Original Article

The enduring effects of early-childhood adversities and troubled sleep among Canadian adults: a population-based study

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ABSTRACT

Objective: Although many studies have consistently found that early-childhood adversities are important risk factors for physical and mental health problems later in adulthood, few have examined the association between early-childhood adversities and troubled sleep. The objective of this study was to examine the association between early-childhood adversities and troubled sleep among adult Canadians.
Methods: Data for this paper ($N = 19,349$) were obtained from Statistics Canada's 2012 Canadian Community Health Survey – Mental Health (CCHS-MH). Logistic regression analysis was conducted to examine the association between adverse childhood adversities and troubled sleep, while accounting for various sociodemographic, socioeconomic, health, and mental health factors.
Results: Of the 19,349 respondents examined, 2748 representing 14.2% had troubled sleep. Controlling for sociodemographic, socioeconomic, health, and mental health factors, it was observed that for each additional childhood adversity experienced, the odds of having troubled sleep increased by 10% (odds ratio (OR) = 1.10, $p < 0.001$, 95% confidence interval (CI) = 1.07–1.13). In addition, psychological distress, older age, being female, being unmarried, being white, a lower annual income, chronic pain, poor perceived health, and mental health difficulties were associated with troubled sleep.
Conclusion: The results from this paper provide population-based evidence for childhood adversities as a major predictor of troubled sleep in adulthood. The long-standing effects of these adversities on sleep highlight the importance of early detection, such as consistent assessment of sleep habits for children, adolescents, and adults, who have experienced childhood adversities, in health and mental health settings.

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1. Introduction

A good night's sleep is considered important in maintaining both physical and mental health; however, sleep difficulties are common for many Canadians. Sleep problems may include difficulty falling or staying asleep, disordered breathing while sleeping, insomnia, or parasomnias [1,2]. Among Canadians, the prevalence of sleep difficulties ranges from 20% to 25%, with about 10% having severe sleep problems [3]. Findings from the US also suggest that about one in three adults have troubled sleep, with 10–15% reporting severe sleep difficulties [4–6].

Sleep problems have been studied extensively and have been found to be associated with many physical and mental health problems, including impaired decision making [3,7], increased absenteeism and loss of productivity [8,9], decreased quality of life [4], poor physical health [10], depression and anxiety [11,12], risky

health-related behaviors, such as heavy alcohol consumption and cigarette smoking [6,13,14], and suicide-related behaviors [11,15,16]. Studies have also found high rates of obesity and weight gain among individuals with troubled sleep [14,17–20].

The existing literature has also consistently found that early-childhood adversities, such as neglect, emotional, physical, and sexual abuse, are risk factors for physical and mental health problems later in adulthood [21–23]. Most of these studies have shown higher rates of poor physical health [24–26], obesity [18], anxiety and depression [27], personality disorders [28], aggression and attention deficit–hyperactivity disorder (ADHD) [29], substance use disorders [30], chronic conditions [31], and suicide-related behaviors [32,33] among adults with a history of childhood adversities.

Although numerous studies have examined the phenomenon of troubled sleep, few have examined the association between early-childhood adversities and troubled sleep. Studies that have examined early-childhood adversities and troubled sleep have found a significant association. For example, Chapman et al. [34] analyzed data on >17,000 Americans and found that, compared to individuals with no history of childhood adversities, those with a history of childhood adversities were over two times more likely to report trouble

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falling or staying asleep. Koskenvuo et al. [13] also examined the link between childhood adversities and troubled sleep among Finnish adults and found that adults who experienced multiple childhood adversities were over three times more likely to have troubled sleep than their counterparts who did not experience any adversities growing up. This association persisted after adjusting for work status, use of psychotropic drugs, health behaviors, recent life events, and child–parent relationships.

One reason that has been proffered in trying to understand the link between early-childhood adversities and troubled sleep relates to the increased hyperarousal and hypervigilance, which often results from the experience of traumatic events [35]. Early and repeated trauma has been linked to elevated stress hormones in individuals. This prolonged elevation of stress hormones is hypothesized to alter the development of the central nervous system, including a dysregulated brain stem that is more easily startled and, thus, more prone to hyperarousal, hypervigilance, and a dysregulated neuroendocrine system, which regulates sleep arousal [36,37]. Increased hyperarousal in individuals who have post-traumatic stress disorder is thought to account for difficulties sleeping due to increased activity within the brain, making it hard to fall asleep and stay asleep [35].

