

Gender/sex disparity in self-reported sleep quality among Canadian adults

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Abstract

Objective: This study investigated gender/sex differences in sleep quality among Canadian adults in a population-representative survey.

Methods: Data for this study was provided by the Canadian Community Health Survey (CCHS). For respondents who completed the 2011–12 CCHS sleep module, multinomial logistic regression was used to investigate the relationship between gender/sex and a composite sleep quality measure among adults ≥ 18 years old, adjusted for confounders.

Results: Among the sample ($n = 39,700$), gender/sex was evenly distributed (49.3% men, 50.7% women). In the adjusted logistic model, being a woman was independently associated with higher odds of poor sleep quality at all levels of poor sleep quality (from ‘a little of the time’ AOR = 1.47, 95% CI: 1.24, 1.73 to ‘all of the time’ AOR = 2.10, 95% CI: 1.74, 2.54). This sleep quality disparity was progressively greater the more frequent the poor sleep quality reported, for all but the highest poor sleep quality level.

Conclusions: This study provides population-level evidence of a sleep quality disparity between Canadian men and women. Using a mixed gender/sex population-based sample and a robust composite sleep quality measure, this study contributes to a growing understanding of poor sleep as a population health issue. Further research is needed to understand the mechanisms underlying the gender/sex-sleep relationship, as well as to investigate effective public health and policy interventions for addressing sleep-gender/sex population health disparities.

Introduction

Sleep is increasingly recognized as a determinant of health at both individual and population levels, as well as a symptom of other underlying conditions (*i.e.*, poor sleep).¹ The Public Health Agency of Canada recognizes “personal health practices and coping skills,” under which sleep arguably falls, as one of the twelve key determinants of health.² Sufficient and high quality sleep is important for normal daily functioning, while poor sleep is associated with increased use of healthcare services and products, reduced workplace productivity, and high economic burden.³ Sleep problems have a range of health consequences including increased risk of occupational injury,⁴ motor vehicle accidents,⁵ short-term and chronic morbidities, and early cause-specific and all-cause mortality.⁶ While the epidemiology of sleep problems is not well described in the Canadian context, 40% of Canadian adults experience insomnia symptoms.⁷

Women disproportionately experience poor sleep quality. Gender/sex-based differences in sleep can be explained by underlying neurochemical processes and anatomical differences, including less nonrapid eye movement, decreased delta activity, and higher prevalence of sleep apnea in women.⁸ Gender/sex-based differences in sleep can be explained by psychosocial and environmental factors, and include, for women, greater sleepiness, longer sleep latency, shorter sleep duration for older women (20 minutes or less per night), and poorer sleep quality.⁸ Sleep disorders are also more prevalent among women—women experience higher rates of insomnia and twice the risk of restless leg syndrome.⁸ In the limited research using mixed gender/sex samples that is able to examine gender/sex differences in sleep-related morbidity and mortality, it has been shown that women have a greater likelihood of both depression

and cardiovascular disease-related death than men.^{8,9} In gender/sex-specific research, poor sleep among women is associated with decreased neuroendocrine and metabolic function and increased risk of metabolic syndrome, including diabetes,¹⁰ higher body mass index, and incident obesity.¹¹

Though there is growing evidence of gender-based sleep differences, gaps in the literature remain. For one, high rates of sleep disorders known to be more prevalent among men have resulted in the underrepresentation of women in clinical studies. This likely leaves women both undertreated and understudied. Furthermore, the literature on gender/sex and sleep largely consists of clinical studies and gender/sex-specific samples. Much of the existing literature has focused on insomnia, the most prevalent sleep disorder in Canada.⁷ In gender-specific research, much has focused on midlife or menopausal women. There is a need for the investigation of gender differences in sleep quality across age groups using population studies to inform public health strategies and focus resources. While some population health research has investigated the relationship between gender/sex and sleep, much of the literature is U.S.-based, where the healthcare system and sociopolitical environment differs substantially from Canada and may impact gender/sex disparities in health outcomes. The Canadian Community Health Survey (CCHS) provides a unique opportunity to address these gaps in the literature, providing representative population-level data on sleep quality among Canadian adults across all age ranges. The objective of this study was to investigate gender differences in sleep quality among Canadian adults. We hypothesized that there would be a gender disparity in sleep quality, with women experiencing poorer quality sleep.

