


Sleep Problems and Psychological Well-Being: Baseline Findings from the Canadian Longitudinal Study on Aging

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Article

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Résumé

Des études internationales ont démontré l'existence de liens entre les problèmes de sommeil et un faible bien-être psychologique. Cependant, les données canadiennes sur ce sujet sont limitées. La présente étude a examiné cette association à l'aide de données de base transversales provenant de l'Étude longitudinale canadienne sur le vieillissement, une enquête nationale menée auprès de 30 097 adultes âgés de 45 à 85 ans vivant dans la communauté. La courte durée du sommeil, l'insatisfaction face au sommeil, les symptômes d'insomnie et les troubles diurnes étaient systématiquement associés à une plus forte prévalence de l'insatisfaction à l'égard de la vie, de la détresse psychologique et de la mauvaise santé mentale autodéclarée. Un sommeil de plus longue durée était associé à une prévalence plus élevée de détresse psychologique et de mauvaise santé mentale autodéclarée, mais n'était pas lié à une insatisfaction à l'égard de la vie. Les associations entre les problèmes de sommeil et la détresse psychologique étaient de 11 % à 18 % plus fortes chez les hommes. L'accroissement en âge, par tranche de 10 ans, augmentait l'association entre les troubles diurnes et l'insatisfaction envers la vie de 11 %, mais diminuait l'association entre les symptômes d'insomnie et la mauvaise santé mentale de 11 %. Les problèmes de sommeil chez les adultes d'âge moyen et les personnes âgées nécessiteraient une attention accrue au Canada puisqu'ils constituent des problèmes de santé publique.

Abstract

International studies have demonstrated associations between sleep problems and poor psychological well-being; however, Canadian data are limited. This study investigated this association using cross-sectional baseline data from the Canadian Longitudinal Study on Aging, a national survey of 30,097 community-dwelling adults, 45–85 years of age. Short sleep duration, sleep dissatisfaction, insomnia symptoms, and daytime impairment were consistently associated with a higher prevalence of dissatisfaction with life, psychological distress, and poor self-reported mental health. Long sleep duration was associated with a higher prevalence of psychological distress and poor self-reported mental health, but not with dissatisfaction with life. Associations between sleep problems and psychological distress were 11–18 per cent stronger in males. With each 10-year increase in age, the association between daytime impairment and life dissatisfaction increased by 11 per cent, and insomnia symptoms and poor mental health decreased by 11 per cent. Sleep problems in middle-aged and older adults warrant increased attention as a public health problem in Canada.

Introduction

Sleep problems, such as short or long sleep duration, insomnia symptoms, and daytime sleepiness, are common globally. A study of 50 countries reported that one in four adults do not sleep well (Soldatos, Allaert, Ohta, & Dikeos, 2005). Among older adults, it is estimated that disruptions in sleep quality or sleep duration affect over half of this age group (Crowley, 2011; Neikrug & Ancoli-Israel, 2010; Stranges, Tigbe, Gómez-Olivé, Thorogood, & Kandala, 2012; Unruh et al., 2008). In Canada, estimates range from one in three to as many as one in two adults reporting fewer hours of sleep than the recommended 7 hour minimum (Chaput, Wong, & Michaud, 2017; Gilmour et al., 2013; Nunez, Nunes, Khan, Stranges, & Wilk, 2021; Public Health Agency of Canada, 2019). Insomnia symptoms are also highly prevalent in Canadians,

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experienced by approximately one in four adults, with the prevalence increasing over a 10-year period (Chaput, Yau, Rao, & Morin, 2018; Garland et al., 2018; Public Health Agency of Canada, 2019). Indeed, more recent Canadian data indicate that 55 per cent of adult females and 41 per cent of adult males experience insomnia symptoms (Nunez et al., 2021). Insomnia symptoms have been associated with middle-age in particular, with a higher prevalence in 40–59-year-olds than in 18–29-year-olds (Morin et al., 2011). Given the high prevalence of sleep problems among adults and older adults in Canada, understanding the potential health impacts of sleep problems is important for informing public health policy and clinical interventions.

In the context of an aging population, sleep problems have also been associated with poor well-being in middle-aged and older adults, in studies from low-resource settings (Stranges et al., 2012), China (Zhi et al., 2016), the United States (Lemola, Ledermann, & Friedman, 2013), and Europe (Faubel, Lopez-Garcia, Guallar-Castillón, Balboa-Castillo, & Gutiérrez-Fisac, 2009; Lukaschek, Vanajan, Johar, Weiland, & Ladwig, 2017). However, there is limited Canadian evidence, and measures of well-being are likely to differ across populations; therefore, it is important to assess these associations in different settings (Lindert, Bain, Kubzansky, & Stein, 2015). Also, evidence suggests that country is an important moderator of the association between sleep quality and depression, anxiety, and stress (João, de Jesus, Carmo, & Pinto, 2018). Recent Canadian evidence from an adult sample suggests significant associations between abnormal sleep duration and insomnia symptoms, and poor psychological well-being (Dai, Mei, An, Lu, & Wu, 2020). Insomnia in Canadian adults has also been significantly associated with poor mental health, psychological problems, and anxiety symptoms (Morin et al., 2011). Notably, prior Canadian studies have primarily focused on sleep duration and insomnia symptoms and have neglected other facets of sleep, such as sleep dissatisfaction and the impact of sleep problems on daytime functioning. Furthermore, there is evidence of variation in associations across age groups. Short sleep duration has been found to be associated with higher odds of poor/fair self-reported mental health in Canadian adults (18–64 years), but not older adults (65 years and older; Chang, Chaput, Roberts, Jayaraman, & Do, 2018). An in-depth understanding of the association between sleep problems and psychological well-being across middle-aged and older Canadian adults is warranted to better understand the public health implications of poor sleep on well-being across the lifespan.

