

Insomnia and Associated Risk Factors in Later Adolescence

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By

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ABSTRACT

Sleep is an essential component of health and well-being. The effect of insomnia, whether as a primary or secondary symptom, is a major health concern and should be closely studied and examined across all age groups. There is growing evidence that the effect of insomnia on adolescent's functioning is comparable to that of other major psychiatric disorders (e.g., mood disorders, anxiety disorders, etc.). Insomnia is associated with significant negative consequences, impairing functioning across a number of emotional, social, cognitive, and physical domains (Carskadon, 1999; Johnson, Roth, Schultz, & Breslau, 2006; Roberts, Roberts, & Duong, 2008b; Wolfson & Carskadon, 1998). This study examines insomnia in a sub-sample of 15 to 19 year old participants (n = 2,866) using data from the Canadian Community Health Survey (CCHS): Mental Health and Well-being (Cycle 1.2). Specifically, this study aims to: 1) assess the prevalence of insomnia among Canadian adolescents, 15 to 19 years of age; and 2) identify the variables associated with insomnia in this population. Based on the academic literature to date, it is hypothesized that insomnia will be significantly more prevalent among adolescents of the female sex and among those reporting psychological and/or physical health concerns. The analyses conducted included basic descriptive statistics (frequencies/percentages), bivariate analyses (Chi-square tests), and a multiple logistic regression. The prevalence rate of insomnia in adolescents was 9.5%, with no significant association found between sex and insomnia. The multivariate analysis showed insomnia to be significantly associated with the presence of a chronic condition, selected mood disorders (12 months), in adolescents who are experiencing "quite a bit" to "extreme" life stress, and in adolescents who were living in households other than with both parents. Insomnia was not found to be significantly associated with sex, selected anxiety disorder (12 months), heavy drinking, heavy cannabis use, and in

adolescents who were only experiencing “some life stress”. What was interesting was that when all other variables were not held constant, heavy cannabis use and having a selected anxiety disorder was significantly associated with insomnia. By examining the prevalence rate and variables associated with adolescent insomnia, more informed knowledge can be used to create prevention and treatment strategies to address adolescent sleep problems. By doing this, we can hopefully mitigate any negative impact insomnia may have on the adolescent’s ability to function and address the concerns before they become chronic.

Keywords: insomnia, adolescent, quantitative, prevalence, mental health, chronic health, sex, life stress, household type, cannabis use, medication use, alcohol use

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TABLE OF CONTENTS

PERMISSION TO USE	i
ABSTRACT	ii
ACKNOWLEDGMENTS	iv
TABLE OF CONTENTS	v
LISTS OF TABLES	viii
Chapter One: Introduction	1
Chapter Two: Literature Review	8
Insomnia Defined	8
Adolescents and Sleep	11
Prevalence of Insomnia	13
Insomnia, socioeconomic status, and ethnicity	14
Insomnia and age	16
Insomnia and sex	17
Health and Insomnia	18
Physical health problems and insomnia	19
Mental health problems and insomnia	20
Mental health problems and insomnia in adolescents	22
Summary	24
Consequences of Insomnia	25
Consequences of insomnia in adolescents	27
Summary	29
Purpose of Study	30

Chapter Three: Methodology	31
Data	31
Ethics	33
Participants	33
Measures	34
Dependent variable	34
Insomnia	34
Independent variables	34
Sex	34
Mental health	34
Selected mood disorders	34
Selected anxiety disorders	35
Physical health	35
Chronic health conditions	35
Life Stress	36
Use of medication to aid sleep	37
Uses sleep medication	37
Finds sleep refreshing	37
Heavy drinking	37
Heavy cannabis use	38
Education	38
Household type	38
Analysis	39

Chapter Four: Results	40
Participants' Profile	40
Bivariate Results	42
Multiple Logistic Regression Results	44
Summary	46
Chapter 5: Discussion	47
Summary of Findings	47
Findings as They Relate to the Current Literature	47
Limitations of the Current Study	50
Limitations of cross-sectional data	51
Limitations of self-reports and sample	52
Strengths of the Current Study	53
Implications for Future Research and Intervention	54
Conclusion	56
References	58
Appendix A: Variables used from the 2002 Canadian Community Health Survey (CCHS):	
Mental Health and Well-being Data Set	63