Data and Methods

Study Design

Data for this study were obtained from the 2011–12 CCHS public use microdata file.¹² The CCHS is an ongoing, national, cross-sectional survey of the health status, service utilization, and related health determinants of the Canadian population. Conducted by Statistics Canada in two-year cycles, the CCHS is designed to provide

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reliable estimates at the health region level. Interviewer-administered questionnaire data are obtained from respondents aged 12 years or older living in private homes across the 115 health regions in Canada based on a multistage, stratified cluster design, in person or via telephone, which is representative of 98% of the Canadian population aged 12 years or older. Ethical approval of the study was covered under the University of British Columbia Research Involving Human Participants Policy (#89, item 7.1), governing use of publicly available datasets.¹³

Study Sample

The overall CCHS 2011–12 sample included 124,929 respondents. Of those, 46,172 respondents (37.0%) lived in provinces that opted to include the optional sleep content survey module for their residents (Nova Scotia, Quebec, Manitoba, Alberta, and Yukon). The 2011–12 cycle was the most recent, most geographically representative cycle to include the sleep module. The current study sample was restricted to respondents aged ≥ 18 years and without invalid responses (“Don’t Know”, Refusal, Not Stated) to any study variable. Figure 1 illustrates the selection process to achieve the final analytic sample ($n = 39,700$, 31.8% of the CCHS total sample and 93.8% of eligible respondents).

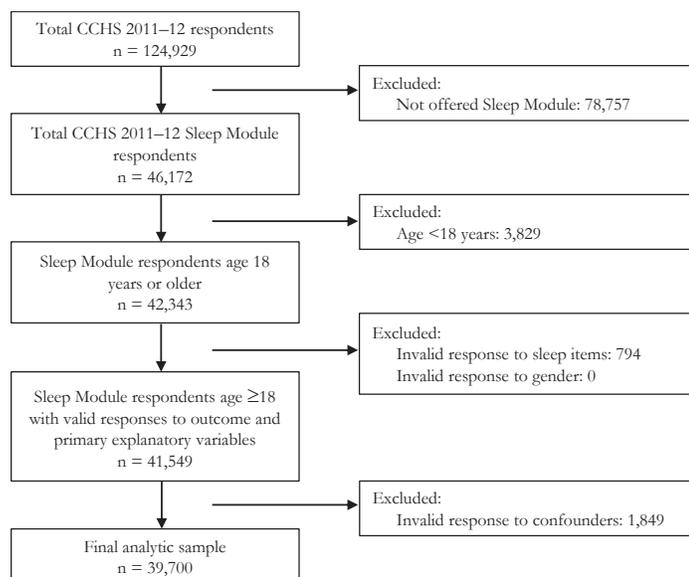


Figure 1 | Selection of analytic sample to investigate the relationship between gender/sex and sleep quality, Canadian Community Health Survey, 2011–12.

Measures

The main outcome for the analysis was sleep quality. A composite sleep quality outcome variable was created based conceptually on the Pittsburgh Sleep Quality Index (PSQI), a commonly used sleep quality measure.¹⁴ The outcome measure combined three CCHS items related to the PSQI components *sleep latency*, *sleep disturbances*, and *daytime dysfunction*, respectively: “How often do you have trouble going to sleep or staying asleep?”, “How often do you find sleep refreshing?”, and “How often do you find it difficult to stay awake when you want to?”. The CCHS used a five-level response for all three questions: “none of the time”, “a little of the time”, “some of the time”, “most of the time”, and “all of the time”. For this study, respondents were assigned to the highest level of poor sleep based on their highest level of response to any one of the three CCHS sleep variables. The primary explanatory variable was gender/sex (men/women).¹⁵ Informed by a review of the sleep-gender/sex literature,

potential confounders were included in the model, based on evidence of association with both the outcome and primary explanatory variables. These included age (younger adults: 18–39 years, midlife adults: 40–59 years, older adults: ≥ 60 years), educational attainment ($<$ secondary school, \geq secondary school, \geq post-secondary school), visible minority status (yes/no), self-reported current mood disorder diagnosis (e.g., self-reported depression, bipolar, mania, or dysthymia diagnosis) (yes/no), marital status (married, common-law, widowed/separated/divorced, single, never married), and presence of children five years old or under in the household (none, ≥ 1).^{16–19}

Data Analysis

Data analyses were conducted with SAS® University Edition statistical software (SAS Institute Inc., Cary NC). Accounting for the nonrandom CCHS survey sampling design and uneven probabilities of selection, CCHS survey weights were applied to all analyses to provide appropriate variance estimates and meaningful population representative estimates.²⁰ Following descriptive statistics, a multinomial logistic regression model was built to examine the independent effect of gender/sex on sleep quality, adjusted for confounders. Potential confounders were assessed via addition to the unadjusted model one at a time using a 10% shift in the point estimate strategy.²¹ Despite no strong statistical evidence of confounding, all were retained in the final analysis based on an *a priori* conceptual model of potential confounders of the relationship between gender/sex and sleep quality.

