potential uses for the data. Additionally, when necessary, interviewers called and visited selected households on multiple occasions to encourage participation and maximize the response rate.

Weighting

In probability sampling, each participant in the sample represents multiple members of the population as well as himself or herself. A sampling weight was calculated for each respondent based on the number of individuals in the total population that were represented by that respondent. The inclusion of sampling weights in analyses is necessary for estimates to be representative of the entire population rather than the sample.

Study variables

This study examined insomnia symptoms in Canadian adults. Insomnia symptomatology was assessed using the question "How often do you have trouble going to sleep or staying asleep?" Responses were rated on a 5-point scale from 1 (none of the time) to 5 (all of the time). Participants who reported having trouble sleeping "most of the time" or "all of the time" were considered to have poor sleep. Age was divided into three groups: 20 to 39 years, 40 to 59 years, and 60 to 80 years and older. Sex was a binary variable with male and female as the 2 options. Demographic information, including marital status, education level, and province of residence, was also reported to characterize the sample.

Analyses

Frequencies were tabulated to characterize the sample based on demographic information, and χ^2 analyses were used to assess differences in demographic variables between 2002 and 2012. Logistic regression analyses examined whether the 10-year difference in year of analysis (i.e., 2002 vs 2012) was associated with a change in the likelihood of insomnia. Thus, an odds ratio (OR) >1 represents increased likelihood of insomnia in 2012 vs 2002, and an OR <1 indicates a decreased likelihood of insomnia in 2012 vs 2002. Analyses included insomnia as the outcome and year as the predictor variable. To examine the context of covariates, a model adjusted for age, sex, and education was evaluated, as was a model adjusted for age, sex, education, mental health, and physical health. This final model may represent an overadjusted model because insomnia may be both cause and consequence of mental and physical health. Results are expressed as unadjusted and adjusted ORs and 95% confidence intervals (CIs).

To evaluate whether the change in odds of insomnia by year of analysis was differentially predicted by age, sex, and health groups, interaction terms were computed for year-by-age, year-by-sex, year-by-education, year-by-mental health, and year-by-physical health. All significant interactions were followed up by post hoc stratified analyses adjusted for all other covariates. In addition, a 3-way interaction was computed for year-by-age-by-sex, with post hoc stratified analyses.

Results

Demographic information

Characteristics of the sample are reported in Table 1, stratified by year of analysis. After excluding respondents under the age of 20, the final sample sizes were n = 34,118 in 2002 and n = 23,089 in 2012. χ^2 tests showed that there were differences between 2002 and 2012 in insomnia symptom prevalence, age, marital status, education, province of residence, physical health, and mental health. Overall, the rate of insomnia symptomotology was 15.6% in 2002 and 17.1% in 2012, representing a modest absolute increase of 1.5%. The sample was approximately 55% female, and approximately 42% of the sample was aged 40-59 in both population samples, although the proportion who were 60 or older increased, whereas the proportion under 40 decreased from 2002 to 2012. More than half of the sample was married in both samples, although the proportion that were single was higher in 2012 and the proportion divorced/widowed/separated was higher in 2002. Education level increased over time; postsecondary degrees were obtained by 49% in 2002 and 60% in 2012.

Prevalence of poor sleep

Table 2 presents the results of the unadjusted and adjusted logistic regression analyses examining the relationship of year (2002 vs 2012) to change in insomnia symptoms. In the unadjusted analysis, the likelihood of insomnia increased by approximately 12% between 2002 and 2012. After adjusting for age, sex, and education, the likelihood of insomnia symptoms increased to approximately 16%. After further adjustment for mental and physical health, the likelihood of insomnia symptoms was attenuated to approximately 9%. All of these were statistically significant (all $P < .001$). In the stratified analyses, adjusted for all covariates, all interaction terms were also significant ($P < .0005$). Of note, the likelihood of insomnia symptoms was

