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Original quantitative research

Associations of sleep duration and sleep quality with indicators of mental health among youth and adults: findings from the 2015 Canadian Community Health Survey

Zahra M. Clayborne, PhD (1,2); Raelyne L. Dopko, PhD (1); Chinchin Wang, MSc (1,3,4); Marisol T. Betancourt, MSc, MD (1); Karen C. Roberts, MSc (1); Colin A. Capaldi, PhD (1)

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Abstract

Introduction: A growing number of Canadian studies have examined the link between sleep and mental health. This research builds upon that work by investigating associations of sleep duration and quality with positive mental health (PMH) and mental illness and suicidal ideation (MI/SI) outcomes among youth and adults from three Canadian provinces (i.e. Ontario, Manitoba and Saskatchewan).

Methods: Using cross-sectional data from respondents 12 years and older (n = 18 683) who were asked questions on their sleep in the 2015 Canadian Community Health Survey – Annual Component, we conducted unadjusted and adjusted logistic regressions with self-reported measures of sleep duration and sleep quality as independent variables and a range of PMH (e.g. high self-rated mental health) and MI/SI indicators (e.g. mood disorder diagnosis) as dependent variables. Analyses were conducted of all complete cases and also stratified by sex and age group.

Results: Good sleep quality was associated with higher odds of PMH indicators (adjusted odds ratio [aOR]: 1.52–4.24) and lower odds of MI/SI indicators (aOR: 0.23–0.47); associations remained significant when analyses were stratified. Meeting sleep duration recommendations was positively associated with PMH indicators (aOR: 1.27–1.56) and negatively associated with MI/SI indicators (aOR: 0.41–0.80), but some associations did not remain significant when stratified.

Conclusions: This study provides support for associations between sleep duration and quality and indicators of PMH and MI/SI. Findings can inform future research and surveillance efforts that monitor sleep behaviours and indicators of PMH and MI/SI.

Keywords: *sleep, positive mental health, anxiety disorders, mood disorders, population health, suicidal ideation, suicide*

Highlights

- We examined associations between self-reported measures of sleep (duration, quality) and mental health outcomes among youth (12–17 years old) and adults (18 years and older) in three Canadian provinces.
- Good sleep quality was consistently associated with higher odds of positive mental health and lower odds of mental illness and suicidal ideation across all sex and age groups.
- Meeting sleep duration recommendations was associated with higher odds of positive mental health and lower odds of mental illness and suicidal ideation overall, although these associations were not consistent across sex and age groups.

Introduction

Insufficient sleep and poor sleep quality are common issues. Over one-third of Canadians between 5 and 79 years old fail to obtain the daily recommended amount of sleep.[1] Furthermore, one-quarter of adults aged 18 to 79 and one-tenth of children and youth aged 5 to 17 years in Canada report problems with falling or staying asleep most or all of the time.[2,3] Research suggests that poor sleep is associated with a range of adverse physical health outcomes, including poor self-rated health, obesity, cardiovascular disease and increased risk of all-cause mortality.[4-7]

Previous studies suggest that poor sleep is associated with various negative psychological outcomes. For example, international research has shown that poor sleep quality is associated with increased risk of depression and anxiety throughout the lifespan.[8,9] Furthermore, researchers have observed a U-shaped association between sleep duration and risk of depressed mood and suicidal behaviour in youth and adults, with the greatest risk at short (e.g. less than 6–7 hours for adults) and long (e.g. more than 8–9 hours for adults) sleep durations.[10-12] Among adults in Canada,

Author references:

1. Public Health Agency of Canada, Ottawa, Ontario, Canada
2. School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario, Canada
3. Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, Quebec, Canada
4. Centre for Clinical Epidemiology, Lady Davis Institute for Medical Research, Montréal, Quebec, Canada

Correspondence: Colin A. Capaldi, Public Health Agency of Canada, 785 Carling Ave, Ottawa, ON K1A 0K9; Tel: 613-299-7714; Email: colin.capaldi@phac-aspc.gc.ca

associations between long sleep duration and diagnosis of major depression,[13,14] short sleep duration and chronic stress[15] and poor sleep quality and self-reported symptoms of depression and anxiety[16] have been documented. Among youth in Canada, meeting sleep duration recommendations has been associated with lower stress,[17] and additional time spent sleeping has been associated with fewer symptoms of anxiety and depression for those who slept less than 8 hours each day.[18]

Fewer studies have examined the associations between sleep and positive mental health (PMH). Research among young adults in South Korea found that better sleep quality was associated with greater life satisfaction,[19] and a recent meta-analysis of studies from several countries reported that adequate sleep duration among adolescents was generally associated with positive mood.[20] However, Canadian studies have had mixed findings. One reported that short and long sleep durations were associated with lower self-rated mental health (SRMH), community belonging and life satisfaction among adults, even after adjusting for numerous covariates.[21] Another study of adults with mood and/or anxiety disorders found that the association of short sleep duration (< 6 hours) with lower SRMH and life satisfaction did not persist after controlling for other variables, and long sleep duration was not associated with either PMH outcome in unadjusted or adjusted analyses.[22]

Sleep and PMH research findings in Canada have also varied by age group. One study reported associations between short and long sleep durations and lower SRMH and community belonging in adults, but only the association between long sleep duration and lower community belonging was statistically significant for older adults aged 65 to 79 years.[13] Furthermore, the authors reported that short sleep duration was not significantly associated with SRMH or community belonging for youth aged 14 to 17 years (long sleep duration was not assessed in this age group).[13] Nevertheless, other findings involving youth suggest that meeting sleep duration recommendations is associated with high SRMH[17] and that additional time spent sleeping is associated with greater psychological well-being among youth who slept less than 8 hours each day.[18]

Given these varied findings, there is a need for more population-based research examining associations between good sleep quality, meeting sleep duration recommendations and a breadth of PMH and mental illness and suicidal ideation (MI/SI) indicators among Canadian youth, adults and older adults. Indeed, exploring the association between sleep and well-being was a research need identified in the process of developing the Canadian 24-Hour Movement Guidelines.[23,24]

PMH and mental illness are not at opposite ends of the same spectrum; rather, they represent distinct constructs that can have unique antecedents and consequences.[25,26] It is possible to concurrently experience high/low levels of PMH and high/low levels of mental illness,[22,25] which strengthens the argument for examining both constructs.