Results

Descriptive statistics profiling the overall study sample demographics are presented in Table 1. The study sample ($n = 39,700$) was comprised of approximately equivalent proportions of men and women (49.32% and 50.78%, respectively). Almost half of all respondents were in the older age category (43.68% aged ≥ 60 years), 35.43% were midlife adults (40–59 years), and 20.89% were younger adults (18–39 years). Most of the sample had completed post-secondary education or higher (68.88%), 15.88% identified as visible minorities, 6.42% reported a current doctor-diagnosed mood disorder, almost half (45.23%) were married, and 13.83% reported children under five years old in their household.

Overall, women reported poorer sleep quality than men. Further, the difference in the proportion of women versus men reporting poor sleep quality increased with each level of poor sleep quality. Specifically, 52.24% of women reported poor sleep quality “some of the time” compared to 47.76% of men, 55.88% of women reported poor sleep quality “most of the time” compared to 44.12% of men, and 57.11% of women reported poor sleep quality “all of the time” compared to 42.89% of men.

In unadjusted bivariable analysis (Table 2), being a woman was associated with increased odds of poor sleep quality from lowest level (“a little of the time”, odds ratio (OR) = 1.40, 95% confidence interval (CI): 1.19, 1.64) to highest level (“all of the time”, OR = 2.23, 95% CI: 1.84, 2.70), compared to being a man. In the multivariable model adjusted for age, educational attainment, visible minority status, current doctor-diagnosed mood disorder, marital status, and children in the household (Table 2), the progressively disproportionate relationship between being a woman and poor sleep quality remained overall, though the adjusted odds of poor sleep were somewhat attenuated for the “all of the time” level (AOR = 2.10, 95% CI: 1.74, 2.54). The 95% confidence intervals for estimates of the association

between being a woman and poor sleep quality excluded “1” at all levels of sleep quality, indicating a statistically significant effect.

Discussion

This study makes important contributions to the Canadian and international sleep-gender/sex literature, including use of epidemiological data from a large, population representative Canadian sample. Strengths of the study include use of a mixed gender/sex sample of adults 18 years and older and employment of a robust composite sleep quality outcome measure, rather than reliance on a single sleep problem indicator, with potential for use in future research on sleep in the Canadian population.

Results demonstrated that being a woman was independently associated with higher odds of poor sleep quality overall. Furthermore, a progressively disproportionate effect was observed between being a woman and higher odds of poor sleep quality at each outcome level except the highest (sleep problems “all of the time”). The greatest effect was a more than two-fold (AOR = 2.16) increased odds of poor sleep quality “most of the time” for women versus men, in the adjusted multivariable model. The results of the current study are consistent with other research, including a U.S. based study of socioeconomic impacts on sleep quality that found women had 1.55 times the odds of poor sleep quality compared to men, and a clinic-based European sample of multiple sclerosis patients that found men had 0.10 the odds of poor sleep quality compared to women.^{17,22} A higher prevalence of poor sleep quality in women was also noted in a U.S. community-based sample of older adults (32.6% versus 16.3%)²³ and a cross-sectional study of Korean young adults.²⁴

In this mixed age group study, younger and midlife women experienced poorer sleep quality compared to older women. Much of the sleep-gender/sex research has been conducted among age group-specific samples, with little prior evidence comparing age groups across the life span. While there is limited research utilizing mixed age group and mixed gender/sex adult samples, a community-based study of U.S. adolescents found a 2.75-fold increased risk of insomnia for girls at onset of menses compared to boys.²⁵ The lack of gender/sex difference in insomnia risk prepuberty may point to a potential hormonal pathway for sleep disorders, and suggests maturational development may be related to the natural course of insomnia and the onset of other sleep problems for women and girls.²⁵ Relatedly, there is evidence that menstrual cycle, pregnancy, and menopause can influence sleep in women.¹⁶ Gender/sex-based disparities in sleep quality and other sleep problems may be further explained by gender/sex inequities in leisure time, caregiving responsibilities, and household labour at different life stages, as has been demonstrated in a study of gender/sex and sleep duration in U.S. adults.¹⁹ This finding is consistent with confounding effects in this study, demonstrating poorer sleep for married women and those with children five years old or younger in the household. While much of the sleep literature has shown poor sleep for older adults, finding greater sleep problems for younger and midlife women in this study may be a function of age-differential underreporting. Specifically, older adults may underreport sleep problems due to cultural normalization of sleep issues in older age.²⁶