LIST OF TABLES

Table 4.1: Demographic and Health Profile	41
Table 4.2: Bivariate Associations	43
Table 4.3: Odds Ratio	43

Chapter One: Introduction

Sleep is a necessary component of an individual's health and wellbeing; without sleep one's quality of life is, more often than not, severely compromised. For most individuals, sleep comes easily and without disruption, and is often taken for granted, but for others, the simple task of "falling" and staying asleep is difficult and labourious. Such is the case for individuals who suffer from insomnia, where the desire for restful and restorative sleep, or sleep in general, often eludes them. Insomnia taxes its' sufferers, mentally and physically, and can cause a lot of stress for individuals both in their personal life, and their ability to be productive members of society.

Articles, in academic and popular literature, have warned of the consequences lack of restful and restorative sleep has on an individual and how it affects their social and personal lives. A recent article in the BBC News ("Insomnia damages relationships", 2011) stressed that the lack of sleep needs to be treated as a major health issue. The article summarized findings from a *Sleep Matters* (Robotham, Chakkalackal, & Cyhlarova, 2011) report, which suggested a link between insomnia and poor personal relationships, low energy levels, and an inability to concentrate. The lead author, Robotham (2011), believes "poor sleep leads to mental health problems which lead to even worse sleep," ("Insomnia damages relationships", 2011) recognizing that sleep problems, which had been largely ignored, affect not only our health and overall happiness, but that it is affecting the country and economy, as a whole, as well.

It is estimated that "about 25 per cent of Canadians will have a significant sleep disorder in their lifetime" (Seiberling, 2011). Moscovitch (Seiberling, 2011) noted sleep deprivation is becoming an epidemic that affects both the sufferer and society as a whole: "Sleep deprivation as a result of not sleeping as much as we need, or because of an underlying sleep disorder, is becoming quite an epidemic. [W]e are paying a very heavy price for it – both individually and

as a society”. Unlike the occasional sleep disturbance, sleep disorders are chronic and significantly impact an individual’s physiological and psychological health, and productivity. Both aforementioned articles, and numerous others articles published in the popular press, emphasize approaching the importance of sleep as a major health issue that affects both the individual and society. Not only are sleep problems a concern, they are considered a concern deemed newsworthy by popular press.

The consequences of insomnia are nothing new; 19th century philosopher, Arthur Schopenhauer stated in one of his essays, “Sleep is the interest we have to pay on the capital which is called in at death; and the higher the rate of interest and the more regularly it is paid, the further the date of redemption is postponed” (p. 52, Schopenhauer, 2007). This insight, over a century ago, shows how essential sleep was perceived in extending one’s life. Adequate sleep is one of the foundations in maintaining a certain quality of life. At the biological level, sleep helps support immune and nervous system functioning by allowing the body to fight illness and diseases, and by supporting growth, memory, and learning (Schenck, 2007). At the psychological and social level, sleep helps to improve mood and concentration, increase cognitive functioning, and decrease marital and/or familial problems by allowing individuals to function at a more optimal level (Schenck, 2007). In short, trouble with sleep can lead to grave consequences, especially with the accessibility of prescription drugs and its use to address sleep problems.

Of the numerous sleep disorders, it can sometimes be difficult to differentiate one sleep disorder from another as many have similar symptomatology but different etiologies. In particular, the challenge of recognizing insomnia from other sleep disorders is compounded by the challenges in assessing insomnia, as the concept of insomnia has been poorly defined in

academic studies and is often measured inconsistently; resulting in insomnia prevalence estimates that vary widely depending on the criteria used. These inconsistencies make it difficult to measure the prevalence rate of insomnia with accuracy, therefore, affecting the validity and reliability of the measures. In general, the true prevalence rate of insomnia in the general population is unknown, even though attempts have been made to operationally define the concept of insomnia.

Of the studies conducted, it has been found that 13% of Canadian adults have met the criteria for insomnia; that is, more than three million Canadians, aged 15 and over, had difficulty going to sleep or staying asleep most of or all of the time (Tjepkema, 2005). Research examining the stability of sleep problems, in particular symptoms of insomnia from early childhood to early adulthood, have been inconclusive, but clinical insomnia appears to be chronic (Patten, Choi, Gillin, & Pierce, 2000; Roberts, Roberts, & Duong, 2008b). In particular, age and sex are two of the most commonly identified variables associated with insomnia, but the association of age and sex in sleep problems has not always been consistent, particularly in adolescent insomnia. In general, prevalence rates of insomnia have been shown to increase with age and are higher among women, and, inconclusively, among those with lower socioeconomic status (Tjepkema, 2005).