To the best of our knowledge, no study has examined the link between early-childhood adversities and troubled sleep within the Canadian context and only a few studies have examined this association within a North American sample [30,34]. Thus, the objective of this paper was to further examine the association between early-childhood adversities and troubled sleep in adulthood using a large, representative sample from Canada. In addition, of the few studies examining this relationship, one Finnish study controlled for additional factors associated with sleep, such as health behaviors, work status, and recent life events [13]. The current study aims to add to the literature by examining whether experiencing childhood adversities continue to be significantly associated with sleep problems later in adulthood after accounting for various sociodemographic, socioeconomic, health, and mental health factors within a North American sample. We hypothesized that adults, who experienced childhood adversities before age 16, would be more likely to have troubled sleep after accounting for the various control variables.

2. Methods

2.1. Data

This paper used data from Statistics Canada's 2012 Canadian Community Health Survey – Mental Health (CCHS-MH) public-use microdata files (PUMF). The CCHS-MH is a cross-sectional survey that collects information on factors influencing mental health through a multidisciplinary approach focusing on social and economic determinants of health. The CCHS-MH covers those living in the 10 provinces aged 15 years and above and uses a multistage cluster sampling design with a random sampling method to select a sample that is representative of the Canadian population [38]. Residents of the three territories, individuals living on reserves or other Aboriginal settlements, full-time members of the Canadian Forces, and institutionalized populations are excluded from the survey's coverage area. Those excluded constitute <3% of the target population [38]. Some of the main objectives of the CCHS-MH were to: "(1) assess the mental health status of Canadians on both illness and positive mental health continuums through selected mental and substance disorders, mental health problems, and well-being, and (2) assess timely, adequate, and appropriate access to and utilization of formal and informal mental health services and supports, as well as perceived needs" [38, p. 3]. The 2012 CCHS-MH includes questions on physical and mental health, resilience, mental health service utilization, alcohol and substance use, early-childhood adversities,

chronic conditions, pain and discomfort, troubled sleep, job stress, as well as income and sociodemographic characteristics.

There were 25,113 respondents, representing 28,314,716 Canadians in the 2012 CCHS-MH dataset. However, given that questions on early-childhood adversities were only asked to respondents aged 18 years and older, and because age was measured in 5-year groups, the sample used in this paper consists of the 19,349 respondents aged 20 years and older. To produce a sample that is equal to the original sample size and representative of the population of Canada, the population weight was adjusted by dividing each master weight by the average weight. This was done to maintain the original sample size while, at the same time, keeping the weighting structure recommended by Statistics Canada. The adjusted population weight was used in all the analyses.

2.2. Dependent and independent variables

The dependent variable examined in this paper was troubled sleep and it was measured as a binary variable. Survey respondents were asked to rate on a five-point Likert scale ranging from 1 (none of the time) to 5 (all of the time) how often they have trouble going to sleep or staying asleep. Respondents who indicated having troubled sleep "most of the time" and "all of the time" were coded as 1 (troubled sleep) and compared to their colleagues who indicated "none of the time," "a little of the time," and some of the time" who were coded as 0 (no troubled sleep). The decision to treat troubled sleep as a dichotomous variable to a greater extent was informed by sample size consideration. The distribution of troubled sleep and some of the ordinal variables was not proportional across the various categories but follows a binomial distribution, hence the decision to treat these variables as dichotomous variables. Although there is no agreeable definition and measurement of troubled sleep or insomnia, the most commonly used measure of troubled sleep in the epidemiologic literature [8,9,39] tends to be the frequency of trouble going to sleep or staying asleep.

The main independent variable examined in this paper was early-childhood adversities and it was measured using six questions that ask respondents about events that may have happened to them before they turned 16 years old, either in their school, in their neighborhood, or in their family: (1) How many times did you see or hear any one of your parents, stepparents, or guardians hit each other or another adult in your home? (2) How many times did an adult slap you on the face, head, or ears or hit or spank you with something hard to hurt you? (3) How many times did an adult push, grab, shove, or throw something at you to hurt you? (4) How many times did an adult kick, bite, punch, choke, burn you, or physically attack you in some way? (5) How many times did an adult force you or attempt to force you into any unwanted sexual activity, by threatening you, holding you down, or hurting you in some way? (6) How many times did an adult touch you against your will in any sexual way? By this, I mean anything from unwanted touching or grabbing, to kissing or fondling. These questions were only administered to respondents aged 18 years and older. The responses to each question was coded as 1 (never) to 5 (more than 10 times). Respondents who were coded as 2, 3, 4, or 5 were considered to have experienced the event at least once and respondents who were coded as 1 were considered not to have experienced the event. A sum of early-childhood adversity was created (M = 1.04, SD = 1.41, range = 0–6) to arrive at the number of childhood adversities experienced before age 16.