Preventing or reducing the impacts of physical and mental ill-health and promoting PMH are important priorities for research and public health strategies in Canada and globally.[27-29] Both poor sleep quality and duration and mental health difficulties carry substantial economic and societal burdens, including reduced life expectancy, lost productivity and high health care costs.[30-32] Conversely, PMH has been shown to protect against the onset and lessen the severity of both mental and physical illnesses.[33,34] Examining the associations between sleep and several PMH and MI/SI indicators in a large Canadian sample can inform future surveillance and research on sleep behaviours and mental health in the population.

The aim of this study was to examine the associations of sleep duration and sleep quality with indicators of PMH and MI/SI among individuals aged 12 years and older from three Canadian provinces. We anticipated that individuals would be more likely to report PMH and less likely to report MI/SI if they met sleep duration recommendations or had good sleep quality.

Methods

Data and participants

We analyzed data from the 2015 Canadian Community Health Survey (CCHS) – Annual Component.[35] The CCHS is a voluntary cross-sectional survey conducted by Statistics Canada to obtain representative estimates of health-related information on the target population of community-dwelling individuals aged 12 years and older living in all Canadian provinces and territories. We selected the 2015 CCHS as this dataset was the most recent one with a variety of sleep and mental health measures.

Data from the 2015 CCHS were collected from January to December 2015 using computer-assisted telephone and personal interviews. The CCHS uses a list frame based on the Canadian Child Tax Benefit to sample youth aged 12 to 17 years and an area frame used by the Canadian Labour Force Survey to sample households with adults aged 18 years and older. Excluded from CCHS data collection were institutionalized individuals, full-time members of the Canadian Forces and people living in foster homes, on reserves and other Indigenous settlements, or in two health regions in Quebec; these exclusions represent just under 3% of the Canadian population.

Our analyses were limited to respondents from Ontario, Manitoba and Saskatchewan as the sleep module was optional content that was only asked of respondents from these three provinces (n = 18 683). The overall CCHS 2015 response rate was 57.5%, and response rates from Ontario, Manitoba and Saskatchewan were 55.7%, 63.8% and 61.5%, respectively.

Measures

Sleep measures

Sleep duration was ascertained with the question, "How long do you usually spend sleeping each night?" Response options started at "under 2 hours" and increased in hourly intervals (e.g. "2 hours to less than 3 hours") up to "12 hours or more." We constructed a dichotomous variable to identify respondents who met age-specific sleep recommendations, based on the sleep times from the Canadian 24-Hour Movement Guidelines.[23,24] Using the suggested surveillance cut-points for defining adherence that were released with the 24-Hour Movement Guidelines,[24] we operationalized adherence to the recommendation of 7 to 9 hours of sleep per night for adults (18–64 years) as 7 hours 0 minutes to 9 hours 59 minutes (i.e. response options "7 hours to less than 8 hours" to "9 hours to less than 10 hours"), and adherence to the recommendation of 7 to 8 hours of sleep per night for older adults

(≥65 years) as 7 hours 0 minutes to 8 hours 59 minutes (i.e. response options "7 hours to less than 8 hours" to "8 hours to less than 9 hours").

Suggested surveillance cut-points for defining adherence to sleep duration recommendations are not as specific for youth (i.e. not to the exact number of minutes).[23] We used an approach consistent with that for adults: we operationalized adherence to the recommendation of 9 to 11 hours per night for youth 12 to 13 years old as 9 hours 0 minutes to 11 hours 59 minutes (i.e. response options "9 hours to less than 10 hours" to "11 hours to less than 12 hours"), and adherence to the recommendation of 8 to 10 hours per night for youth 14 to 17 years old as 8 hours 0 minutes to 10 hours 59 minutes (i.e. response options "8 hours to less than 9 hours" to "10 hours to less than 11 hours"). Those in categories above or below the recommended ranges were classified as not meeting recommendations.

The first sleep quality indicator was assessed with the question, "How often do you have trouble going to sleep or staying asleep?" Response options included "never," "rarely," "sometimes," "most of the time" and "all of the time." Similar to the Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicators and previous research,[2,21,36,37] respondents who answered "never," "rarely" or "sometimes" were categorized as having few difficulties going to sleep or staying asleep.

The second sleep quality indicator was assessed with the question, "How often do you find your sleep refreshing?" Response options included "never," "rarely," "sometimes," "most of the time" and "all of the time." Mirroring the coding of our first sleep quality indicator, respondents who answered "most of the time" or "all of the time" were categorized as having refreshing sleep.

MI/SI measures

The four MI/SI measures we examine in the current study have been previously used by the Public Health Agency of Canada (PHAC) in reporting initiatives like the Health Inequalities Data Tool.[38]

Respondents were asked if they have been diagnosed, by a health professional, with various conditions that have lasted or are expected to last 6 months or more. One of the questions was, "Do you have a mood disorder such as depression, bipolar disorder, mania or dysthymia?" Respondents who answered "yes" were categorized as diagnosed with a mood disorder.[38] Respondents were similarly asked, "Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?" Respondents who answered "yes" were categorized as diagnosed with an anxiety disorder.[38]

Lifetime and recent suicidal ideation questions were asked of respondents aged 15 years or older. Lifetime suicidal ideation was assessed via the question, "Have you ever seriously contemplated suicide?" Individuals who responded "yes" were coded as having a lifetime history of suicidal ideation.[38-40] Those who answered "yes" were asked, "Has this happened in the past 12 months?" Individuals who answered "yes" to the second question were coded as having recent suicidal ideation.[38-40] Due to small cell sizes, we examined recent suicidal ideation in overall and sex-stratified analyses, but not in analyses stratified by age group.

PMH measures

The five PMH measures we examine in the current study have been previously used by PHAC to monitor the PMH of Canadians in the Positive Mental Health Surveillance Indicator Framework (PMHSIF).[41,42]

SRMH was examined using the question, "In general, would you say your mental health is …?" Response options included "excellent," "very good," "good," "fair" and "poor." Respondents who answered "excellent" or "very good" were categorized as having high SRMH.