Problems with somatic (e.g., medical disorders or poor physical health) and psychological functioning are strongly associated with sleep problems and insomnia prevalence (Roberts, Roberts, & Chan, 2008a; Taylor, Lichstein, Durrence, Riedel, & Bush, 2005). As a group, individuals with insomnia report more medical problems (e.g., arthritis, vascular disease), more frequent personal history of insomnia, poorer self-rated health, and an increased use of medications, drugs, and alcohol compared to those that do not report having sleep difficulties

(American Psychiatric Association [APA], 2000; Ohayon, 2002; Taylor et al., 2005). In adults, psychiatric disorders – in particular Mood (e.g., depression) and Anxiety Disorders– appear to be the strongest risk factor for, and are the most common co-morbidities associated with, insomnia (Roth, 2007). It is unclear, however, whether poor sleep leads to physical and mental health problems, which lead to even worse sleep, or whether physical and mental health problems lead to poor sleep, which exacerbate the sleep problem into a sleep disorder.

Insomnia affects all sufferers negatively, and there is growing evidence that the burden of insomnia among adolescents is comparable to that of major psychiatric disorders such as mood disorders, anxiety disorders, disruptive disorders, and substance abuse (Roberts et al., 2008a; Roberts et al., 2008b). This is especially concerning considering rates of insomnia have been found to be quite substantial among adolescents, with nearly one-fourth of adolescents meeting the definition of clinical insomnia in Roberts et al.'s (2008b) study. Additionally, adolescents have been shown to carry a significant chronic sleep debt throughout the school week, and are approximately eight times more likely than children to sleep 6 hours or less per night (Ohayon, Roberts, Zulley, Smirne, & Priest, 2000). This inability to obtain adequate amount of sleep for optimum functioning, especially during the week, has been associated with poor concentration, irritability, decrease cognitive functioning, and other negative outcomes in adolescents over time (Roberts et al., 2008a). Overall, the implications of insomnia and disrupted sleep on an adolescent's wellbeing and future functioning are profound.

Adolescence is a time of physical, cognitive, emotional, and social changes, and these changes can have a significant impact on adolescents' sleep patterns and behaviours; consequently, sleep disorders can also have a significant impact on adolescents' daytime functioning and development by affecting how they feel and behave. Similar to adult

insomniacs, the prevalence of insomnia symptoms in adolescents is quite high in those with anxiety and/or affective disorders (Ohayon et al., 2000); sleep disturbances and mood and/or anxiety disorders are often co-morbid complaints (Meltzer & Mindell, 2006). In adolescents, sleep deprivation, over time, increases risk of depression, lower self-esteem, and engagement in unsafe behaviour (e.g. violent behaviour, suicide/depressive feeling). Problems with somatic and psychological functioning have been found to be strong correlates for insomnia and with sleep problems in general, but the role of other associative factors (e.g., sex, age, socioeconomic status, etc.) has not always been reliable and continue to be so as research on adolescent insomnia is not abundant.

Sleep deprivation affects both the sufferer and society as a whole. The incidence and maintenance of insomnia symptoms have been associated with perceived poorer health, depressed mood, physical disability, widowhood, and a presence of a chronic disease (Ohayon, 2002). Compared to non-insomniacs, insomniacs tend to have more visits to the doctor, more hospitalization, and more accidents on the job and on the road (Daley, Morin, LeBlanc, Gregoire, & Savard, 2009); which is understandable as being deprived of adequate sleep over a long period of time can lead to decreased functioning. Insomniacs also have higher rates of work absenteeism, decreased job performance, and experience a decreased quality of life as they tend to have more difficulty coping with day-to-day demands and unexpected problems (Daley et al., 2009; Roth, 2007). Unfortunately, insomnia is often a disorder most individuals suffer quietly by themselves, often assuming it is a condition they bring upon themselves through poor sleep habits or lifestyle choices (e.g., drinking coffee, working shifts, etc.). Insomnia's strong negative impact on health utility also burdens society resources through loss of productivity and health

care expenses (Ohayon, 2002). Overall, the costs of untreated insomnia have been noted to be significantly greater than the direct costs associated with its treatment (Daley et al., 2009).