Table 1
χ^2 analyses examining differences between demographic variables by year

	2002 (n = 34,118) % (n)	2012 (n = 23,089) % (n)	P value
Insomnia			<.0001
Yes	15.6% (5319)	17.1% (3949)	
No	84.4% (28,791)	82.9% (23,068)	
Sex			.9279
Male	45.0% (15,341)	44.9% (10,373)	
Female	55.0% (18,777)	55.1% (12,716)	
Age			<.0001
20 to 39 y	35.5% (12,107)	31.2% (7204)	
40 to 59 y	41.8% (14,275)	42.3% (9768)	
60 or older	22.7% (7736)	26.5% (6117)	
Marital status			<.0001
Married/partnered	56.1% (19,117)	54.4% (12,532)	
Widowed/separated/divorced	23.2% (7959)	10.2% (2359)	
Single	20.6% (7010)	35.3% (8138)	
Education			<.0001
Less than grade 12	25.6% (8690)	17.9% (4113)	
Grade 12	17.7% (6002)	16.0% (3673)	
Some postsecondary	7.9% (2679)	5.7% (1314)	
Postsecondary graduate	48.8% (16,521)	60.4% (13,882)	
Physical health			<.0001
Excellent	15.9% (5413)	13.5% (3114)	
Very good	34.6% (11,805)	34.4% (7936)	
Good	32.8% (11,200)	34.5% (7959)	
Fair/poor	16.7% (4231)	17.7% (3081)	
Mental health			<.0001
Excellent	25.9% (8834)	22.5% (5200)	
Very good	38.8% (13,223)	39.6% (9122)	
Good	27.1% (9251)	28.5% (6578)	
Fair/poor	8.2% (2303)	9.4% (1815)	

Table 2
Logistic regression analyses examining the relationship of year (2002 vs 2012) to change in insomnia symptoms stratified by age, sex, education, and physical and mental health

	OR	95% CI	P value
Complete sample[a]			
Unadjusted	1.118	(1.069-1.17)	<.0005
Adjusted (age, sex, education)	1.159	(1.106-1.213)	<.0005
Adjusted (age, sex, education, physical and mental health)	1.087	(1.036-1.141)	.001
Stratified by age[b]			
20-39 y	0.976	(0.889-1.072)	.612
40-59 y	1.155	(1.075-1.242)	<.0005
60 y and older	1.079	(0.986-1.181)	.097
Stratified by sex[b]			
Male	0.999	(0.925-1.079)	.985
Female	1.144	(1.076-1.217)	<.0005
Stratified by education[b]			
Less than secondary school	1.024	(0.931-1.125)	.628
Secondary School	1.131	(1.008-1.27)	.037
Some postsecondary	1.215	(1.006-1.466)	.043
Postsecondary degree	1.082	(1.01-1.158)	.024
Stratified by physical health[b]			
Excellent	1.001	(0.841-1.19)	.994
Very good	1.168	(1.062-1.285)	.001
Good	1.041	(0.961-1.129)	.326
Fair/poor	1.083	(0.993-1.181)	.071
Stratified by mental health[b]			
Excellent	1.029	(0.912-1.161)	.645
Very good	1.036	(0.952-1.128)	.408
Good	1.094	(1.008-1.187)	.031
Fair/poor	1.230	(1.091-1.385)	.001

[a] These values represent the likelihood of insomnia symptoms, predicted by year of assessment; ORs >1 indicate increased likelihood in 2012, whereas ORs <1 indicate increased likelihood in 2002.
[b] These values indicate likelihood of insomnia symptoms, predicted by year of assessment, evaluated separately for each listed category.

significantly greater in 2012 vs 2002 only among those ages 40-59 (approximately 16% increased likelihood of insomnia symptoms), among women (approximately 14% increased likelihood of insomnia symptoms), among those with at least a secondary education (approximately 13%, 22%, and 8% increased likelihood among those with secondary, some postsecondary, and postsecondary degree, respectively), among those in "very good" physical health (approximately 17% increased likelihood), and among those with either "good" or "fair/poor" mental health (approximately 9% and 23% increased likelihood, respectively). Those in other categories did not see a significant difference in prevalence of insomnia symptoms between 2002 and 2012.