Life satisfaction was examined using the question, "In the past month, how often did you feel: satisfied with your life?" This question was based on the Mental Health Continuum Short-Form (MHC-SF).[43] Response options for the MHC-SF included "every day," "almost every day," "about 2 or 3 times a week," "about once a week," "once or twice" or "never." Individuals who answered "every day" or "almost every day" were categorized as having high life satisfaction.[41]

Happiness was examined using the question, "In the past month, how often did you feel: happy?" based on the MHC-SF.[43] Individuals who answered "every day" or "almost every day" were categorized as having high levels of happiness.[41]

Psychological well-being was measured using six items from the MHC-SF that asked about feelings of self-acceptance, environmental mastery, positive relations with others, personal growth, autonomy and purpose in life during the past month.[43] In keeping with the PMHSIF for adults and previous research,[41,42,44] we converted response options into number of days in the past month as follows: "every day" as 28 days (4 weeks × 7 days per week); "almost every day" as 20 days (4 weeks × 5 days per week); "about 2 or 3 times a week" as 10 days (4 weeks × 2.5 days per week); "about once a week" as 4 days (4 weeks × 1 day per week); "once or twice" as 1.5 days; and "never" as 0 days. We generated mean scores after converting the response options and categorized scores of 20 and greater (corresponding to experiencing psychological well-being, on average, "almost every day" or more frequently) as high psychological well-being.

Community belonging was examined using the question, "How would you describe your sense of belonging to your local community? Would you say it is …?" Response options included "very strong," "somewhat strong," "somewhat weak" and "very weak." We categorized individuals who responded with "very strong" or "somewhat strong" as having high community belonging.

Covariates

We adjusted for several key sociodemographic variables in the logistic regression analyses: sex (male, female); age (youth 12–17 years, adults 18–64 years, older adults 65 years or greater); immigrant status (yes, no); household income adequacy quintile (based on the adjusted ratio of the respondent's household income to the low-income cut-off for their community and household size); place of residence (population centre, rural area); and racialized background (yes, no).

Individuals who reported being born in Canada were classified as non-immigrants, and non-permanent residents and landed immigrants as immigrants. Household income was either reported by the respondent (or, for youth, "the person most knowledgeable") or imputed by Statistics Canada. Population centres were defined

as areas with a population density of at least 400/km^2 and a population concentration of at least 1000.

Individuals who identified as White only were coded as non-racialized; those who identified as other ethnicities or as belonging to other cultural backgrounds (e.g. South Asian, Chinese, Black) were coded as racialized. (Those who identified as First Nations, Métis or Inuk [Inuit] were not asked this question about their ethnic or cultural background and were excluded from regression analyses.)

These covariates were selected a priori as PHAC surveillance tools frequently break down results by these sociodemographic characteristics, revealing inequalities in some mental health outcomes in these groups.[2,38,39,42,45]

Analyses

Descriptive statistics for the eligible sample were reported using weighted percentages with 95% confidence intervals (CIs). Unadjusted logistic regressions and logistic regressions adjusted for covariates were conducted to examine the associations between sleep variables and mental health outcomes. These regression analyses included only individuals who provided complete data on all the study variables, that is, 89.2% of eligible participants (n = 16 674); those who responded "don't know" or gave no response on one or more items were removed from the regression analyses. Odds ratios (ORs) with 95% CIs that do not include 1.00 were considered statistically significant.

To account for complex survey design, we used sampling weights from Statistics Canada to generate estimates representative of the population[35] and we estimated variances using bootstrap weights that were also provided by Statistics Canada. We calculated overall estimates as well as results stratified by sex (male and female) and age (youth aged 12–17 years, adults aged 18–64 years and older adults aged ≥65 years).

Analyses were conducted using SAS Enterprise Guide version 7.1 (SAS Institute, Cary, NC, USA).

Results

Descriptive statistics (sociodemographic, sleep, PMH and MI/SI measures) are shown in Table 1. Most individuals reported good sleep quality: 85.3% reported few difficulties going to sleep or staying asleep, and 61.9% reported refreshing sleep. Half (51.0%) met age-specific sleep duration recommendations.

Small proportions of individuals reported lifetime suicidal ideation (10.8%), suicidal ideation in the past 12 months (2.2%), and being diagnosed with a mood disorder (8.1%) or an anxiety disorder (8.0%). Most individuals reported high SRMH (72.4%), life satisfaction (87.4%), psychological well-being (70.9%) and community belonging (70.6%) as well as high levels of happiness (86.2%).

Sex-stratified and age-stratified descriptive statistics (sleep, PMH and MI/SI measures) are shown in Table 2.

Sleep duration recommendations and mental health

Compared to not meeting sleep recommendations, meeting sleep duration recommendations was associated with overall lower odds of all MI/SI variables and higher odds of all PMH variables, prior to and after covariate adjustment (see Table 3).

In sex-stratified analyses, meeting sleep recommendations was associated with lower odds of reporting an anxiety disorder diagnosis and lifetime suicidal ideation and higher odds of high SRMH, life satisfaction and happiness in unadjusted and adjusted analyses for both males and females. Among females (but not males), meeting sleep recommendations was associated with lower odds of being diagnosed with a mood disorder and reporting suicidal ideation in the past 12 months and higher odds of reporting high psychological well-being in both unadjusted and adjusted analyses. Among males (but not females), meeting sleep recommendations was associated with higher odds of reporting high community belonging in unadjusted and adjusted analyses (see Table 3).

Meeting sleep recommendations was associated with higher odds of reporting high SRMH and community belonging across all age groups in unadjusted and adjusted analyses. Among youth, meeting sleep recommendations was also associated with lower odds of reporting lifetime suicidal ideation and higher odds of reporting high levels of happiness in unadjusted and adjusted analyses, and high psychological well-being in unadjusted analyses. Among adults, meeting sleep recommendations was associated with lower odds of all MI/SI variables and higher odds of all PMH variables in unadjusted and adjusted analyses. In older adults, meeting sleep recommendations was also associated with higher odds of reporting high life satisfaction and high levels of happiness in unadjusted and adjusted analyses (see Table 4).

Sleep quality and mental health

Reporting good sleep quality (measured by either sleep quality indicator) was associated with overall lower odds of all MI/SI variables and higher odds of all PMH variables in both unadjusted and adjusted analyses. All unadjusted and adjusted associations remained statistically significant after stratifying analyses by sex and by age group (see Tables 5, 6, 7 and 8).

Discussion

We examined the associations of sleep duration and sleep quality with a number of PMH and MI/SI indicators in a large sample of Canadians living in Ontario, Manitoba and Saskatchewan. Overall, good sleep quality and meeting sleep duration recommendations were positively associated with PMH outcomes and negatively associated with MI/SI outcomes. Whereas the associations between measures of sleep quality and PMH and MI/SI outcomes were consistent across sex and age groups, associations between meeting sleep duration recommendations and some mental health outcomes were inconsistent in sex- and age-stratified analyses.