There is limited evidence examining sex-modified associations between sleep problems and psychological well-being; however, associations between sleep problems and physical health outcomes have been shown to vary by sex, with a stronger magnitude of effect in women. For example, short sleep duration has been associated with a higher risk of metabolic syndrome and hypertension in women than in men (Cappuccio et al., 2007; Smiley, King, & Bidulescu, 2019; Stang, Moebus, Möhlenkamp, Erbel, & Jöckel, 2008; Stranges et al., 2010). As well, sleep problems have been associated with more detrimental effects of cardiovascular risk among women (Meisinger, Heier, Löwel, Schneider, & Döring, 2007). In terms of psychological well-being, Chang et al. did not observe an interaction by sex in the association between self-perceived mental health and short or long sleep duration among Canadian adults. Further exploration of sex differences across different domains of sleep patterns and additional measures of psychological well-being are needed to better understand sex-specific associations and to identify subgroups of people more impacted by sleep problems.

The aim of this study was to explore the association between sleep problems (sleep duration, sleep dissatisfaction, insomnia symptoms, and daytime impairment from insomnia symptoms), and psychological well-being (life satisfaction, psychological distress, self-reported mental health) among middle-aged and older adults in Canada. Effect modification by sex and age group was also explored. It was hypothesized that sleep problems would be associated with poorer psychological well-being, and that these associations would vary by sex and age group.

Materials and Methods

Data Source and Study Design

This study involved a cross-sectional analysis of baseline data from the Canadian Longitudinal Study on Aging (CLSA) Comprehensive Cohort, a study of community-dwelling adults across Canada (Canadian Longitudinal Study on Aging, 2017; Raina et al., 2009, 2019). The CLSA Comprehensive Cohort is a national stratified sample of 30,097 adults 45–85 years of age at recruitment who were able to read and speak French or English (Raina et al., 2019). People living in long-term care institutions, with cognitive impairment, living in the three territories or First Nations reserves, and full-time members of the Canadian Armed Forces were excluded (Raina et al., 2009). Participants were interviewed in person to enable detailed data collection, including physical and clinical measures; therefore, participants were randomly selected from within 25–50 km of one of 11 data collection sites located in major academic centres in seven provinces (British Columbia, Alberta, Manitoba, Ontario, Quebec, Nova Scotia, Newfoundland; Raina, Wolfson, & Kirkland, 2008; Raina et al., 2009). Provincial health care registration databases and random digit dialling were used as sampling frames (Raina et al., 2009). Participants provided written informed consent. Baseline data collection was conducted from 2012 to 2015. Approval to access the data was obtained from the CLSA (Application Number: 180113), and ethics approval was obtained.

Measurements

Sleep problems

Sleep questions in the CLSA were adapted from validated measures (Bastien, Vallières, & Morin, 2001; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). Sleep duration was assessed with the question: “During the past month, on average, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)” Answers were categorized as short (< 6 hours), normal (6–8 hours), and long sleep duration (> 8 hours). Although 7 hours is the recommended minimum for all adults, the National Sleep Foundation further rated the appropriateness of different cut-offs as they relate to health outcomes (Hirshkowitz et al., 2015). A short duration cut-off of < 6 hours was selected, as this cut-off was considered “not appropriate” and “may be appropriate in some individuals” in adults and older adults, respectively (Hirshkowitz et al., 2015), and to align with prior studies showing the health effects of habitual sleep duration, including a prior CLSA study (Ayas et al., 2003; Cappuccio et al., 2007; Kripke, Garfinkel, Wingard, Klauber, & Marler, 2002; Nicholson et al., 2020; Patel et al., 2004; Stranges et al., 2008). The long duration cut-off was selected based on the distribution of sleep duration within the CLSA sample, as only a small number of participants reported sleeping longer than 8 hours (5%). Subjective sleep dissatisfaction was examined using

the question: “How satisfied or dissatisfied are you with your current sleep pattern?” Answers were dichotomized to satisfied/neutral (combining answers of very satisfied, satisfied, or neutral), and dissatisfied (combining answers of very dissatisfied or dissatisfied), consistent with a prior CLSA study (Nicholson et al., 2020). Insomnia symptoms were identified using the questions “Over the last month, how often did it take you more than 30 minutes to fall asleep?” and “Over the last month, how often did you wake in the middle of the night or too early in the morning and found it difficult to fall asleep again?” Insomnia symptoms were defined as having problems with initiating or maintaining sleep three times a week or more. Finally, problems with daytime functioning as a result of insomnia symptoms were examined using the questions: “To what extent do you consider your problem falling asleep to interfere with your daily functioning (for example, from daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.)?” and “To what extent do you consider your problem staying asleep to interfere with your daily functioning (for example, from daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.)?” Answers of “somewhat”, “much”, and “very much” to either question were defined as having problems with daily functioning versus answers of “a little” and “not at all”.