Control variables examined in this paper include age, measured as a categorical variable in groups of 10-year spans; gender coded as a binary variable with male as the reference category; immigrant status (nonimmigrant vs. immigrant); marital status (married, common-law, formerly married, and single/never married);

postsecondary education (no vs. yes); and annual personal income, measured in increments of $10,000.

Both self-perceived physical and mental health were originally measured as ordinal variables on a five-point Likert scale ranging from excellent to poor. However, these variables were dichotomized into two categories by collapsing excellent, very good, and good into one category, called "good" (score = 0), whereas fair and poor were collapsed together into a category called "poor" (score = 1). Chronic pain status refers to the degree of pain that is usually felt by the respondents and the extent to which such pain prevents the respondent from performing certain ~~basic~~ activities. Responses to chronic pain status were coded as 1 if the respondent indicated experiencing pain that prevents a few, some, or most activities. Those who reported having no pain or experienced some amount of pain that does not prevent them from carrying out any activity were coded as 0. For chronic conditions, respondents were asked the following question: "Now I'd like to ask about certain long-term health conditions which you may have. We are interested in 'long-term conditions' which are expected to last or have already lasted 6 months or more and that have been diagnosed by a health professional." The list of chronic conditions include the following: asthma, arthritis (excluding fibromyalgia), back problems (excluding fibromyalgia and arthritis), high blood pressure, migraine headaches, diabetes, heart disease, cancer, and effects of a stroke. The chronic condition variable was a nominal variable and coded 0 if the respondent does not have any of the above chronic conditions, 1 if the respondent has only one chronic condition, and 2 if respondent has two or more chronic conditions. The body weight of adult respondents aged 20 years and over (except for pregnant women) was measured and assigned to one of the following categories, according to their body mass index (BMI): underweight/normal body weight; overweight; and obese class I, II, and III. The BMI categories were adopted from a body weight classification system recommended by Health Canada and the World Health Organization (WHO), which has been widely used internationally.

Psychological distress was assessed using the K6, a standardized screening measure for nonspecific psychological distress [40]. Respondents were asked to rate their psychological distress on a five-point Likert scale ranging from 0 (None of the time) to 4 (All of the time) how often they feel: (1) nervous, (2) hopeless, (3) restless or fidgety, (4) so depressed that nothing can cheer you up, (5) that everything is an effort, and (6) worthless. Scores on the psychological distress scale range from 0 to 24 with higher scores indicating more psychological distress. The K6 has been found to be a valid measure of psychological distress with strong internal consistency and adequate test–retest reliability [40–42]. In the present paper, internal consistency (Cronbach's α) for the K6 was $\alpha = 0.78$. Lastly, we controlled for the following mental health diagnoses: general anxiety disorder, major depressive episode, and alcohol or drug dependence. Each of these was measured as a binary variable and coded 1, if the respondent was diagnosed; otherwise, it was coded as 0.

2.3. Statistical analyses

Data were analyzed using bivariate and multivariate analytic techniques. First, the distribution of the dependent variable (troubled sleep) was examined. Next, a one-way analysis of variance (ANOVA) was conducted to examine whether the average psychological distress scores significantly differed for respondents who have troubled sleep from their counterparts who do not. Bivariate associations between troubled sleep and the categorical variables were also conducted using the Pearson chi-squared test of association. Given that the omnibus Pearson chi-square value does not specify which combination of categories contributes most to statistical significance, categorical variables with more than two categories are examined

in detail in the logistic regression. Finally, a multivariate binary logistic regression model was fitted using the enter procedure to identify the predictors of troubled sleep. Binary logistic regression was chosen because the dependent variable had a binomial distribution and the independent variables were measured as both categorical and continuous variables [43,44]. Control variables were entered in Model 1. Model 2 consists of all the control variables plus the early-childhood adversity score. Model fitness was assessed using the omnibus chi-squared test, the percentage of respondents correctly classified as having troubled sleep versus no troubled sleep, as well as sensitivity and specificity ratios. The classification cutoff was adjusted to 14% to reflect the proportion of respondents who have troubled sleep. Adjusted odds ratios (ORs) are reported together with their 95% confidence intervals (CIs). All analyses were performed using SPSS version 21 for Windows (SPSS Inc., Chicago, IL, USA) and variables were considered significant if the *p*-value was <0.05.