Poor sleep quality was prevalent among individuals in the current study: over one-tenth of the population report experiencing frequent difficulties with falling or staying asleep, and over one-third report that their sleep is often not refreshing. This is of concern because our findings demonstrate strong and consistent associations between reporting good sleep quality and higher odds of PMH and lower odds of MI/SI across sex and age groups. Other Canadian studies have also reported associations between poor sleep quality and life dissatisfaction, poorer SRMH and lower community belonging among adults 18 years and older in Nova Scotia, Quebec,

TABLE 1
Descriptive characteristics of eligible study sample, CCHS 2015 (n = 18 683)

Variables	%[a]	95% LCL	95% UCL
Sociodemographic characteristics			
Sex (n = 18 683)			
Male	48.9	48.6	49.1
Female	51.1	50.9	51.4
Province (n = 18 683)			
Ontario	86.0	85.8	86.1
Manitoba	7.5	7.4	7.6
Saskatchewan	6.5	6.4	6.6
Age group in years (n = 18 683)			
12–17	7.6	7.4	7.7
18–24	11.1	10.3	11.9
25–44	31.5	30.4	32.5
45–64	33.3	32.6	34.0
≥65	16.5	16.3	16.8
Immigrant status (n = 18 342)			
Immigrant	30.7	29.4	32.0
Non-immigrant	69.3	68.0	70.6
Racialized background[b] (n = 17 264)			
No	73.4	72.2	74.7
Yes	26.6	25.3	27.8
Household income adequacy quintile (n = 18 646)			
Q1 (Lowest income)	19.9	18.8	21.0
Q2	19.7	18.7	20.8
Q3	20.1	19.1	21.1
Q4	20.1	19.1	21.1
Q5 (Highest income)	20.2	19.1	21.2
Place of residence (n = 18 683)			
Population centre	84.9	83.9	85.8
Rural area	15.1	14.2	16.1
Sleep measures			
Sleep duration, hours (n = 18 683)			
<3[d]	0.7[c]	0.4	0.9
3 to <4	1.3	1.1	1.6
4 to <5	3.8	3.4	4.3
5 to <6	11.6	10.7	12.4
6 to <7	26.7	25.6	27.9
7 to <8	32.9	31.7	34.1
8 to <9	17.4	16.5	18.3
9 to <10	3.6	3.1	4.1
10 to <11	1.2	1.0	1.5
11 to <12	0.4[c]	0.3	0.5
≥12	0.4[c]	0.2	0.5

Continued on the following page

TABLE 1 (continued)
Descriptive characteristics of eligible study sample, CCHS 2015 (n = 18 683)

Variables	%[a]	95% LCL	95% UCL
Met sleep duration recommendations (n = 18 683)			
Yes	51.0	49.7	52.3
No	49.0	47.7	50.3
Sleep difficulties (n = 18 683)			
Few	85.3	84.4	86.2
Never	26.7	25.5	28.0
Rarely	29.1	28.0	30.3
Sometimes	29.4	28.3	30.6
Frequent	14.7	13.8	15.6
Most of the time	10.5	9.8	11.3
All of the time	4.2	3.7	4.6
Refreshing sleep (n = 18 683)			
Yes	61.9	60.7	63.1
Most of the time	44.6	43.4	45.9
All of the time	17.2	16.2	18.3
No	38.1	36.9	39.3
Never	4.1	3.6	4.6
Rarely	10.1	9.3	10.8
Sometimes	24.0	22.9	25.1
Mental illness and suicidal ideation measures			
Mood disorder (n = 18 644)			
Yes	8.1	7.4	8.7
No	91.9	91.3	92.6
Anxiety disorder (n = 18 652)			
Yes	8.0	7.3	8.7
No	92.0	91.3	92.7
Suicidal ideation, lifetime[e] (n = 17 790)			
Yes	10.8	10.0	11.5
No	89.2	88.5	90.0
Suicidal ideation, past 12 months[e] (n = 17 785)			
Yes	2.2	1.8	2.5
No	97.8	97.5	98.2
Positive mental health measures			
High SRMH (n = 18 642)	72.4	71.2	73.6
High life satisfaction (n = 18 465)	87.4	86.4	88.3
High levels of happiness (n = 18 487)	86.2	85.2	87.1
High psychological well-being (n = 18 683)	70.9	69.7	72.1
High community belonging (n = 18 442)	70.6	69.4	71.9

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Percentages may not sum to the exact total due to rounding.

[a] All estimates weighted.

[b] Individuals who identified as White only were coded as non-racialized; those who identified as other ethnicities or as belonging to other cultural backgrounds (e.g. South Asian, Chinese, Black) were coded as racialized. Individuals who identified as Indigenous were excluded from this sociodemographic variable because they were not asked the question about their ethnic or cultural background.

[c] Estimate should be interpreted with caution due to high sampling variability (coefficient of variation between 15 and 25).

[d] The "<3 hours" sleep duration category combines response options "under 2 hours" and “2 hours to less than 3 hours."

[e] Item only asked of respondents ≥15 years old.

TABLE 2
Prevalence of sleep, mental illness, suicidal ideation and positive mental health outcomes in eligible study sample, stratified by sex and by age group, CCHS 2015 (n = 18 683)

Measures	Male (n = 8525)			Female (n = 10 158)			Youth[a] (n = 1573)			Adults[b] (n = 12 313)			Older adults[c] (n = 4797)		
	%[d]	95% LCL	95% UCL	%[d]	95% LCL	95% UCL	%[d]	95% LCL	95% UCL	%[d]	95% LCL	95% UCL	%[d]	95% LCL	95% UCL
Sleep															
Met sleep duration recommendations	50.9	49.0	52.7	51.1	49.3	52.9	43.7	40.0	47.4	52.1	50.5	53.6	49.3	46.8	51.9
Few sleep difficulties	88.5	87.4	89.6	82.2	80.9	83.5	91.3	89.5	93.1	84.8	83.7	85.8	84.9	83.2	86.6
Refreshing sleep	65.2	63.5	66.9	58.7	57.0	60.4	69.3	66.1	72.6	59.0	57.4	60.5	71.9	69.7	74.1
Mental illness and suicidal ideation															
Mood disorder	6.1	5.2	7.0	10.0	9.0	10.9	5.3	3.8	6.9	8.7	7.9	9.6	6.2	5.2	7.2
Anxiety disorder	5.5	4.7	6.3	10.4	9.3	11.4	7.7	5.6	9.9	8.6	7.8	9.5	5.2	4.2	6.1
Suicidal ideation, lifetime[e]	8.6	7.6	9.7	12.8	11.8	13.9	9.7	7.2	12.2	11.8	10.9	12.7	6.3	5.4	7.2
Suicidal ideation, past 12 months[e]	1.4	1.0	1.7	2.9	2.3	3.5	–	–	–	–	–	–	–	–	–
Positive mental health															
High SRMH	74.1	72.5	75.7	70.8	69.2	72.4	76.5	73.4	79.6	72.5	71.1	74.0	69.9	67.8	72.1
High life satisfaction	87.5	86.0	88.9	87.3	86.0	88.5	91.7	89.5	93.9	86.1	85.0	87.3	91.1	89.8	92.5
High levels of happiness	86.5	85.1	87.9	85.9	84.6	87.1	92.2	90.4	94.1	85.3	84.1	86.5	87.6	86.0	89.2
High psychological well-being	71.8	70.0	73.6	70.0	68.5	71.6	73.7	70.7	76.7	71.5	70.0	73.0	66.9	64.5	69.2
High community belonging	70.3	68.4	72.1	71.0	69.4	72.6	84.5	81.6	87.3	67.9	66.4	69.4	77.0	74.7	79.3