Psychological well-being

The Satisfaction with Life Scale (SWLS) was used, a five-item instrument rated on a seven-point scale (Diener, Emmons, & Griffin, 1985). For example, for the item “I am satisfied with my life,” respondents select answers from 1 = strongly disagree to 7 = strongly agree. Scores for each item are summed to provide an overall score ranging from 5 to 35, with higher scores indicating more satisfaction. A cut-off score of 15 or less was used, indicating dissatisfaction with life (Diener, 2006). Psychological distress was also examined, measured by the Kessler Psychological Distress Scale (K10; Kessler et al., 2003). The K10 is a 10-item questionnaire about nonspecific psychological distress experienced in the past 30 days (Kessler et al., 2003). Responses for each item use a five-point scale and are summed to provide an overall score ranging from 10 to 50, with higher scores indicating more psychological distress. A cut-off score of 15 or higher was selected to indicate clinically significant psychological distress, which was found to be associated with the best balance of sensitivity (0.77) and specificity (0.78) in predicting depression/anxiety in older adults (Anderson et al., 2013). Subjective mental health was assessed with the question: “In general, would you say your mental health is excellent, very good, good, fair, or poor?” Answers were dichotomized to fair or poor versus good, very good, or excellent, consistent with prior studies (Atkins, Naismith, Luscombe, & Hickie, 2013; Dai et al., 2020; Magee, Caputi, & Iverson, 2011; Wang et al., 2017).

Covariates

Socio-demographic, lifestyle, and clinical factors included in the analysis were selected *a priori*. Socio-demographic factors included age group, sex (male or female), self-reported ethnicity (white vs. ethnic minority group), rural or urban residence, annual household income (< \$20,000, \$20,000–49,999, \$50,000–99,999, \$100,000–149,000, ≥ \$150,000), employment status (retired, employed full-time, employed part-time, or unemployed), education (less than secondary, secondary, some post-secondary, post-secondary degree/diploma), and marital status (single/never married, married/common-law, widowed/divorced). For lifestyle factors, frequency of alcohol consumption in the past year was

examined (lifelong abstainer, former drinker [no alcohol in the past year], infrequent drinker [drank less than once a month], occasional drinker [drank about once a month to once a week], regular drinker [drank 2–3 times a week to almost every day], and binge drinker [more than 4–5 drinks per sitting at least 2–3 times per month]). Smoking status was categorized as daily smoker, occasional smoker, former smoker, or never smoker. The Medical Outcomes Study Social Support Survey was used, a 19-item scale consisting of items for emotional support, instrumental assistance, information, guidance and feedback, personal appraisal support, and companionship (Sherbourne & Stewart, 1991). The overall score is obtained by averaging responses over each item and transforming scores to range from 0 to 100, with higher scores indicating higher levels of social support. A binary variable for whether participants had provided caregiving assistance in the past year was also included. Frequency of fruit and vegetable consumption was measured using the Short Diet Questionnaire (SDQ; Shatenstein & Payette, 2015), which measured the average number of times per day fruit and vegetables were consumed in the past 12 months. The Physical Activity Scale for the Elderly (PASE) assessed past-week frequency, duration, and intensity of various forms of physical activity (Washburn, Smith, Jette, & Janney, 1993). The overall scores range from 0 to 793, with higher scores indicating a higher level of physical activity. To control for clinical factors, the number of self-reported chronic conditions from a list of 42 physical conditions was counted, including respiratory, cardiovascular, neurological, gastrointestinal and rheumatic conditions, cancer, diabetes, allergies, acute infections (past year), and vision-related and psychiatric conditions. A complete list of conditions is available in the online supplement (Table S1). Pain was accounted for using the question “Are you usually free of pain or discomfort?” with answers of “no” indicating pain/discomfort.

Data Analysis

Descriptive analyses were conducted with sampling weights to account for the cluster and strata sampling design (Canadian Longitudinal Study on Aging, 2017). Modified Poisson regression models with robust variance estimators (Zou, 2004) and analytic sampling weights (Canadian Longitudinal Study on Aging, 2017) were used to estimate prevalence ratios (PR) and 95 per cent confidence intervals (CI) for the prevalence of sleep problems (short/long sleep duration, dissatisfaction with sleep, insomnia symptoms, and daytime impairment) among participants with each well-being outcome (dissatisfaction with life, psychological distress, poor self-reported mental health). Unadjusted PRs and PRs adjusted for the socio-demographic, lifestyle, and clinical covariates selected *a priori* were estimated.

Effect modification by sex was examined by estimating stratified PRs and 95 per cent CIs for sleep problems within each well-being outcome among males and females in fully adjusted models. The ratio of male/female subgroup PRs and the associated 95 per cent CI was calculated to determine whether there were significant sex differences. For effect modification by age, age was analyzed as a continuous variable, so an interaction term for sleep problems × age was added to the fully adjusted models and the difference in effects over 10 years was calculated. Effects at specific ages were also estimated, in which PRs and 95 per cent CIs at age 45, 55, 65, 75, and 85 were calculated.

A sensitivity analysis was conducted in which participants with suspected clinical sleep disorders (sleep apnea, insomnia, and rapid eye movement-sleep behavior disorder) were removed to ascertain

whether observed associations between sleep and psychological well-being were being driven by participants with clinical sleep disorders (methods described in the online supplement, Appendix S1).