There is a strong emphasis on the importance of sleep needing to be approached as a major health issue due to its affect on both the individual and society as a whole. Sleep is an important aspect of all our lives; it allows our body and mind to rest and our body to reenergize itself for the next day. Without proper sleep we become fatigued, and our body and mind become stressed, thereby, not allowing us to function as optimally as we need it to. Like most disorders, insomnia is a condition associated with significant negative consequences, impairing functioning across a number of emotional, social, cognitive, and physical domains (Carskadon, 1999; Johnson, Roth, Schultz, & Breslau, 2006; Roberts et al., 2008b; Wolfson & Carskadon, 1998), with the degree of impairment increasing with insomnia's severity (Leblanc et al., 2007). These consequences are often compounded by insomnia's chronicity, further adding substantial impairments to the individual's quality of life.

If insomnia is considered an under-researched and poorly understood condition, than insomnia in adolescents is even more so. The effects of insomnia, whether as a primary or secondary symptom, is a major health concern and should be closely studied and examined across all age groups, and this study hopes to add to the small academic literature on adolescent insomnia. In particular, this study aims to examine insomnia prevalence in a group of adolescents, 15 to 19 years of age, in Canada, and examine whether certain variables like sex, chronic health concerns, mental health concerns, life stress, household structures, and alcohol use has any significant association with adolescent insomnia. By examining insomnia in adolescents, before they become insomniacs as adults, we, as professionals, can hopefully shed

some light on this subject and provide information and insight on how insomnia progresses and in how to best address these concerns.

Chapter Two: Literature Review

This chapter aims to summarize the current literature on insomnia, in general, and adolescent insomnia specifically. This chapter will also attempt to define insomnia, provide an overview of sleep behaviours during adolescence, review the prevalence and consequences of insomnia, and examine various variables (e.g., sex, mental health problems, chronic health problems, socioeconomic status, etc.) associated with insomnia and, more specifically, adolescent insomnia.

Insomnia Defined

Sleep disorders are distinguished from sleep problems by their chronicity and their effect on an individual's daily functioning. Sleep problems tend to be random occurrences that peak during stressful times, and are accentuated by worry and rumination, but usually goes away after the stressful situation passes, sleep disorders on the other hand persist during times of no stress and are themselves a cause of stress for most sleep disorder sufferers. Unlike occasional sleep disturbances, sleep disorders are chronic and significantly impact the individual's physiological and psychological health, and the individual's productivity as a whole. In particular, insomnia is commonly cited to be the primary sleep disorder found in those with chronic sleep problems.

The Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition – Text Revision (DSM-IV-TR) has a specific chapter devoted to Sleep Disorders (pp. 597-661, APA, 2000). The Sleep Disorders are organized into four sections according to presumed etiology: Primary Sleep Disorders (which is further subdivided into Dysomnia and Parasomnia), Sleep Disorder related to another Mental Disorder, Sleep Disorder due to a General Medical Condition, and Substance-Induced Sleep Disorder (APA, 2000). Primary Insomnia – a type of Dysomnia – will be the primary sleep disorder of interest in this study.

Dysomnia is characterized by abnormalities in the amount, quality, or timing of sleep, and includes sleep disorders such as Primary Insomnia, Primary Hypersomnia, Narcolepsy, Breathing-Related Sleep Disorder, Circadian Rhythm Disorder, and Dysomnia Not Otherwise Specified (Dysomnia NOS) (APA, 2000). In particular, Primary Insomnia is characterized by difficulty falling asleep, difficulty maintaining sleep, or a feeling of non-restorative sleep not due to any other identifiable causes such as a mental disorder or physical illness (APA, 2000).

According to the DSM-IV-TR, Primary Insomnia is defined by the following diagnostic criteria:

1) difficulty initiating or maintaining sleep, or non restorative sleep for at least one month being the predominant complaints; 2) sleep disturbance or associated daytime fatigue causes clinically significant distress or impairment in important areas of functioning (e.g., social, occupational, etc.); 3) sleep disturbance does not occur exclusively during the course of other Primary Sleep Disorders (e.g., Narcolepsy, Breathing-Related Sleep Disorder, Circadian Rhythm Sleep Disorder, etc.); 4) sleep disturbance does not occur exclusively during the course of a mental disorder (e.g., mood or anxiety disorders, delirium, etc.); and 5) sleep disturbance is not due to direct physiological effects of a substance (e.g., drug abuse, medication) or a general medical condition (p. 604, APA, 2000).