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Sample sizes differed for the different measures because of missing responses.

[a] 12–17 years old.

[b] 18–64 years old.

[c] ≥65 years old.

[d] All estimates weighted.

[e] Item only asked of respondents ≥15 years old.

TABLE 3
Associations between meeting (vs. not meeting) sleep duration recommendations and mental illness, suicidal ideation and positive mental health outcomes, overall and stratified by sex, CCHS 2015

Outcome	Overall (n = 16 674)						Males (n = 7649)						Females (n = 9025)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	**0.79**	**0.65**	**0.96**	**0.80**	**0.66**	**0.97**	0.94	0.65	1.35	0.96	0.68	1.37	**0.71**	**0.57**	**0.89**	**0.71**	**0.56**	**0.89**
Anxiety disorder	**0.68**	**0.56**	**0.85**	**0.66**	**0.54**	**0.81**	**0.66**	**0.48**	**0.91**	**0.63**	**0.46**	**0.88**	**0.70**	**0.54**	**0.92**	**0.67**	**0.51**	**0.87**
Suicidal ideation, lifetime[a]	**0.72**	**0.62**	**0.85**	**0.70**	**0.59**	**0.82**	**0.78**	**0.61**	**1.00**	**0.76**	**0.60**	**0.97**	**0.68**	**0.55**	**0.84**	**0.66**	**0.53**	**0.81**
Suicidal ideation, past 12 months[a]	**0.42**	**0.29**	**0.61**	**0.41**	**0.28**	**0.58**	0.72	0.40	1.28	0.60	0.35	1.04	**0.31**	**0.19**	**0.50**	**0.32**	**0.20**	**0.51**
Positive mental health																		
High SRMH	**1.44**	**1.27**	**1.62**	**1.46**	**1.29**	**1.64**	**1.46**	**1.22**	**1.76**	**1.46**	**1.22**	**1.76**	**1.41**	**1.19**	**1.67**	**1.43**	**1.20**	**1.70**
High life satisfaction	**1.54**	**1.30**	**1.83**	**1.56**	**1.32**	**1.85**	**1.32**	**1.04**	**1.69**	**1.31**	**1.02**	**1.68**	**1.80**	**1.42**	**2.28**	**1.82**	**1.44**	**2.31**
High levels of happiness	**1.56**	**1.31**	**1.86**	**1.55**	**1.31**	**1.84**	**1.35**	**1.05**	**1.73**	**1.31**	**1.02**	**1.69**	**1.79**	**1.41**	**2.28**	**1.81**	**1.42**	**2.29**
High psychological well-being	**1.31**	**1.16**	**1.49**	**1.33**	**1.18**	**1.50**	1.09	0.91	1.30	1.13	0.94	1.36	**1.57**	**1.33**	**1.85**	**1.55**	**1.31**	**1.83**
High community belonging	**1.23**	**1.09**	**1.39**	**1.27**	**1.12**	**1.43**	**1.38**	**1.14**	**1.66**	**1.43**	**1.19**	**1.73**	1.10	0.94	1.30	1.14	0.97	1.34

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) bolded. Covariates adjusted for in analyses include age group, sex (except in sex-stratified analyses), immigrant status, racialized background, place of residence and household income adequacy quintile.

[a] Restricted to respondents ≥15 years old.

TABLE 4
Associations between meeting (vs. not meeting) sleep duration recommendations and mental illness, suicidal ideation and positive mental health outcomes, stratified by age group, CCHS 2015

Outcome	Youth[a] (n = 1356)						Adults[b] (n = 11 030)						Older adults[c] (n = 4288)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	0.86	0.36	2.04	0.88	0.37	2.08	**0.75**	**0.60**	**0.95**	**0.75**	**0.59**	**0.95**	0.95	0.67	1.36	0.94	0.65	1.34
Anxiety disorder	0.77	0.38	1.57	0.83	0.42	1.64	**0.67**	**0.53**	**0.86**	**0.66**	**0.52**	**0.84**	0.72	0.45	1.15	0.68	0.43	1.10
Suicidal ideation, lifetime[d]	**0.47**	**0.23**	**0.94**	**0.42**	**0.22**	**0.81**	**0.71**	**0.59**	**0.85**	**0.70**	**0.58**	**0.84**	0.91	0.64	1.29	0.87	0.60	1.25
Positive mental health																		
High SRMH	**1.76**	**1.16**	**2.69**	**1.65**	**1.05**	**2.60**	**1.44**	**1.24**	**1.67**	**1.46**	**1.26**	**1.69**	**1.36**	**1.08**	**1.70**	**1.27**	**1.01**	**1.60**
High life satisfaction	1.63	0.73	3.62	1.39	0.58	3.35	**1.55**	**1.28**	**1.88**	**1.58**	**1.30**	**1.92**	**1.74**	**1.18**	**2.56**	**1.64**	**1.10**	**2.45**
High levels of happiness	**2.47**	**1.27**	**4.79**	**2.25**	**1.14**	**4.56**	**1.58**	**1.29**	**1.94**	**1.59**	**1.30**	**1.95**	**1.51**	**1.06**	**2.15**	**1.44**	**1.00**	**2.07**
High psychological well-being	**1.56**	**1.04**	**2.36**	1.35	0.87	2.10	**1.32**	**1.14**	**1.54**	**1.33**	**1.15**	**1.54**	1.22	0.98	1.51	1.19	0.96	1.47
High community belonging	**1.78**	**1.11**	**2.87**	**1.81**	**1.08**	**3.01**	**1.23**	**1.07**	**1.43**	**1.23**	**1.06**	**1.42**	**1.35**	**1.04**	**1.75**	**1.33**	**1.02**	**1.72**

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) bolded. Covariates adjusted for in analyses include sex, immigrant status, racialized background, place of residence and household income adequacy quintile.