Percentage of missing data ranged from 0 per cent to 9 per cent across all variables, and the case-wise proportion of missingness was up to 27 per cent. Missing data were imputed and analyzed using 25 multiply imputed data sets using chained equations. All sleep variables, socio-demographic, lifestyle, and clinical factors were used in the imputation model. The parameters in each model were estimated in each imputed data set separately and combined using Rubin's rules (Rubin, 1987). All analyses were conducted in Stata/IC, version 16.0 (Stata Corporation, College Station, TX).

Results

CLSA Participants

Characteristics of the CLSA participants are summarized in Table 1. Among participants who reported dissatisfaction with life, psychological distress, and poor/fair self-reported mental health, there was a larger proportion of females, participants in the youngest age group (45–54 years), lower income groups, unemployed, participants providing caregiving assistance, single/never married, former and infrequent drinkers, daily smokers, and those usually experiencing pain/discomfort (Table 1). The dissatisfied with life, psychological distress, and poor/fair self-reported mental health groups also had lower levels of social support and physical activity, and more chronic conditions (Table 1).

Sleep Problems and Psychological Well-Being

Overall, 11 per cent of participants reported dissatisfaction with life, 36 per cent reported psychological distress, and 5 per cent reported poor/fair mental health (Table 1). For sleep duration, 18 per cent of participants reported abnormal sleep duration (13% short duration and 5% long duration). For sleep satisfaction, 26 per cent were dissatisfied with their sleep, whereas 59 per cent were satisfied. Associations among sleep problems, subjective well-being, and psychological distress are summarized in Table 2. All sleep problems were associated with a higher prevalence of poor psychological well-being across all measures in unadjusted models. In fully adjusted models, short sleep duration, but not long sleep, versus normal (PR = 1.38, 95% CI 1.27–1.49), sleep dissatisfaction (PR = 1.85, 95% CI 1.73–1.99), insomnia symptoms (PR = 1.54, 95% CI 1.43–1.65), and associated daytime impairment (PR = 1.83, 95% CI 1.70–1.97) were associated with a higher prevalence of dissatisfaction with life. Both short and long sleep versus normal (short: PR = 1.16, 95% CI 1.11–1.21; long: PR = 1.13, 95% CI 1.06–1.20), sleep dissatisfaction (PR = 1.31, 95% CI 1.27–1.36), insomnia symptoms (PR = 1.28, 95% CI 1.24–1.32), and associated daytime impairment (PR = 1.40, 95% CI 1.35–1.45) were associated with a higher prevalence of psychological distress. For poor/fair self-reported mental health, both short and long sleep versus normal (short: PR = 1.42, 95% CI 1.25–1.61; long: PR = 1.53, 95% CI 1.28–1.82), sleep dissatisfaction (PR = 1.88, 95% CI 1.68–2.09), insomnia symptoms (PR = 1.65, 95% CI 1.47–1.84), and daytime impairment (PR = 2.27, 95% CI 2.02–2.55) were associated with a higher prevalence of poor/fair mental health. In the sensitivity analysis from which respondents with suspected clinical sleep disorders were excluded ($n = 7,680$ [27%]), associations were partially attenuated, but remained consistent with the main analysis (online supplement, Table S2).

Effect Modification by Sex and Age

Results for effect modification by sex are presented in Table 3. Associations between psychological distress and sleep dissatisfaction (males: PR = 1.40, 95% CI 1.32–1.47; females: PR = 1.25, 95% CI = 1.20–1.31; ratio of PRs = 1.12, 95% CI 1.04–1.19), insomnia symptoms (males: PR = 1.36, 95% CI 1.29–1.43; females: PR = 1.22, 95% CI 1.17–1.27; ratio of PRs = 1.11, 95% CI 1.04–1.19), and daytime impairment (males: PR = 1.53, 95% CI 1.45–1.62; females: PR = 1.31, 95% CI 1.25–1.37; ratio of PRs = 1.18, 95% CI 1.10–1.26) were modified by sex with significantly larger magnitude of effect in males, although associations remained significant in both sexes. No other associations were modified by sex.

Results for effect modification by age are summarized in Table 4. The association between dissatisfaction with life and daytime impairment caused by insomnia symptoms were modified by age, with an 11 per cent increase in prevalence of dissatisfaction with life with each 10-year increase in age (age \times sleep PR = 1.11, 95% CI 1.04–1.19), although associations between dissatisfaction with life and daytime impairment were still significant at all ages. The association between poor/fair self-reported mental health and insomnia symptoms was associated with an 11 per cent decrease in prevalence with each 10-year increase in age (age \times sleep PR = 0.89, 95% CI 0.80–0.99). Insomnia symptoms were associated with a higher prevalence of poor/fair self-reported mental health at age 45 (PR = 1.93, 95% CI 1.57–2.37) – an association that decreased and was no longer statistically significant by age 85 (PR = 1.20, 95% CI 0.91–1.59). Larger associations between short and long sleep duration and poor/fair self-reported mental health in younger adults was also observed, albeit that interaction effects between sleep and age were not statistically significant.