3. Results

3.1. Prevalence of troubled sleep and early-childhood adversities

Of the 19,349 respondents examined, 2748 (representing 14.2%) had troubled sleep. Early-childhood adversities relating to physical abuse were more prevalent. For instance, 40.3% of the respondents were slapped in the face, hit, or spanked by an adult; 21.2% were pushed, grabbed, or shoved; and 10.2% were physically attacked (kicked/bitten/punched/choked/burned). About 16.0% of the respondents witnessed domestic violence and 10.0% experienced unwanted sexual touching, kissing, or fondling. Lastly, 6.1% of the respondents experienced forced or attempted forced sexual activity. About one in two respondents (49.6%) experienced at least one of these adversities.

3.2. Bivariate association between troubled sleep and psychological distress

Table 1 displays the relationship between troubled sleep and psychological distress. The results indicate that the average psychological distress scores for respondents who had troubled sleep was significantly greater than respondents who did not have troubled sleep ($M_{\text{no troubled sleep}} = 2.60$ versus $M_{\text{troubled sleep}} = 5.19$, $F(1, 19,346) = 1502.23$, $p < 0.001$).

3.3. Bivariate association between troubled sleep and categorical explanatory variables

The significant bivariate associations between troubled sleep and the categorical variables presented in Table 2, to a large extent, were consistent with what was expected. The proportion of respondents who experienced early-childhood adversities (across the six early-childhood adversities) and had troubled sleep was significantly greater than the proportion of respondents who had not experienced early-childhood adversities and had troubled sleep. A little over 11% of males compared to 17% of females reported having

Table 1
ANOVA result examining the relationship between troubled sleep and psychological distress ($N = 19,349$).

Variables	No troubled sleep	Troubled sleep	Sig.	*F* value (df)
	Mean (SD)	Mean (SD)		
Psychological distress score	2.60 (2.94)	5.19 (4.62)	0.001	1502.23 (1, 19,346)

Table 2

Bivariate association between troubled sleep and explanatory variables (N = 19,349).

Variables	Sample size (N)	%Troubled Sleep	Chi-square (sig.)
Age			107.84 (0.001)
20–29 years	3143	12.3	
30–39 years	3381	10.6	
40–49 years	3894	12.9	
50–59 years	4068	17.7	
60 years and above	4863	16.1	
Gender			149.07 (0.001)
Male	9797	11.2	
Female	9552	17.3	
Immigrant status			96.02 (0.001)
Nonimmigrant	14,470	15.6	
Immigrant	4878	10.0	
Marital status			142.91 (0.001)
Married	10,356	12.1	
Common law	2378	14.7	
Formerly married	2772	20.9	
Single/never married	3843	14.9	
Postsecondary graduate			85.33 (0.001)
No	6656	17.4	
Yes	12,693	12.5	
Annual personal income			286.59 (0.001)
No income/ <$10,000	1050	19.3	
$10,000 to $19,999	2384	20.8	
$20,000 to $29,999	4154	17.9	
$30,000 to $39,999	2594	14.7	
$40,000 to $49,999	2260	10.4	
$50,000 and above	6908	10.0	
Self-perceived physical health			950.05 (0.001)
Good	17,406	11.6	
Poor	1944	37.3	
Self-perceived mental health			842.94 (0.001)
Good	17,898	12.1	
Poor	1450	39.8	
Pain prevents respondent from performing certain basic activities			886.10 (0.001)
No	16,523	11.1	
Yes	2827	32.3	
Chronic condition			710.47 (0.001)
No chronic condition	9585	8.3	
One chronic condition	5284	15.8	
Two or more chronic conditions	4481	24.9	
BMI category			41.16 (0.001)
Underweight/Normal	8940	13.0	
Overweight	6583	14.0	
Obese	3825	17.3	
Lifetime major depressive episode			696.59 (0.001)
No	17,069	11.8	
Yes	2280	32.3	
Lifetime general anxiety disorder			573.29 (0.001)
No	17,577	12.3	
Yes	1772	33.1	
Lifetime alcohol dependence			62.99 (0.001)
No	18,709	13.8	
Yes	641	25.0	
Witnessed domestic violence			109.52 (0.001)
No	16,359	13.1	
Yes	2989	20.3	
Slapped in the face, hit, or spanked by an adult			127.27 (0.001)
No	11,559	11.9	
Yes	7790	17.7	
Pushed, grabbed, or shoved			203.54 (0.001)
No	15,243	12.3	
Yes	4105	21.1	
Physically attacked (kicked/bitten/ punched/choked/burned)			212.93 (0.001)
No	17,374	13.0	
Yes	1975	25.1	
Experienced forced or attempted forced sexual activity			264.28 (0.001)
No	18,162	13.2	
Yes	1187	30.2	
Experienced unwanted sexual touching, kissing, or fondling			274.87 (0.001)
No	17,409	12.8	
Yes	1939	26.7	