However, it can be difficult to differentiate Primary Insomnia from secondary insomnia and the vast number of sleep disorders mirroring Primary Insomnia's symptoms. For example, cases of secondary insomnia (when insomnia is not the primary cause of the sleep disorder) can be observed in Sleep Disorders due to a General Medical Condition, Mental Disorder, and/or are substance-induced, but insomnia in these cases is secondary to a condition that is severe enough to warrant independent clinical attention in precedence to the insomnia (APA, 2000). Other

Sleep Disorders such as Circadian Rhythm Sleep Disorder, Narcolepsy, and Parasomnias may also have symptoms similar to Primary Insomnia but have different etiologies (APA, 2000).

There are additional challenges to assessing insomnia. As insomnia has been operationally defined in multiple ways with varying standards and criteria, most academic authors acknowledge the lack of consistency found in the concept construction of insomnia. Some researchers have used the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM) to operationalize insomnia, while other researchers have focused on specific symptoms of insomnia (e.g., quality of sleep, duration of sleep, level of difficulty initiating and maintaining sleep, etc.). This is particularly common in large scale, epidemiological surveys where the criteria used to define insomnia varies between surveys, and there is a lack of comparability between the population studied, time frames used, and the time between follow up periods. So although attempts have been made, no standard definition of insomnia has prevailed as the accepted definition used for research purposes, therefore comparison between studies on insomnia should be done with caution.

For the purpose of this study, insomnia will be defined as a condition that is related to significant distress or impairments in an individual's functioning (e.g., physical, mental, occupational, etc.) due to difficulty initiating or maintaining sleep (Maxmen, Ward, & Kilgus, 2009). The purpose of this study is not to examine the specific prevalence rate of Primary Insomnia (i.e., insomnia that is mutually exclusive from all other etiologies) but to examine the prevalence of insomnia in adolescents in conjunction with well-established variables (e.g., sex, mental health, and chronic health) associated with adult insomniacs but that have not been well explored with adolescent insomniacs.

Adolescents and Sleep

Adolescence is a time of physical, cognitive, emotional, and social changes, and such changes can have a significant impact on adolescents' sleep patterns and behaviours. Consequently, sleep disorders can also have a significant impact on adolescents' daytime functioning and development (e.g., growth, learning, behaviour, mood, attention, memory, academic performance, etc.). It has been observed that individuals need more sleep during adolescence than during pre-puberty, but adolescents, more often than not, get less sleep than they need (Johnson et al., 2006; Ohayon et al., 2000).

The recommended hours of sleep for adolescents, optimal functioning is approximately 9 to 9.25 hours of sleep per night (Carskadon & Acebo, 2002; Carskadon, Wolfson, Acebo, Tzischinsky, & Seifer, 1998). By the time adolescents were in grade 12, many were found to obtain less than 7 hours of sleep per night (Carskadon et al., 1998; O'Brien & Mindell, 2005; Wolfson & Carskadon, 1998), indicating that many adolescents are not obtaining adequate amount of sleep during the week to function optimally. This meant that most of the adolescents, in particular the older ones, are functioning in a sleep-deprived state, with only a small portion of students obtaining more than 8 hours of sleep a night during the week (O'Brien & Mindell, 2005). In Ohayon et al.'s (2000) study, adolescents were found to be eight times or more likely than children to sleep 6 hours or less per night, and are only half as likely to sleep 9 or more hours per night.

Due to the onset of puberty, and its' accompanying biological changes (e.g., hormonal changes, shift in melatonin secretion, etc.), adolescents often experience a 2-hour shift in their circadian rhythm, causing their sleep patterns to undergo a phase delay (Carskadon & Acebo, 2002; Ohayon et al., 2000). This shift in the adolescent's circadian rhythm, and increased

preference for a delayed sleep phase, can lead to significant disturbances in their bedtime, rise time, and total sleep time, which can result in insufficient sleep and an eventual accumulated sleep debt (Johnson et al., 2006). This sleep debt becomes more pronounced in the higher grades (i.e., grade 11 and 12), where older students are observed to obtain less sleep than students in the lower grades (i.e., grade 9 and 10) (Carskadon et al., 1998; O'Brien & Mindell, 2005; Wolfson & Carskadon, 1998).