Discussion

This study found that sleep problems among middle-aged and older adults in Canada were consistently and independently associated with multiple measures of poor psychological well-being. Specifically, short sleep duration relative to normal, sleep dissatisfaction, insomnia symptoms, and daytime impairment caused by insomnia symptoms were associated with a higher prevalence of dissatisfaction with life, psychological distress, and fair/poor self-reported mental health. Long sleep duration relative to normal was associated with psychological distress and poor/fair self-reported mental health, but not with dissatisfaction with life. This study observed some evidence of effect modification by sex, with larger associations between sleep dissatisfaction, insomnia symptoms, and associated daytime impairment and psychological distress in males than in females, although associations were still statistically significant in both sexes. Effect modification by age was also observed, with stronger associations between daytime impairment and dissatisfaction with life at older ages, although associations remained significant at all ages. Effect modification by age was also observed for associations between insomnia symptoms and poor/fair self-reported mental health, with associations decreasing with age.

Findings from this study, that short and long sleep duration, sleep dissatisfaction, and insomnia symptoms were associated with poor psychological well-being, are consistent with previous studies in international settings (Atkins et al., 2013; Cunningham, Wheaton, & Giles, 2015; Foley et al., 1995; Jacobs, Cohen, Hammerman-Rozenberg, & Stessman, 2006; Lee & Sibley, 2019; Lukaschek et al., 2017; Magee et al., 2011; Ohayon et al., 2019;

Table 1. CLSA participant characteristics by psychological well-being measure

	Overall	Dissatisfied with Life		Psychological Distress (K10 score \geq 15)		Poor/Fair Self-Reported Mental Health	
		No	Yes	No	Yes	No	Yes
Sample size	30,097	26,215	3,528	18,328	10,090	28,417	1,653
% of sample	100%	89%	11%	64%	36%	95%	5%
Sex							
Female	50%	50%	54%	48%	55%	50%	52%
Age, mean (SD)							
45-54 years	59.5 (9.9)	59.6 (10.0)	58.2 (9.1)	59.9 (9.9)	58.6 (9.7)	59.5 (9.9)	57.9 (9.3)
55-64 years	42%	42%	46%	40%	46%	42%	47%
65-74 years	30%	29%	33%	30%	29%	30%	32%
75-85 years	17%	18%	14%	19%	15%	17%	12%
Ethnic minority group ^a	11%	11%	8%	11%	10%	11%	9%
Rural (vs. urban)	6%	5%	7%	5%	5%	6%	6%
Household income ^b							
< \$20,000	8%	9%	5%	8%	9%	9%	7%
\$20,000-\$49,999	5%	3%	15%	3%	7%	4%	15%
\$50,000-\$99,999	19%	18%	27%	16%	22%	18%	25%
\$100,000-\$149,999	33%	33%	35%	33%	34%	33%	34%
\geq \$150,000	22%	23%	15%	24%	21%	23%	16%
21%	23%	9%	24%	17%	22%	11%	
Employment ^c							
Completely retired	36%	37%	30%	38%	34%	37%	34%
Employed full-time	46%	47%	41%	47%	46%	47%	31%
Employed part-time	11%	11%	12%	11%	11%	11%	12%
Unemployed	7%	5%	18%	5%	10%	6%	23%
Education ^d							
Less than secondary school	5%	5%	6%	4%	6%	5%	8%
Secondary school	9%	9%	9%	9%	9%	9%	9%
Some post-secondary	7%	6%	9%	7%	7%	7%	9%
Post-secondary degree	80%	80%	75%	81%	78%	80%	74%
Marital status ^d							
Single/never married	8%	7%	18%	7%	11%	8%	16%
Married/common-law	76%	79%	55%	79%	72%	77%	60%
Widowed/divorced	16%	14%	27%	14%	18%	15%	23%
Provided caregiving assistance ^d	45%	45%	49%	45%	47%	45%	48%
Alcohol consumption ^d							
Never	2%	2%	3%	2%	2%	2%	3%
Former drinker	11%	10%	17%	10%	12%	10%	19%
Infrequent drinker	11%	11%	16%	10%	13%	11%	16%
Occasional drinker	27%	27%	29%	27%	28%	28%	25%
Regular drinker	46%	47%	31%	49%	41%	46%	32%
Excessive drinker	3%	3%	4%	3%	4%	3%	5%
Smoking status ^e							
Daily smoker	7%	7%	14%	5%	10%	7%	14%
Occasional smoker	2%	2%	2%	1%	2%	2%	2%
Former smoker	57%	58%	54%	58%	57%	58%	55%

(Continued)

Table 1. Continued

	Overall	Dissatisfied with Life		Psychological Distress (K10 score ≥ 15)		Poor/Fair Self-Reported Mental Health	
		No	Yes	No	Yes	No	Yes
Never smoker	33%	34%	30%	35%	31%	34%	28%
Usually experiences pain/discomfort ^f	36%	34%	52%	29%	48%	35%	61%
Median (IQR)							
Social support availability scale (0-100) ^g	87 (74-96)	88 (76-97)	71 (55-86)	90 (78-97)	80 (68-92)	87 (75-96)	72 (57-87)
Fruit and vegetable consumption (times/day) ^d	3.4 (2.4-4.6)	3.4 (2.5-4.6)	3.0 (2.1-4.2)	3.4 (2.6-4.7)	3.3 (2.4-4.5)	3.4 (2.5-4.6)	3.0 (2.0-4.2)
Past week physical activity (PASE scale; 0-793) ^h	140 (94-198)	142 (96-200)	121 (76-181)	145 (99-202)	132 (86-191)	141 (95-199)	115 (70-173)
Number of chronic conditions	4 (2-6)	3 (2-5)	5 (3-8)	3 (2-5)	4 (2-7)	3 (2-5)	6 (4-9)

Note. Weighted percentages are shown.