troubled sleep ($\chi^2(1) = 149.07$, $p < 0.001$). The proportion of nonimmigrants who reported having troubled sleep (15.6%) was significantly greater than the proportion of immigrants who had troubled sleep (10%) ($\chi^2(1) = 96.02$, $p < 0.001$). Respondents were more likely to have troubled sleep if they were older, single/never married, formerly married, or in a common-law relationship; if they had less than postsecondary education; or if they had low annual income. Furthermore, respondents were more likely to have troubled sleep if they perceived their physical or mental health to be poor, experienced chronic pain, reported having some chronic condition, or were overweight or obese. All the three mental health diagnoses examined were also significantly associated with troubled sleep.

3.4. Multivariate logistic regression predicting the odds of having troubled sleep

Although the independent and control variables were significantly associated with troubled sleep at the bivariate level, there were no controls at this level so we were unable to ascertain the relative contribution of each variable in explaining troubled sleep. In the multivariate analysis, we controlled for the effect of all the explanatory variables in predicting troubled sleep. All the model diagnostic statistics indicated that the multivariate model was fit and both the independent and control variables made significant contributions to the model. Based on the Nagelkerke pseudo R^2, early-childhood adversities and the control variables explained about 20% of the variance in troubled sleep. In the final model, approximately 73% of the respondents were correctly classified as having troubled sleep versus no troubled sleep. Roughly 75% of respondents were observed and correctly predicted to have troubled sleep (sensitivity), whereas 67% were observed as not having troubled sleep and were correctly predicted to not have troubled sleep (specificity).

Controlling for all other factors in Table 3, Model 2, for each additional childhood adversity experienced, the odds of having troubled sleep were predicted to increase by a factor of 10%, net the effect of all the other factors (OR = 1.10, $p < 0.001$, 95% CI = 1.07–1.13). In addition, for every increase in psychological distress scores, the odds of having troubled sleep were predicted to increase by a factor of 10% (OR = 1.10, $p < 0.001$, 95% CI = 1.09–1.12). Respondents who were between 50 and 59 years of age were 1.47 times more likely to have troubled sleep when compared to respondents aged 20–29 years (OR = 1.47, $p < 0.001$, 95% CI = 1.24–1.74). Compared to males, the odds were 36% higher for females to have troubled sleep (OR = 1.36, $p < 0.001$, 95% CI = 1.23–1.49). The odds were 29% less likely for immigrants to have troubled sleep when compared to their nonimmigrant counterparts (OR = 0.71, $p < 0.001$, 95% CI = 0.64–0.80). With respect to marital status, respondents who were single/ never married (OR = 1.20, $p = 0.008$, 95% CI = 1.05–1.38), formerly married (OR = 1.33, $p < 0.001$, 95% CI = 1.18–1.50), or living in a common-law relationship (OR = 1.20, $p = 0.015$, 95% CI = 1.04–1.39) were more likely to have troubled sleep when compared to respondents who were married. For every increase in annual income by $10,000, the odds of respondents having troubled sleep were predicted to decrease by 7% holding all other factors in the model constant (OR = 0.93, $p < 0.001$, 95% CI = 0.90–0.96). Compared to respondents with no chronic condition, respondents who had one chronic condition were 1.56 times more likely to have troubled sleep (OR = 1.56, $p < 0.001$, 95% CI = 1.40–1.75), and the odds were 1.81 times higher for respondents who had two or more chronic conditions to have troubled sleep (OR = 1.81, $p < 0.001$, 95% CI = 1.60–2.06). Respondents were also more likely to have troubled sleep if they: perceived their physical and mental health to be poor, had pain that prevented them from performing certain basic activities, or had a lifetime diagnosis of major depressive episode or general anxiety

Table 3
Multivariate logistic regression predicting the likelihood of having troubled sleep.