Finding elevated odds of poor sleep quality for women using population-based data adds to the evidence that poor quality sleep is a population health issue, intersecting with larger social disparities in health.²⁷ Currently, intervention for sleep problems is dominated

by individual-level clinical and behavioural remedies such as sleeping pill use and sleep hygiene training.⁸ While these options may improve sleep quality for individuals, they do not address population-level causes. Understanding sleep quality as a population health issue rather than an individual issue brings into focus the need for population-level interventions aimed at improving sleep quality, such as sleep-conducive employment schedules and incorporation of sleep optimization education into primary school curricula. While poor individual autonomy and the uneven distribution of socioeconomic resources have been theorized as potential underlying causes of poor quality sleep, further research is needed to investigate effective public health and social policy interventions for ameliorating root causes and ultimately addressing related population health disparities, including gender/sex-specific efforts.^{1,28}

Limitations

There are a number of limitations to this study. Firstly, use of cross-sectional self-report survey data restricts the ability to assess temporality and causality, limiting inferences to observation of association. Though the composite sleep quality outcome is based conceptually on the validated PSQI, it is not a validated measure itself nor as comprehensive a measure of sleep-related problems and thus may have introduced information bias in this study.¹⁴ As a result, study findings may be a conservative estimate of sleep problems among Canadian adults. Relatedly, as respondents were classified by the highest level of sleep problems reported for any of the three sleep quality items, the outcome effect may be dulled, though this is likely non-differential by gender/sex. Selection bias may have been introduced as it is possible that those who opted to respond to the sleep questions experienced more sleep problems. In this event, findings of poor sleep quality in this study may be an overestimation, though likely non-differential by gender/sex. However, the number of non-respondents to the sleep module was relatively low, at less than 2% of eligible respondents. Further, this study is limited by an inability to control for a variety of known confounders of the relationship between gender/sex and sleep in the CCHS (*e.g.*, household division of labour), resulting in possible residual confounding.

Potential misclassification of gender/sex may also bias this study. Survey documentation instructs CCHS interviewers to input respondent sex and, if necessary, ask “is respondent male or female?” Though the term “sex” is used in the CCHS documentation, this variable is more accurately a gender/sex measure. The survey question does not collect sex assigned at birth and thus likely captures interviewer assessment of respondent gender/sex based on name, voice pitch, or other gendered signifiers. Though inconsistent with best practices in the literature regarding measurement of sex and gender, this item has been used to make both sex- and gender-related inferences in the CCHS.²⁹ The binary male/female response options also constitute a methodological erasure of transgender respondents and/or those with non-binary identities—an important consideration both for future CCHS research and for Statistics Canada as the survey instrument evolves. Though the resulting potential for misclassification bias is an important limitation, this study used the best available CCHS gender/sex measure, and the number of any potentially misclassified respondents is likely small, as to have minimal impact on results. Despite oversimplification of gender/sex measurement, a meaningful gender/sex difference was detected in this study.

Table 1 | Descriptive statistics for the study sample to investigate the relationship between gender/sex and sleep quality, Canadian Community Health Survey, 2011–12 (n = 39,700).

Sleep Quality	Overall Study Sample	Study Sample by Sleep Quality				
	39,700 (100%)	None (%)	A little of the time (%)	Some of the time (%)	Most of the time (%)	All of the time (%)
Gender		2,484 (6.34)	10,671 (27.41)	14,184 (35.98)	8,276 (20.43)	4,085 (9.84)
Men	17,464 (49.32)	62.57	54.48	47.76	44.12	42.89
Women	22,236 (50.78)	37.43	45.52	52.24	55.88	57.11
Age						
Older (≥60)	22,191 (43.68)	53.96	42.50	43.52	40.84	46.83
Midlife (40–59)	10,846 (35.43)	32.07	35.77	35.45	36.33	34.68
Younger (18–39)	6,663 (20.89)	13.97	21.74	21.03	22.83	18.49
Educational Attainment						
< Secondary	7,758 (14.94)	20.42	12.39	13.82	16.06	20.34
Secondary	6,629 (16.18)	14.54	14.82	15.89	17.84	18.64
Post-secondary	25,313 (68.88)	65.14	72.79	70.29	66.10	61.01
Visible Minority Status						
Visible Minority	3,983 (15.88)	21.79	13.42	16.49	16.82	14.77
White	35,717 (84.12)	78.21	86.58	83.51	83.18	85.23
Current Mood Disorder						
No	36,745 (93.58)	98.39	97.49	94.28	90.39	83.69
Yes	2,955 (6.42)	1.61	2.51	5.72	9.61	16.31
Marital Status						
Married	16,595 (45.23)	45.86	46.52	45.24	43.01	45.75
Common-law	5,395 (17.10)	15.93	18.79	16.79	17.06	14.40
Widowed/ Separated/ Divorced	8,417 (35.56)	17.77	11.54	13.44	12.95	18.19
Single/ Never Married	9,293 (24.11)	20.44	23.15	24.53	26.97	21.70
Children under 5						
None	35,010 (86.17)	89.40	85.25	86.39	85.25	87.77
1 or more	4,690 (13.83)	10.60	14.75	13.61	14.75	12.23