^a1,382 observations missing

^b1,941 observations missing

^c2,832 observations missing

^d<100 observations missing

^e176 observations missing

^f1,343 observations missing

^g606 observations missing

^h1,570 observations missing.

K10 = Kessler Psychological Distress Scale; SD = standard deviation; IQR = interquartile range; PASE = Physical Activity Scale for the Elderly

Table 2. Associations between sleep problems and psychological well-being in the Canadian Longitudinal Study on Aging (n = 30,097)

	n	n with Outcome	Weighted %	Model 1 ^a		Model 2 ^b	
				PR	95% CI	PR	95% CI
Dissatisfaction with life							
Sleep duration							
Short (< 6 h) vs. normal	3,914	846	20%	2.19	(2.02-2.37)	1.38	(1.27-1.49)
Long (> 8 h) vs. normal	1,616	216	13%	1.46	(1.26-1.70)	1.07	(0.93-1.23)
Sleep dissatisfaction	7,636	1657	21%	2.64	(2.47-2.83)	1.85	(1.73-1.99)
Insomnia symptoms	9,283	1741	18%	2.18	(2.04-2.34)	1.54	(1.43-1.65)
Daytime impairment	5,052	1341	25%	3.01	(2.81-3.23)	1.83	(1.70-1.97)
Psychological distress (K10 score ≥ 15)							
Sleep duration							
Short (< 6 h) vs. normal	3,669	1,778	50%	1.45	(1.39-1.51)	1.16	(1.11-1.21)
Long (> 8 h) vs. normal	1,518	631	44%	1.29	(1.21-1.38)	1.13	(1.06-1.20)
Sleep dissatisfaction	7,247	3,611	52%	1.60	(1.55-1.66)	1.31	(1.27-1.36)
Insomnia symptoms	8,801	4,150	49%	1.53	(1.48-1.59)	1.28	(1.24-1.32)
Daytime impairment	4,769	2,785	60%	1.83	(1.76-1.89)	1.40	(1.35-1.45)
Poor/fair self-reported mental health							
Sleep duration							
Short (< 6 h) vs. normal	3,959	429	10%	2.49	(2.20-2.81)	1.42	(1.25-1.61)
Long (> 8 h) vs. normal	1,634	156	9%	2.36	(1.97-2.83)	1.53	(1.28-1.82)
Sleep dissatisfaction	7,717	826	11%	2.96	(2.66-3.29)	1.88	(1.68-2.09)
Insomnia symptoms	9,392	886	9%	2.59	(2.33-2.89)	1.65	(1.47-1.84)
Daytime impairment	5,117	764	15%	4.21	(3.79-4.67)	2.27	(2.02-2.55)

Note. ^aModel 1 - unadjusted

^bModel 2 - adjusted for all socio-demographic, lifestyle, and clinical covariates.

PR = prevalence ratio; CI = confidence interval; K10 = Kessler Psychological Distress Scale.

Table 3. Modification of the associations between sleep problems and psychological well-being by sex in the Canadian Longitudinal Study on Aging

	Males			Females			Male/Female Ratio of PRs (95% CI)
	<i>n</i> ^a	<i>n</i> with outcome ^a	PR (95% CI) ^a	<i>n</i> ^a	<i>n</i> with outcome ^a	PR (95% CI) ^a	
Dissatisfaction with life							
Sleep duration							
Short vs. normal	1718	344	1.32 (1.16–1.50)	2196	502	1.42 (1.28–1.58)	0.93 (0.79–1.09)
Long vs. normal	676	82	1.07 (0.86–1.33)	940	134	1.07 (0.89–1.27)	1.00 (0.76–1.33)
Sleep dissatisfaction	3268	689	1.88 (1.70–2.09)	3400	968	1.83 (1.67–2.00)	1.03 (0.90–1.18)
Insomnia symptoms	3872	703	1.59 (1.43–1.77)	5411	1038	1.50 (1.37–1.64)	1.06 (0.93–1.22)
Daytime impairment	1968	522	1.88 (1.68–2.10)	3084	819	1.80 (1.63–1.97)	1.05 (0.91–1.20)
Psychological distress (K10 ≥ 15)							
Sleep duration							
Short vs. normal	1604	745	1.20 (1.12–1.28)	2065	1033	1.13 (1.07–1.19)	1.06 (0.98–1.15)
Long vs. normal	633	225	1.12 (1.01–1.25)	885	406	1.13 (1.05–1.22)	0.99 (0.87–1.13)
Sleep dissatisfaction	3091	1489	1.40 (1.32–1.47)	4156	2122	1.25 (1.20–1.31)	1.12 (1.04–1.19)
Insomnia symptoms	3671	1669	1.36 (1.29–1.43)	5130	2481	1.22 (1.17–1.27)	1.11 (1.04–1.19)
Daytime impairment	1855	1092	1.53 (1.45–1.62)	2914	1693	1.31 (1.25–1.37)	1.18 (1.10–1.26)
Poor/fair self-reported mental health							
Sleep duration							
Short vs. normal	1731	196	1.46 (1.21–1.75)	2228	233	1.38 (1.17–1.63)	1.05 (0.83–1.34)
Long vs. normal	683	60	1.57 (1.21–2.03)	951	96	1.50 (1.19–1.90)	1.04 (0.74–1.47)
Sleep dissatisfaction	3298	371	1.92 (1.64–2.25)	4419	455	1.84 (1.60–2.12)	1.04 (0.85–1.28)
Insomnia symptoms	3910	379	1.69 (1.44–1.99)	5482	507	1.61 (1.39–1.86)	1.05 (0.85–1.30)
Daytime impairment	1988	320	2.37 (2.01–2.79)	3129	444	2.18 (1.88–2.53)	1.09 (0.88–1.34)

Note. ^ans shown are unweighted

^bPRs adjusted for socio-demographic, lifestyle, and clinical covariates.