Characteristics	Model 1			Model 2		
	B	Sig	Exp(B) (95% CI)	B	Sig	Exp(B) (95% CI)
Age (20–29 years)						
30–39 years	−0.081	0.365	0.92 (0.77–1.10)	−0.102	0.254	0.90 (0.76–1.08)
40–49 years	−0.024	0.782	0.98 (0.82–1.16)	−0.063	0.481	0.94 (0.79–1.12)
50–59 years	0.416	0.001	1.52 (1.28–1.80)	0.385	0.001	1.47 (1.24–1.74)
60 years and above	0.126	0.169	1.13 (0.95–1.36)	0.128	0.160	1.14 (0.95–1.36)
Gender (male)						
Female	0.298	0.001	1.35 (1.23–1.48)	0.304	0.001	1.36 (1.23–1.49)
Immigrant status (nonimmigrant)						
Immigrant	−0.342	0.001	0.71 (0.63–0.80)	−0.340	0.001	0.71 (0.64–0.80)
Marital status (married)						
Common law	0.187	0.012	1.21 (1.04–1.40)	0.182	0.015	1.20 (1.04–1.39)
Formerly married	0.282	0.001	1.33 (1.17–1.50)	0.283	0.001	1.33 (1.18–1.50)
Single/never married	0.190	0.007	1.21 (1.05–1.39)	0.186	0.008	1.20 (1.05–1.38)
Postsecondary graduate (no)						
Yes	−0.086	0.077	0.92 (0.83–1.01)	−0.085	0.081	0.92 (0.83–1.01)
Annual personal income	−0.076	0.001	0.93 (0.90–0.96)	−0.076	0.001	0.93 (0.90–0.96)
Self-perceived physical health (good)						
Poor	0.563	0.001	1.76 (1.54–2.00)	0.566	0.001	1.76 (1.55–2.01)
Self-perceived mental health (good)						
Poor	0.226	0.004	1.25 (1.08–1.46)	0.207	0.008	1.23 (1.06–1.43)
Chronic condition (none)						
One chronic condition	0.461	0.001	1.59 (1.42–1.77)	0.446	0.001	1.56 (1.40–1.75)
Two or more chronic conditions	0.619	0.001	1.86 (1.64–2.11)	0.595	0.001	1.81 (1.60–2.06)
Pain prevents respondent from performing certain activities (no)						
Yes	0.491	0.001	1.63 (1.46–1.83)	0.475	0.001	1.61 (1.44–1.80)
BMI category (underweight/normal)						
Overweight	0.087	0.097	1.09 (0.98–1.21)	0.086	0.101	1.09 (0.98–1.21)
Obese	0.021	0.725	1.02 (0.91–1.15)	0.016	0.793	1.02 (0.90–1.14)
Lifetime major depressive episode (no)						
Yes	0.546	0.001	1.73 (1.53–1.95)	0.514	0.001	1.67 (1.48–1.89)
Lifetime general anxiety disorder (no)						
Yes	0.194	0.005	1.21 (1.06–1.39)	0.170	0.015	1.19 (1.03–1.36)
Lifetime alcohol dependence (no)						
Yes	0.087	0.422	1.09 (0.88–1.35)	0.007	0.952	1.01 (0.81–1.25)
Psychological distress	0.103	0.001	1.11 (1.09–1.12)	0.097	0.001	1.10 (1.09–1.12)
Early-childhood adversity score				0.094	0.001	1.10 (1.07–1.13)
Nagelkerke pseudo R^2			0.197			0.200
Model chi-square (sig)			2253.23 (0.001)			2292.29 (0.001)
Sensitivity			73.9			74.5
Specificity			65.3			66.6
Overall percentage correctly classified			72.7			73.4

Reference categories are identified in brackets.

disorder. Postsecondary education, body weight, and a lifetime diagnosis of alcohol dependence failed to reach statistical significance.

To examine whether the impact of troubled sleep differs depending on the type of adversity experienced, we reexamined the association between early-childhood adversity ("0 = no early adversities," "1 = only witnessed domestic violence," "2 = only slapped

Table 4
~~Multivariate logistic~~ regression examining the association between early-childhood adversity and troubled sleep.

Characteristic	B	Sig	Exp(B) (95% C.I)
Early-childhood adversity (none)			
Witnessed domestic violence	0.014	0.924	1.01 (0.76–1.36)
Slapped in the face, hit or spanked by an adult	0.341	0.001	1.41 (1.25–1.58)
Pushed, grabbed, or shoved	0.100	0.537	1.11 (0.81–1.52)
Physical attacked (kicked/bitten/punched/choked/burned)	0.897	0.001	2.45 (1.46–4.10)
Experienced forced or attempted forced sexual activity	0.621	0.291	1.86 (0.59–5.90)
Experienced unwanted sexual touching, kissing, or fondling	1.060	0.001	2.87 (2.17–3.83)
Experienced multiple incidents of adversities	0.758	0.001	2.13 (1.94–2.34)

Reference category is identified in brackets.