[a] 12–17 years old.

[b] 18–64 years old.

[c] ≥65 years old.

[d] Restricted to respondents ≥15 years old.

TABLE 5
Associations between few (vs. frequent) difficulties falling or staying asleep and mental illness, suicidal ideation and positive mental health outcomes, overall and stratified by sex, CCHS 2015

Outcome	Overall (n = 16 674)						Males (n = 7649)						Females (n = 9025)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	**0.24**	**0.19**	**0.29**	**0.29**	**0.23**	**0.36**	**0.22**	**0.15**	**0.31**	**0.24**	**0.16**	**0.26**	**0.26**	**0.21**	**0.22**	**0.32**	**0.25**	**0.41**
Anxiety disorder	**0.27**	**0.22**	**0.34**	**0.31**	**0.25**	**0.38**	**0.26**	**0.26**	**0.37**	**0.28**	**0.20**	**0.40**	**0.31**	**0.24**	**0.40**	**0.33**	**0.25**	**0.43**
Suicidal ideation, lifetime[a]	**0.32**	**0.27**	**0.38**	**0.36**	**0.30**	**0.42**	**0.28**	**0.21**	**0.36**	**0.29**	**0.22**	**0.39**	**0.37**	**0.29**	**0.46**	**0.40**	**0.32**	**0.50**
Suicidal ideation, past 12 months[a]	**0.24**	**0.17**	**0.35**	**0.27**	**0.19**	**0.38**	**0.25**	**0.15**	**0.42**	**0.23**	**0.14**	**0.40**	**0.27**	**0.17**	**0.42**	**0.27**	**0.17**	**0.42**
Positive mental health																		
High SRMH	**2.64**	**2.28**	**3.06**	**2.54**	**2.19**	**2.95**	**2.53**	**2.01**	**3.19**	**2.42**	**1.90**	**3.08**	**2.69**	**2.21**	**2.37**	**2.64**	**2.16**	**3.22**
High life satisfaction	**3.56**	**2.94**	**4.30**	**3.77**	**3.10**	**4.57**	**4.42**	**3.35**	**5.84**	**4.69**	**3.52**	**6.25**	**3.08**	**2.38**	**3.98**	**3.23**	**2.51**	**4.14**
High levels of happiness	**3.34**	**2.77**	**4.02**	**3.46**	**2.85**	**4.19**	**3.78**	**2.88**	**4.97**	**4.00**	**2.99**	**5.36**	**3.09**	**2.41**	**3.94**	**3.14**	**2.45**	**4.03**
High psychological well-being	**2.01**	**1.74**	**2.31**	**2.02**	**1.75**	**2.33**	**2.19**	**1.74**	**2.77**	**2.20**	**1.75**	**2.78**	**1.87**	**1.55**	**2.26**	**1.91**	**1.58**	**2.31**
High community belonging	**1.58**	**1.36**	**1.82**	**1.57**	**1.36**	**1.82**	**1.52**	**1.22**	**1.88**	**1.49**	**1.18**	**1.86**	**1.65**	**1.35**	**2.01**	**1.64**	**1.34**	**2.01**

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) are bolded. Covariates adjusted for in analyses include age group, sex (except in sex-stratified analyses), immigrant status, racialized background, place of residence, and household income adequacy quintile.

[a] Restricted to respondents ≥15 years old.

TABLE 6
Associations between few (vs. frequent) difficulties falling or staying asleep and mental illness, suicidal ideation and positive mental health outcomes, stratified by age group, CCHS 2015

Outcome	Youth[a] (n = 1356)						Adults[b] (n = 11 030)						Older adults[c] (n = 4288)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	**0.11**	**0.05**	**0.24**	**0.13**	**0.06**	**0.26**	**0.23**	**0.18**	**0.29**	**0.27**	**0.21**	**0.35**	**0.41**	**0.28**	**0.61**	**0.43**	**0.28**	**0.65**
Anxiety disorder	**0.20**	**0.10**	**0.40**	**0.20**	**0.11**	**0.39**	**0.26**	**0.20**	**0.32**	**0.30**	**0.24**	**0.39**	**0.50**	**0.31**	**0.81**	**0.52**	**0.32**	**0.85**
Suicidal ideation, lifetime[d]	**0.12**	**0.06**	**0.25**	**0.15**	**0.08**	**0.31**	**0.31**	**0.25**	**0.38**	**0.35**	**0.29**	**0.44**	**0.49**	**0.34**	**0.73**	**0.51**	**0.35**	**0.76**
Positive mental health																		
High SRMH	**7.94**	**4.73**	**13.32**	**8.06**	**4.66**	**13.94**	**2.76**	**2.30**	**3.31**	**2.75**	**2.38**	**3.19**	**2.65**	**2.21**	**3.18**	**1.56**	**1.15**	**2.12**
High life satisfaction	**4.22**	**2.14**	**8.31**	**4.22**	**2.07**	**8.59**	**3.52**	**2.81**	**4.39**	**3.86**	**3.09**	**4.82**	**3.40**	**2.27**	**5.10**	**3.29**	**2.20**	**4.92**
High levels of happiness	**8.49**	**4.37**	**16.49**	**9.55**	**4.65**	**19.61**	**3.28**	**2.64**	**4.09**	**3.62**	**2.91**	**4.52**	**2.56**	**1.83**	**3.57**	**2.59**	**1.84**	**3.64**
High psychological well-being	**4.82**	**2.89**	**8.04**	**4.81**	**2.81**	**8.24**	**2.02**	**1.71**	**2.39**	**2.04**	**1.72**	**2.42**	**1.13**	**1.13**	**2.00**	**1.46**	**1.09**	**1.95**
High community belonging	**2.13**	**1.19**	**3.81**	**2.77**	**1.45**	**5.27**	**1.53**	**1.30**	**1.82**	**1.55**	**1.30**	**1.83**	**1.08**	**1.08**	**1.93**	**1.42**	**1.04**	**1.94**

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) bolded. Covariates adjusted for in analyses include sex, immigrant status, racialized background, place of residence, and household income adequacy quintile.

[a] 12–17 years old.

[b] 18–64 years old.

[c] ≥65 years old.

[d] Restricted to respondents ≥15 years old.