A year-by-age-by-sex 3-way interaction was statistically significant ($P < .0005$). Results of stratified analyses (both unadjusted and adjusted for mental and physical health) are presented in Table 3. When all age groups were further stratified by sex, increased likelihood of insomnia symptoms in 2012 vs 2002 was seen among women aged 40-59 in both unadjusted and adjusted analyses

Table 3
Logistic regression analyses examining the relationship of year (2002 vs 2012) to change in insomnia symptom prevalence, stratified by age and sex, and adjusted by health status

Age group	Sex	Unadjusted			Adjusted		
		OR	95% CI	P value	OR	95% CI	P value
20-39	Male	0.952	(0.827-1.096)	.491	0.948	(0.818-1.098)	.473
	Female	1.029	(0.918-1.154)	.625	0.995	(0.881-1.124)	.941
40-59	Male	1.087	(0.978-1.208)	.123	1.033	(0.922-1.157)	.573
	Female	1.286	(1.179-1.402)	<.0005	1.240	(1.128-1.362)	<.0005
60+	Male	0.940	(0.814-1.086)	.402	0.983	(0.845-1.143)	.821
	Female	1.088	(0.977-1.211)	.124	1.136	(1.015-1.271)	.026

(approximately 29% and 24% increased likelihood, respectively). Increased likelihood of insomnia symptoms in 2012 vs 2002 was also seen among women 60 or older, but only in the adjusted analysis (approximately 14% increased likelihood).

Discussion

This is the first study to investigate the prevalence of, and factors associated with, insomnia symptoms among Canadian adults between 2002 and 2012. The prevalence of insomnia symptoms experienced a modest increase of 1.5% across the 10-year span. The overall results of this study are consistent with population-based surveys that have been conducted elsewhere, including the United States,[1] Finland,[15] Norway,[13] and the United Kingdom,[14] which suggest that there has been a widespread increase in insomnia symptoms internationally.

Interestingly, this increase in insomnia symptoms seems to have been primarily driven by women in the 40- to 59-year age range. Women 60+ also experienced an increase in insomnia symptoms, but only after adjusting for health status. Findings from the United States are consistent with the present study in that both females and individuals between the ages of 55 and 64 had the highest prevalence of insomnia symptoms.[1] Similarly, research in other countries has shown that females have higher levels of insomnia symptoms, although the effect of age has been less consistent.[13–15] This finding may be due in part to a reduction in the use of hormone replacement therapy to treat menopause-related symptoms. Menopause, in the absence of hormonal therapy, is associated with insomnia symptoms including increased sleep latency, difficulty staying asleep, and early morning awakenings, as well as decreased levels of restorative slow-wave sleep.[16,17] Hormonal therapy has been shown to promote sleep among menopausal women, likely by reducing hot flashes and night sweats,[18] but it is also associated with an increased risk of breast and ovarian cancers.[19] The identification of this risk has resulted in an appreciable decline in the prescription of hormonal therapy in North America.[20] Perhaps, then, it is this decreased prevalence of hormonal therapy use among menopausal and postmenopausal women that partially accounts for the greater reported levels of poor sleep among women in the 40- to 59-year age range. Unfortunately, questions about hormonal therapy use were not asked consistently across provinces or time points in the CCHS-MH survey, so we were unable to investigate this potential effect.

A further possible explanation for the increase in insomnia symptoms among middle-aged women is the greater level of psychosocial stress that is often experienced by this group. Women aged 40-59 commonly fall within the so-called "sandwich generation", a label that is given to those that provide care both for their own or others' children and for aging parents.[21] Membership in the sandwich generation is associated with diminished health-promoting behaviors,[21] greater occurrence of chronic disease including hypertension and depression.[21-23] The literature illustrates that sleep may be negatively impacted in this group both directly and indirectly given the known robust association between increased stress levels and insomnia symptoms.[24]

There is also an increasing trend toward later motherhood. In North America as well as in many parts of Europe, the shift toward later first births began in the early 1970s[25] and has been reflected in an average age of first-time mothers in Canada of 28.5 years in 2011.[26] Additionally, over half of all Canadian births (52%) were to women aged 30 or older.[26] This trend has been accompanied by a similar delay in other markers of adulthood: both women and men now take longer to complete their education, to become established in the workforce, and to gain financial independence from their families, and both sexes are also postponing marriage.[26] This shift suggests that many of the stressors associated with establishing a financially stable household and raising young children have been delayed until closer to middle age, at which time women are already at a greater risk of sleep disturbance due to menopause and membership in the "sandwich generation".

To support women at this vulnerable age, it may be beneficial to explore nonhormonal treatment options for managing menopausal symptoms, such as gabanergics,[27] selective serotonin reuptake inhibitors,[28] or serotonin-norepinephrine reuptake inhibitors.[29] These medications improve sleep quality by reducing hot flashes and have fewer associated risks than hormonal therapies.[30] Equally important, it may be necessary to promote nonpharmacological methods to improve sleep quality among middle-aged women. Interventions such as cognitive-behavioral therapy for insomnia,[31] mindfulness-based stress reduction,[32] acupuncture,[33] and physical activity[34] may help reduce sleep problems caused by menopausal symptoms or stress. Employers may also see the benefits of improved sleep among their workforce if they advocate for work-life balance in this 24-hour society and culture of increased stress.