in the face, hit or spanked by an adult," "3 = only pushed, grabbed, or shoved (kicked/bitten/punched/choked/burned)," "4 = only experienced forced or attempted forced sexual activity," "5 = only experienced unwanted sexual touching, kissing, or fondling," and "6 = experienced multiple incidents of adversities") and troubled sleep using logit regression. The results presented in Table 4 indicate that respondents who experienced only unwanted sexual touching, kissing, or fondling were 2.87 times more likely to have troubled sleep (OR = 2.87, $p < 0.001$, 95% CI = 2.17–3.83); those who were only physically attacked were 2.45 times more likely to have troubled sleep (OR = 2.45, $p < 0.001$, 95% CI = 1.46–4.10); those who were only slapped in the face, hit, or spanked by an adult were 1.41 times more likely to have troubled sleep (OR = 1.41, $p < 0.001$, 95% CI = 1.25–1.58); and those who experienced multiple incidents of adversities were 2.13 times more likely to have troubled sleep (OR = 2.13, $p < 0.001$, 95% CI = 1.94–2.34), all when compared to respondents who experienced no early-childhood adversities.

4. Discussion

Using a large dataset from Canada, this paper investigated the association between early-childhood adversities and troubled sleep in adulthood. Consistent with past studies [3,4,39], we found that 14% of Canadians had troubled sleep. Excluding Aboriginal

individuals, members of the armed forces, and institutional populations may have impacted the prevalence rate of troubled sleep reported in this paper as some studies have found prevalence rates of troubled sleep among these individuals to be high [45,46]. However, given that this population constituted <3% of the sample, their impact, if any, would be minimal on the prevalence rate of troubled sleep reported in this study.

Although some studies have examined factors associated with troubled sleep in adulthood, few have examined the link between early adversities and troubled sleep. This paper found that experience of early-childhood adversities significantly increases the odds of having difficulty falling or staying asleep among Canadian adults. This key finding is consistent with previous literature, which has found that adverse experiences during childhood and adolescence are risk factors for sleep problems in later life [34,35].

This study also identified that more severe and chronic types of childhood adversities, such as sexual, physical, and multiple types of abuse, have the largest association with sleep problems. This is consistent with research that has identified that chronically maltreated children tend to have more mental health and social challenges than children who have experienced transient maltreatment [47]. In addition, severe abuse, such as chronic sexual and physical abuse, has been associated with increased mental health problems in adulthood, including post-traumatic stress disorder, which often involves difficulty sleeping. In fact, the effects of chronic interpersonal maltreatment is often referred to as complex post-traumatic stress disorder, due to the increased intensity and severity of the distress experienced by these individuals when compared to individuals who have experienced non-chronic forms of maltreatment (e.g., Refs. [48,49]).

The higher association between more traumatizing forms of childhood maltreatment (i.e., chronic and severe) and sleep is consistent with Gaensbauer and Jordan's [50] theory that individuals who have been traumatized may develop maladaptive strategies to cope with their abusive history and/or become hyperaroused when confronted with acute stressors in adulthood. These maladaptive strategies and the increased hyperarousal can then increase troubled sleep [35]. This may be especially true for adults who experienced child sexual abuse; for these individuals, bedtime may be a trigger for their traumatic experiences. Therefore, adults with child trauma histories and sleep problems may benefit from the consistent use of relaxation techniques that increase the body and brain's familiarity with less aroused states of being. However, for individuals who reexperience the trauma when trying to sleep or have severe symptoms of hyperarousal, a more intensive, trauma-focused intervention that includes relaxation training may be more beneficial.

Another possible explanation for the association between childhood adversity and troubled sleep is that many children who experience maltreatment grow up in disorganized family environments that lack a model of good sleep hygiene, such as bedtime routines and reduced noise levels. Prolonged exposure to poor sleep hygiene can then manifest into poor sleep patterns, which may persist into adulthood [35]. In support of this, Gregory, Caspi, Moffitt, and Poulton [51] found that family chaos is significantly correlated with sleep problems in childhood. Thus, in cases where adults have not been exposed to good sleep hygiene models due to chaotic and traumatic childhood experiences, it may be especially helpful to provide psychoeducation and help them develop an environment and routine that is more conducive to sleep.

The current paper found perceived poor physical and mental health, psychological distress, and lifetime diagnoses of major depressive episodes and general anxiety disorder as significant predictors of troubled sleep, which is consistent with previous literature [6,12,14] and the current general understanding of psychological distress. A symptom of both depression and anxiety is fatigue and sleep difficulties [52]. In addition, anxiety and rumination have been identified as important factors in maintaining sleep difficulties and insomnia because these cognitive processes trigger hyperarousal and emotional distress, increasing one's difficulty falling asleep [53].