TABLE 7
Associations between refreshing (vs. not refreshing) sleep and mental illness, suicidal ideation and positive mental health measures, overall and stratified by sex, CCHS 2015

Outcome	Overall (n = 16 674)						Males (n = 7649)						Females (n = 9025)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	**0.30**	**0.25**	**0.36**	**0.34**	**0.27**	**0.41**	**0.29**	**0.20**	**0.41**	**0.33**	**0.23**	**0.47**	**0.32**	**0.25**	**0.40**	**0.34**	**0.26**	**0.43**
Anxiety disorder	**0.31**	**0.25**	**0.38**	**0.34**	**0.28**	**0.42**	**0.34**	**0.25**	**0.48**	**0.38**	**0.27**	**0.52**	**0.30**	**0.23**	**0.39**	**0.32**	**0.24**	**0.43**
Suicidal ideation, lifetime[a]	**0.42**	**0.36**	**0.50**	**0.47**	**0.40**	**0.55**	**0.47**	**0.37**	**0.60**	**0.52**	**0.40**	**0.66**	**0.41**	**0.33**	**0.51**	**0.44**	**0.35**	**0.54**
Suicidal ideation, past 12 months[a]	**0.21**	**0.14**	**0.31**	**0.23**	**0.15**	**0.35**	**0.18**	**0.10**	**0.33**	**0.17**	**0.09**	**0.32**	**0.24**	**0.14**	**0.40**	**0.26**	**0.15**	**0.45**
Positive mental health																		
High SRMH	**2.69**	**2.40**	**3.02**	**2.68**	**2.38**	**3.02**	**2.75**	**2.33**	**3.25**	**2.74**	**2.31**	**3.25**	**2.63**	**2.23**	**3.09**	**2.65**	**2.24**	**3.13**
High life satisfaction	**4.43**	**3.71**	**5.30**	**4.24**	**3.55**	**5.08**	**4.05**	**3.12**	**5.27**	**3.82**	**2.91**	**5.02**	**4.98**	**3.92**	**6.32**	**4.78**	**3.76**	**6.07**
High levels of happiness	**3.58**	**3.02**	**4.24**	**3.53**	**2.95**	**4.21**	**3.64**	**2.89**	**4.58**	**3.59**	**2.81**	**4.57**	**3.55**	**2.78**	**4.57**	**3.48**	**2.69**	**4.49**
High psychological well-being	**2.40**	**2.11**	**2.72**	**2.40**	**2.11**	**2.73**	**2.31**	**1.91**	**2.78**	**2.32**	**1.91**	**2.81**	**2.48**	**2.11**	**2.91**	**2.47**	**2.10**	**2.91**
High community belonging	**1.62**	**1.42**	**1.84**	**1.52**	**1.33**	**1.74**	**1.55**	**1.27**	**1.87**	**1.39**	**1.14**	**1.70**	**1.71**	**1.44**	**2.02**	**1.63**	**1.37**	**1.94**

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) bolded. Covariates adjusted for in analyses include age group, sex (except in sex-stratified analyses), immigrant status, racialized background, place of residence and household income adequacy quintile.

[a] Restricted to respondents ≥15 years old.

TABLE 8
Associations between refreshing (vs. not refreshing) sleep and mental illness, suicidal ideation and positive mental health measures, stratified by age group, CCHS 2015

Outcome	Youth[a] (n = 1356)						Adults[b] (n = 11 030)						Older adults[c] (n = 4288)					
	Unadjusted			Adjusted			Unadjusted			Adjusted			Unadjusted			Adjusted		
	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL	OR	95% LCL	95% UCL
Mental illness and suicidal ideation																		
Mood disorder	**0.22**	**0.10**	**0.53**	**0.22**	**0.09**	**0.54**	**0.29**	**0.23**	**0.37**	**0.33**	**0.26**	**0.42**	**0.41**	**0.29**	**0.59**	**0.43**	**0.29**	**0.62**
Anxiety disorder	**0.40**	**0.20**	**0.80**	**0.42**	**0.23**	**0.77**	**0.31**	**0.24**	**0.39**	**0.34**	**0.27**	**0.43**	**0.30**	**0.19**	**0.48**	**0.30**	**0.19**	**0.49**
Suicidal ideation, lifetime[d]	**0.32**	**0.16**	**0.62**	**0.35**	**0.18**	**0.69**	**0.45**	**0.37**	**0.54**	**0.48**	**0.40**	**0.58**	**0.41**	**0.29**	**0.60**	**0.41**	**0.28**	**0.59**
Positive mental health																		
High SRMH	**2.62**	**1.76**	**3.91**	**2.54**	**1.67**	**3.86**	**3.01**	**2.62**	**3.46**	**2.90**	**2.52**	**3.34**	**1.81**	**1.45**	**2.26**	**1.74**	**1.39**	**2.19**
High life satisfaction	**7.03**	**3.39**	**14.57**	**6.83**	**3.21**	**14.55**	**4.41**	**3.59**	**5.41**	**4.37**	**3.54**	**5.38**	**3.12**	**2.15**	**4.54**	**3.03**	**2.08**	**4.43**
High levels of happiness	**5.64**	**2.74**	**11.58**	**5.77**	**2.70**	**12.31**	**3.57**	**2.91**	**4.37**	**3.58**	**2.91**	**4.39**	**2.90**	**2.11**	**4.00**	**2.92**	**2.13**	**4.00**
High psychological well-being	**2.91**	**1.95**	**4.35**	**2.79**	**1.85**	**4.20**	**2.55**	**2.19**	**2.97**	**2.49**	**2.14**	**2.91**	**1.79**	**1.44**	**2.22**	**1.76**	**1.42**	**2.19**
High community belonging	**1.73**	**1.08**	**2.76**	**1.95**	**1.18**	**3.23**	**1.50**	**1.29**	**1.75**	**1.49**	**1.28**	**1.74**	**1.81**	**1.42**	**2.30**	**1.80**	**1.41**	**2.30**

Abbreviations: CCHS, Canadian Community Health Survey; LCL, lower confidence limit; OR, odds ratio; SRMH, self-rated mental health; UCL, upper confidence limit.

Note: Statistically significant results ($p < 0.05$) bolded. Covariates adjusted for in analyses include sex, immigrant status, racialized background, place of residence and household income adequacy quintile.

[a] 12–17 years old.

[b] 18–64 years old.

[c] ≥65 years old.

[d] Restricted to respondents ≥15 years old.