PR = prevalence ratio; CI = confidence interval; K10 = Kessler Psychological Distress Scale.

Paunio et al., 2009; Štefan, Vučetić, Vrgoč, & Sporiš, 2018; Stranges et al., 2008, 2012; Wang et al., 2017; Zhi et al., 2016). These findings are also consistent with Canadian evidence among adults, showing that short and long sleep duration and insomnia symptoms are associated with poor self-reported mental health and dissatisfaction with life (Chaput et al., 2018; Dai et al., 2020). This study builds on this prior international and Canadian evidence to show that sleep dissatisfaction and daytime impairment caused by insomnia symptoms are also significant and independent correlates of poor psychological well-being. Importantly, this study observed that daytime impairment caused by insomnia symptoms was among the strongest correlates of poor psychological well-being, suggesting that this particular sleep problem is an important factor in well-being, although often overlooked in prior studies.

Mechanisms underlying associations between sleep problems and psychological well-being may be related to the hypothalamic–pituitary–adrenal (HPA) axis, particularly for psychological distress. Sleep and stress share pathways through the HPA axis and interact bidirectionally (Hirshkowitz et al., 2015). Sleep deprivation and insomnia lead to hyperactivation of the HPA axis (Buckley & Schatzberg, 2005; Hirotsu, Tufik, & Andersen, 2015; Meerlo, Sgoifo, & Suchecki, 2008; Rodenbeck & Hajak, 2001). The HPA axis is also one of the main systems activated in the stress response, affecting brain function, cognition, and mood (Johnson, Kamilaris, Chrousos, & Gold, 1992; Meerlo et al., 2008). It has been

hypothesized that sleep problems, and short sleep duration in particular, may sensitize people to stress-related disorders, including mood disorders, by acting on stress systems such as dysregulation of the HPA axis (Meerlo et al., 2008). However, pathways connecting long sleep duration with poor well-being may differ from other sleep domains, as it has been suggested that long sleep is a consequence rather than a cause of poorer health conditions observed in long sleepers, such as depression, obesity, hypertension, and other chronic conditions (Magee et al., 2011; Nicholson et al., 2020; Patel, Malhotra, Gottlieb, White, & Hu, 2006; Stranges et al., 2008; Zhai, Zhang, & Zhang, 2015).

This study found some evidence of effect modification by sex and age. Associations among sleep dissatisfaction, insomnia symptoms, and daytime impairment and psychological distress were stronger in males than in females, contrary to evidence for other health outcomes, which generally show stronger effects in women (Cappuccio et al., 2007; Meisinger et al., 2007; Smiley et al., 2019; Stang et al., 2008; Stranges et al., 2010). This study's finding of stronger associations between sleep and psychological distress in males may be related to HPA axis activation, as evidence suggests higher hormone responses, including adrenocorticotropin and cortisol responses, in older males compared with females (Uhart, 2006; Kudielka et al., 1998; Traustadottir et al., 2003). Some effect modification by age was also observed, with stronger associations between daytime impairment and dissatisfaction with life at

Table 4. Modification of the associations between sleep problems and psychological well-being by age in the Canadian Longitudinal Study on Aging