Furthermore, respondents who had chronic health conditions or pain that prevents them from performing certain basic activities were found to be at an elevated risk of having troubled sleep. Similarly, extant research has consistently found that chronic and acute health problems that induce pain affect sleep, as well as daily functioning. Individuals who experience pain at night often report difficulty falling and staying asleep as a result of the discomfort. Indeed, Moldofsky [54] argues that the link between sleep and bodily pain, as well as fatigue and psychological distress, has been known for >4000 years. We failed to find any association between obesity and troubled sleep, although some studies have found this association to hold after adjusting for other demographic and health factors. The nonsignificant finding reported in this paper may be due to the exclusion of pregnant women in the computation of BMI. Some studies have observed an increased incidence of troubled sleep during pregnancy with most symptoms prevalent during the third trimester [55,56].

Consistent with past studies [57,58], this paper found a significant association between marital status and troubled sleep with unmarried adults more likely to have sleep problems. The unmarried are more likely to experience loneliness, which in turn may compromise the body's rejuvenating functions by disturbing sleep or hindering sleep's recuperative effect [59]. Being married therefore provides an emotional support system for dealing with stress, which in turn increases the quality of sleep. However, it is worth noting that highly strained relationships, lack of emotional support, and coughing and snoring when sharing a bed may also increase sleep difficulties in marriages, as noted by some scholars [60]. Consequently, the quality of sleep for married individuals is conditioned on a good relationship and sound health.

Researchers [61,62] have posited that sleep complaints are common in all ages; nonetheless, their prevalence increases with age. We found a similar trend in Canada, as older adults, relative to younger ones, had significantly increased likelihood of having troubled sleep. Epidemiological studies have shown that older adults have less slow-wave sleep (deep sleep) and rapid eye movement sleep, which affects their quality of sleep compared to those in their youthful years [63,64]. This may account for the differences seen between the older and the younger generation.

The current study found that Canadian females are more likely to have difficulty falling and staying asleep, which is consistent with most previous studies that assess troubled sleep rather than the quantity of sleep [65,66]. With regard to quantity, it has been found that males report less sleep [67]. It is well established in the literature that females are more likely to have internalizing problems, such as anxiety and depressive symptoms, and chronic pain (e.g., Refs. [68,69]). This may partially explain the gender difference, given that both internalizing problems and chronic pain are also associated with troubled sleep.

4.1. Limitations

Notwithstanding the interesting findings, this paper has some limitations that are also opportunities for future research. First, the cross-sectional nature of the data limits our ability to make causal claims on the temporal order between some of the covariates and troubled sleep. Additional studies that use longitudinal data are warranted. Second, most of the information collected is self-reported and, thus, is subject to recall bias. Lastly, changing the underlying levels of measurement of an ordinal variable into a dichotomous variable has the potential to affect the effect size of some of the results reported in this paper. However, the decision to recode ordinal

variables into dichotomous variables in the current study was informed by the fact that the distribution on most of the ordinal variables was not proportional across the various categories. In these situations, it is recommended that ordinal variables be treated as dichotomous variables [44].

4.2. Implications and future research

In summary, the results from this paper provide population-based evidence for childhood adversities as a major predictor of troubled sleep in adulthood. They highlight the importance of exploring sleep habits for children, adolescents, and adults who have experienced childhood maltreatment in health and mental health settings. Identifying sleep problems early and making appropriate referrals may help reduce the long-term effects of these adverse experiences on sleep, particularly for those who experienced sexual, physical, or multiple types of childhood maltreatment. Although this study identified that severe forms of childhood adversity are more highly associated with sleep problems than less severe forms, identifying the mechanism underlying the relationship between childhood adversity and sleep problems was beyond the scope of the current paper. For example, how do the characteristics of the sleep problem (e.g., onset of problems, type of sleep problem, intensity and severity of the sleep problem, presence of trauma-related symptoms at bedtime, etc.) and the childhood adversity (e.g., frequency of adversity, age at onset of adversity, duration of adversity, social support at time of adversity, etc.) impact the relationship? This is an important area for future research, especially given the negative health and mental health outcomes associated with both childhood adversity and long-term sleep problems. Obtaining more information on the mechanisms underlying the relationship will allow for more targeted and evidence-based prevention and intervention efforts to reduce the long-term impact of childhood adversity and sleep problems.

Conflict of interest

The authors declare that they had no conflicts of interests with respect to their authorship and/or the publication of this paper.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: http://dx.doi.org/10.1016/j.sleep.2015.02.527.

Acknowledgments

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