Interestingly, insomnia symptoms increased among physically healthy participants. This was surprising because physical health problems are strongly associated with poor sleep[35] and may suggest that poor sleep is becoming more of a problem for otherwise healthy people. It is possible that many people see poor sleep as part of their lifestyle rather than a legitimate health concern. Chronic stress, long work hours, and circadian disrupting technology use are ubiquitous in modern society and could be contributing to and maintaining insomnia symptoms in healthy adults.[36,37] Additionally, participants' health status was based on how they perceived their own health. It is possible that participants did not consider their sleep quality when assessing their health and therefore classified themselves as physically healthy despite having trouble sleeping. Another possible explanation is that with the increasing attention and recognition, individuals may be more aware of the importance of sleep and rate themselves as poor sleepers because they feel that their sleep is not as optimal as it could or should be. All of these hypotheses would require additional investigation before any firm explanations would be possible.

There was also an increase in insomnia symptoms in participants reporting good and fair/poor mental health compared to those with very good or excellent mental health. This is not surprising considering that sleep disturbances are symptoms of many psychological disorders, particularly mood and anxiety disorders; however, insomnia is now considered to be a distinct diagnostic entity even when it occurs simultaneously with a medical and/or psychiatric condition.[3] It is also the case that insomnia does not often remit with the treatment of the concurrent disorder, requires its own specific intervention,[38–40] and can increase the risk of developing a mood disorder.[41] The American College of Physicians has released a practice guideline recommending cognitive-behavioral therapy as a first-line treatment for insomnia.[42] The increase observed in individuals reporting good and fair/poor mental health supports the need for increased access to evidence-based sleep interventions alongside more traditional mental health services.[43,44]

We found an increased prevalence of insomnia symptoms in individuals with higher levels of education compared to individuals without a secondary education. Educational attainment is intricately tied to socioeconomic status. Previous research has found a relationship between lower AND higher socioeconomic status, level of education, and insomnia symptoms,[45–48] suggesting that there are factors that contribute to poor sleep at both ends of the socioeconomic status continuum. Clearly, this is a complex and multifactorial relationship complicated by interactions with other demographic and economic factors.

This study had several limitations. First, participants were categorized as having insomnia symptoms based on a single question. The

use of a single item precludes assessing for comorbid sleep disorders or medical conditions, such as obstructive sleep apnea or chronic pain, which may contribute to insomnia symptoms. It also prevents speculation about the clinical significance of the insomnia symptoms and the true prevalence of insomnia disorder. That said, it is not uncommon in population-based studies for insomnia to be assessed using a single question.[15] This limitation is further mitigated by the fact that the proportion of individuals reporting poor sleep in this study was similar to rates observed by Morin et al[2] in their survey of 2000 Canadians. Using the diagnostic criteria for insomnia, 13.4% of their sample had insomnia disorder and 16% exhibited symptoms of insomnia.[2] The similar prevalence rates reported here suggest that the question used was an efficient and reliable approximation of insomnia symptoms at a population level. Second, there was no time frame associated with the sleep question, which may have affected response accuracy because participants were not given a specific period to reflect upon when selecting their responses. This lack of a specified timeframe of reported insomnia symptoms prevents the determination of whether their trouble sleeping was due to transient/acute or chronic insomnia. A final limitation is the use of self-reported data; however, individuals' experience of poor sleep is highly subjective and not necessarily related to more objective sleep measures, making self-reports the most appropriate form of measurement.[49,50]

Our findings have demonstrated an increase in insomnia symptoms in Canadian adults between the years 2002 and 2012, particularly among women in the 40- to 59-year age range. Future research should investigate the potential roles of menopausal symptoms and treatment, later motherhood, and caregiving stress in exacerbating insomnia symptoms among middle-aged women. An improved understanding of the reasons for this phenomenon will allow for the development of targeted prevention and intervention initiatives to reduce the negative impact on physical and mental health, as well as the economic burden of insomnia on the Canadian population.

Disclosure

Dr. Garland has nothing to disclose.

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