Manitoba, Alberta and Yukon;[21] symptoms of depression and anxiety among public safety personnel;[16] and higher internalizing problems at ages 12 to 15 years in girls and 12 to 13 years in boys, cross-sectionally.[46] Longitudinal research into these relationships and their potential mechanisms is needed, as growing evidence suggests that the associations between sleep quality and mental health are complex and bidirectional.[47,48] For example, research from Sweden and the United Kingdom has found that baseline depression and anxiety were associated with disturbed sleep 12 months later, with baseline disturbed sleep also predicting subsequent depression and anxiety.[47,48]

Few Canadian studies have investigated the associations of other measures of sleep quality with PMH and MI/SI. Research conducted among adolescents in Ontario suggests that daytime sleepiness is prevalent and may be associated with poorer outcomes,[49] calling for further inquiry into how other measures may be associated with mental health. Nonetheless, the current study contributes to existing research by examining a breadth of associations between sleep duration, sleep quality and indicators of PMH and MI/SI by sex and age groups. This adds to the evidence base and addresses research gaps that have been highlighted elsewhere.[23,24]

Approximately half of people aged 12 years and older in Ontario, Manitoba and Saskatchewan met sleep duration recommendations, lower than the almost two-thirds previously estimated based on the 2014–2015 Canadian Health Measures Survey.[1] This could be due to differences in the populations sampled (e.g. individuals living in different provinces), question wording (e.g. "each night" vs. "in a 24-hour period"), response options (e.g. categorical vs. continuous), etc. We found that meeting sleep duration recommendations was generally associated with higher odds of PMH and lower odds of MI/SI; however, these associations were inconsistent across sex and age groups.

Some other Canadian studies have reported inconsistent associations between short and long sleep durations and outcomes including SRMH and community belonging,[13,21] depression[14] and life satisfaction in general populations[21] and SRMH and life satisfaction among individuals with mood and/or anxiety disorders.[22] Such inconsistencies may be due to differences in conceptualizing and operationalizing sleep measures or mental health outcomes, with some studies using different instruments, devices or scoring methods or different cut-offs to measure short, medium and long sleep durations, for example.[14,21,22] Furthermore, the association between sleep duration and well-being may be mediated by other sleep indicators including sleep quality.[50] The associations of sleep duration and sleep quality with mental health may be complex and bidirectional, and longitudinal research into these relationships is needed. An initial study with youth in British Columbia and Ontario found that psychological well-being increased over one year among females who started meeting sleep duration recommendations.[51]

Strengths and limitations

This study has a number of strengths. The use of data from a large population-based sample affords sufficient statistical power to conduct stratified analyses, by sex and age group, of associations between several sleep measures and indicators of PMH and MI/SI. The examination of both sleep quality and sleep duration is in line with recommendations to investigate both types of measures and their associations with health,[52] as they may be differentially associated with mental health.[53] Indeed, compared to meeting sleep duration recommendations, our two measures of sleep quality were more robust correlates of PMH and MI/SI.

In terms of limitations, the data analyzed were cross-sectional, and as a result, causality and directionality of associations could not be ascertained. Second, although the CCHS is conducted annually, we were limited to using data from 2015 due to availability of study measures; it is possible that the observed associations may have changed over time. For example, preliminary research has suggested that sleep quality and PMH have declined and symptoms of mental disorders have increased in a number of different populations, including Canadians, during the COVID-19 pandemic,[54-56] which may affect associations between sleep and mental health. However, the current study analyzes more recent data than some Canadian studies,[14,21] which may provide recent baseline data for investigating impacts of the COVID-19 pandemic. Findings may also inform sleep and mental health surveillance as well as future data collection and analysis.

Third, given that the sleep measures were collected only in Ontario, Manitoba and Saskatchewan, findings may not reflect other Canadian provinces or the territories, or individuals excluded from CCHS data collection or regression analyses (e.g. Indigenous Peoples). Fourth, all of the measures were self-reported and therefore subject to recall or social desirability bias. While generally not feasible for large-scale population-based surveillance given the additional costs and time needed for data collection, measuring sleep duration and quality through more detailed (e.g. sleep diaries over several days) or objective means (e.g. actigraphy) are considered to have greater validity for assessing sleep duration and sleep quality.[57] Interestingly, research from the UK that assessed sleep more objectively, using accelerometers, found that previous mental illness diagnoses were more strongly and consistently associated with measures of sleep quality than of sleep duration.[58]

Fifth, we applied sampling weights that take household and individual nonresponse into account in our analyses, but there is still a possibility that estimates could be biased due to issues like self-selection given the response rate.[59] Sixth, the PMH and MI/SI measures were examined as independent outcomes in our analyses. Other research has simultaneously examined PMH and mental illness, finding that Canadian youth with high psychological well-being and low depressive symptoms were the most likely to meet sleep duration recommendations, and those with low psychological well-being and high depressive symptoms were the least likely.[60]

Seventh, respondents with partially missing data who were excluded from the regression analyses could have differed from those with complete data, and results could have differed if variables were coded differently. Nevertheless, sensitivity analyses (not reported here) that included respondents with partially complete data or that dichotomized the sleep quality measures differently (i.e. "sometimes" included in the frequent sleep difficulties group; "sometimes" included in the refreshing sleep group) still found significant overall unadjusted and adjusted associations in the expected direction between the sleep measures and all the PMH and MI/SI outcomes. Finally, we cannot rule out the potential for residual confounding of the observed associations,

as other measures that have been associated with sleep and mental health were not measured in the 2015 CCHS (e.g. sleep hygiene) or not controlled for in our analyses (e.g. physical activity).[61,62]

Conclusion

Sleep difficulties are prevalent among Canadians, and poor sleep quality and duration have been associated with lower well-being and mental ill-health. The current study demonstrates strong associations between good sleep quality and lower MI/SI and higher PMH across sex and age groups. Although less consistent, meeting sleep duration recommendations was also generally associated with PMH and MI/SI. Additional longitudinal research is needed to ascertain directionality of the associations. Future research may also benefit from examining how sleep interacts with other health behaviours (e.g. physical activity), from using objective or more detailed sleep measures (e.g. measures of sleep consistency and continuity) and from examining how sleep quality and sleep duration interact to affect health. Surveillance efforts should continue to monitor sleep behaviours and indicators of PMH and MI/SI to inform public health strategies targeted at promoting improved sleep and well-being among Canadians.

Conflicts of interest

The authors do not have any conflicts of interest to disclose.

Authors' contributions and statement

RD, CC and MB conceptualized the study. ZC conducted the statistical analyses and drafted the initial manuscript. All authors were involved in study design and analytic approach, contributed to interpretation of results, and reviewed and edited the draft manuscript. All authors approved the manuscript for publication.

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