Conflict of interest

The authors have declared no conflict of interest.

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Table 2 | Multinomial logistic regression model of the relationship between gender/sex and sleep quality (reference = no poor sleep quality)* (n = 39,700).

	Unadjusted Odds Ratios (95% CIs)				Adjusted Odds Ratios (95% CIs)			
	A little of the time	Some of the time	Most of the time	All of the time	A little of the time	Some of the time	Most of the time	All of the time
Gender								
Men	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Women	1.40 (1.19,1.64)	1.82 (1.56,2.14)	2.11 (1.79,2.51)	2.23 (1.84,2.70)	1.47 (1.24,1.73)	1.88 (1.60,2.21)	2.16 (1.82,2.57)	2.10 (1.74,2.54)
Age (years)								
Older (≥60)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Midlife (40–59)	1.42 (1.16,1.73)	1.37 (1.13,1.67)	1.50 (1.22,1.83)	1.25 (1.00,1.56)	1.36 (1.08,1.72)	1.34 (1.07,1.69)	1.47 (1.16,1.86)	1.47 (1.13,1.91)
Young (18–39)	1.98 (1.60,2.45)	1.87 (1.51,2.31)	2.16 (1.73,2.70)	1.53 (1.19,1.96)	2.12 (1.61,2.79)	1.92 (1.47,2.51)	2.11 (1.56,2.79)	2.09 (1.51,2.90)
Educational Attainment								
<Secondary	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Secondary	1.70 (1.32,2.17)	1.63 (1.28,2.06)	1.57 (1.28,2.06)	1.30 (0.99,1.70)	1.49 (1.16,1.92)	1.45 (1.14,1.84)	1.37 (1.06,1.76)	1.20 (0.92,1.58)
Post-secondary	1.84 (1.53,2.23)	1.60 (1.33,1.91)	1.29 (1.06,1.57)	0.94 (0.77,1.16)	1.63 (1.34,1.98)	1.44 (1.20,1.73)	1.13 (0.92,1.38)	0.87 (0.70,1.08)
Visible Minority Status								
Visible Minority	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
White	1.80 (1.38,2.35)	1.41 (1.10,1.81)	1.38 (1.06,1.80)	1.61 (1.20,2.16)	2.12 (1.61,2.78)	1.63 (1.26,2.10)	1.63 (1.24,2.13)	1.79 (1.33,2.41)
Current Mood Disorder								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.58 (1.05,2.35)	3.72 (2.53,5.46)	6.51 (4.44,9.54)	11.94 (8.10,17.60)	1.56 (1.04,2.33)	3.51 (2.39,5.16)	6.03 (4.10,8.87)	10.96 (7.44,16.14)
Marital Status								
Married	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Common-law	1.16 (0.92,1.47)	1.07 (0.85,1.35)	1.14 (0.90,1.45)	0.91 (0.69,1.20)	0.89 (0.70,1.13)	0.86 (0.68,1.10)	0.90 (0.70,1.15)	0.72 (0.54,0.96)
Widowed/ Separated/ Divorced	0.64 (0.51,0.80)	0.77 (0.61,0.97)	0.78 (0.61,0.99)	1.03 (0.79,1.33)	0.65 (0.51,0.83)	0.72 (0.57,0.92)	0.70 (0.55,0.90)	0.84 (0.64,1.10)
Single/ Never Married	1.11 (0.91,1.38)	1.23 (0.99,1.50)	1.41 (1.13,1.75)	1.06 (0.84,1.35)	0.83 (0.65,1.07)	0.94 (0.74,1.19)	1.05 (0.81,1.35)	0.76 (0.57,1.02)
Children under 5								
None	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1 or more	1.46 (1.12,1.89)	1.33 (1.03,1.72)	1.46 (1.12,1.91)	1.18 (0.88,1.57)	1.25 (0.93,1.67)	1.17 (0.88,1.58)	1.29 (0.95,1.75)	1.08 (0.77,1.51)

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