	Age × Sleep (10-Year Change) ^a	Associations with Sleep Problems at Specific Ages ^a				
		Age 45	Age 55	Age 65	Age 75	Age 85
		PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Dissatisfaction with life						
Sleep duration						
Short vs. normal	1.02 (0.95–1.10)	1.34 (1.15–1.55)	1.36 (1.24–1.50)	1.40 (1.29–1.51)	1.43 (1.25–1.62)	1.46 (1.20–1.77)
Long vs. normal	0.87 (0.75–1.00)	1.30 (1.00–1.71)	1.13 (0.96–1.33)	0.98 (0.85–1.13)	0.85 (0.67–1.08)	0.74 (0.51–1.06)
Sleep dissatisfaction	1.03 (0.97–1.10)	1.78 (1.57–2.02)	1.84 (1.70–1.99)	1.89 (1.76–2.03)	1.95 (1.75–2.18)	2.02 (1.71–2.38)
Insomnia symptoms	1.06 (0.99–1.13)	1.42 (1.25–1.62)	1.51 (1.39–1.63)	1.60 (1.49–1.72)	1.69 (1.52–1.89)	1.79 (1.52–2.12)
Daytime impairment	1.11 (1.04–1.19)	1.60 (1.40–1.82)	1.77 (1.63–1.93)	1.97 (1.83–2.13)	2.19 (1.95–2.46)	2.44 (2.05–2.90)
Psychological distress						
Sleep duration						
Short vs. normal	1.02 (0.98–1.07)	1.12 (1.04–1.21)	1.15 (1.10–1.21)	1.18 (1.13–1.23)	1.20 (1.12–1.29)	1.23 (1.11–1.37)
Long vs. normal	0.98 (0.93–1.04)	1.16 (1.03–1.31)	1.14 (1.06–1.23)	1.12 (1.05–1.20)	1.10 (1.00–1.22)	1.08 (0.93–1.26)
Sleep dissatisfaction	1.02 (0.99–1.06)	1.27 (1.19–1.35)	1.30 (1.25–1.35)	1.33 (1.29–1.38)	1.36 (1.29–1.44)	1.40 (1.28–1.52)
Insomnia symptoms	1.02 (0.99–1.05)	1.25 (1.17–1.33)	1.27 (1.22–1.32)	1.30 (1.25–1.34)	1.32 (1.25–1.40)	1.33 (1.24–1.46)
Daytime impairment	1.03 (1.00–1.07)	1.34 (1.25–1.42)	1.38 (1.33–1.44)	1.43 (1.38–1.48)	1.48 (1.39–1.56)	1.53 (1.40–1.66)
Poor self-reported mental health						
Sleep duration						
Short vs. normal	0.96 (0.84–1.09)	1.50 (1.19–1.89)	1.44 (1.25–1.65)	1.38 (1.21–1.57)	1.32 (1.06–1.64)	1.26 (0.91–1.76)
Long vs. normal	0.91 (0.76–1.09)	1.73 (1.24–2.42)	1.57 (1.29–1.93)	1.43 (1.19–1.72)	1.30 (0.95–1.76)	1.17 (0.74–1.87)
Sleep dissatisfaction	0.93 (0.83–1.03)	2.07 (1.70–2.52)	1.92 (1.70–2.17)	1.78 (1.59–2.00)	1.65 (1.37–1.99)	1.53 (1.16–2.03)
Insomnia symptoms	0.89 (0.80–0.99)	1.93 (1.57–2.37)	1.71 (1.51–1.94)	1.52 (1.36–1.71)	1.35 (1.13–1.62)	1.20 (0.91–1.59)
Daytime impairment	0.98 (0.88–1.10)	2.32 (1.89–2.85)	2.28 (2.00–2.59)	2.24 (1.99–2.52)	2.20 (1.82–2.66)	2.16 (1.63–2.87)

Note. ^aPRs adjusted for socio-demographic, lifestyle, and clinical covariates.
PR = prevalence ratio; CI = confidence interval;

older ages, whereas associations between insomnia symptoms and poor/fair self-reported mental health decreased with age. It is of note that this study observed consistent associations between abnormal sleep duration and well-being across all ages. The National Sleep Foundation states that sleep from 5 to 6 hours may be appropriate for older adults and that long duration cut-offs of 10 hours and 9 hours may be appropriate for adults and older adults, respectively (Hirshkowitz et al., 2015). Findings from this study suggest that sleep of less than 6 hours and more than 8 hours has detrimental associations with well-being in middle-aged and older adults. Although the strength of some associations between

sleep and well-being varied across sex and age, based on the specific sleep problem and well-being measurement, most associations were significant across both sexes and all ages, suggesting that sleep problems are relevant for well-being in both sexes and from middle age to older adulthood.

Strengths and Limitations

This study used a large, national sample to examine associations between sleep problems and psychological well-being among middle-aged and older adults in Canada. Findings from this study

are strengthened by the examination of multiple dimensions of sleep patterns, providing an in-depth analysis of the associations between sleep problems and psychological well-being. This study also provides further insight into the differences in associations between sleep problems and well-being across sex and age groups.

Because of the cross-sectional study design, this study was unable to determine the direction of the associations between sleep problems and psychological well-being. Self-reported sleep duration was used, which tends to overestimate objective sleep duration (Jackson, Patel, Jackson, Lutsey, & Redline, 2018). Studies using a longitudinal approach and objective measures of sleep duration are warranted, particularly to investigate the effects of changes to sleep patterns over time. Also, whereas the National Sleep Foundation guidelines were consulted to define sleep duration, individual sleep needs may differ from guideline recommendations. There are some limitations to the representativeness of the CLSA sample as compared with the Canadian population: the CLSA excludes residents of the Canadian territories and some remote regions, people living on First Nations reserves, full-time members of the Canadian Armed Forces, and people who are institutionalized at baseline (e.g., in long-term care). Inclusion criteria for the CLSA requires participants to complete interviews in English or French, and therefore some populations such as recent migrants and people from ethnic minority groups, as well as individuals with disabilities such as hearing problems, memory impairment, and mobility issues, may be under-represented (Raina et al., 2019). Therefore, findings from this study may not be generalizable to these groups. Comparison of the CLSA sample with other Canadian data sources suggest that the CLSA Comprehensive Cohort is more educated with a higher household income, and has better self-rated general health (Raina et al., 2019). Data on sleep and psychotropic medication use were unavailable from the CLSA at the time this study was conducted; therefore, this study was unable to account for medication use in the analysis.

Conclusions

Findings from this study suggest that in an aging population, sleep problems, including abnormal sleep duration, sleep dissatisfaction, insomnia symptoms, and associated daytime impairment, are important independent correlates of psychological well-being, in both sexes and across the lifespan. Overall, these findings, alongside prior Canadian evidence, highlight the importance of common sleep problems for psychological well-being in the Canadian population, and among middle-aged and older adults in particular. Longitudinal studies examining the temporality of the associations between sleep problems and psychological well-being, as well as the effect of changes in sleep patterns on well-being, are warranted.

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