These biological pressures towards later bedtimes and rise times also often conflicts with early school start times and adolescence's external commitments (e.g., after-school employment, extracurricular activities, lifestyle choices, social activities, etc.) (Carskadon & Acebo, 2002; Carskadon et al., 1998; Johnson et al., 2006). These external commitments and early school hours can have a strong negative impact on adolescents' functioning by adversely affecting their daytime alertness and behaviours due to sleep deprivation (Carskadon et al., 1998; Ohayon et al., 2000).

Sleep habits are also observed to change considerably between late adolescence and young adulthood (individuals age 19 to 24) (Ohayon et al., 2000). When Ohayon et al. (2000) compared adolescents' sleep behaviours with those of the young adults in their study, they found adolescents (age 15 to 18) slept earlier, woke up earlier, slept for longer durations, and had less disrupted sleep compared to their young adult counterparts. It was also found that the extra amount of sleep obtained on weekends and days off are more important for adolescents than for young adults (Ohayon et al., 2000), as oversleeping on the weekends (i.e., "catching up" on sleep) appears to buffer the sleep deficit most adolescents accumulate over the weeknights (Carskadon et al., 1998; O'Brien & Mindell, 2005). Overall, insomnia-like symptoms are the most common sleep symptoms reported by adolescents (Johnson et al., 2006; Ohayon et al.,

2000), and are found to be relatively stable (Gregory & O'Connor, 2002; Johnson et al., 2006; Patten et al., 2000). However, careful consideration should be taken when trying to differentiate disrupted sleep as either a sleep delay – which can contribute to limited sleep, disrupted sleep patterns, and an increased vulnerability to excessive sleepiness – or insomnia. Unlike insomnia, individuals with delayed sleep patterns have little difficulty maintaining sleep once it is initiated and, although delayed, the sleep is normal.

Prevalence of Insomnia

According to the most recent data from a 2002 survey done by the Canadian Community Health Survey (CCHS): Mental Health and Well-being (Cycle 1.2), about 13% of Canadians, aged 15 and over, were found to have met the criteria for insomnia; that is, more than an estimated three million Canadians have difficulty going to sleep or staying asleep most of or all of the time (Tjepkema, 2005). In a study by Morin, LeBlanc, Daley, Gregoire, and Merette (2006), comprised of a representative sample of French-speaking Canadians, aged 18 and older, from the province of Quebec, Canada, 9.5% of the participants meet the diagnostic criteria for an insomnia syndrome, and about a third of their participants reported having at least one insomnia symptom. Similar rates were also found in LeBlanc et al.'s (2007) study; a little over one-third (32.3%) of their participants (age 18 and older) were classified as having insomnia symptoms, and 15.4% of their participants were classified as having an insomnia syndrome.

Rates of insomnia have been found to be quite substantial among adolescents. Roberts et al. (2008b) found nearly a quarter (22.3%) of their adolescent participants met their definition of chronic clinical insomnia. Similarly Roberts et al. (2008a) found that over 20% of their participants, who were sampled from the same data set as those found in Roberts et al.'s (2008b) study, met their definition of clinical insomnia during reassessment, and one-fourth of their

participants reported having one or more symptoms of insomnia almost daily for the past 4 weeks. Rates of insomnia that met the DSM-IV criteria were comparable across a number of studies (Johnson et al., 2006; Ohayon et al., 2000; Roberts et al., 2008a), with prevalence rates ranging from about 4% to 10.7%. Of the adolescents who reported having a sleep disorder in Ohayon et al.'s (2000) study, half of the adolescent reported having Primary Insomnia.

Clinical insomnia also appears to be chronic in adolescents. Rates of insomnia chronicity – usually measured by the reporting of insomnia symptoms during the initial assessment and reassessment – were found to be highly comparable in both Patten et al. (2000) and Roberts et al.'s (2008b) studies, with rates of reported insomnia symptoms being 41% and 46% respectively at reassessment. Data from studies by Roberts et al. (2008b), Johnson et al. (2006), Gregory and O'Connor (2002), and Patten et al. (2000) found that, between the period of 1 to 4 years, around 25% to 50% of adolescents have reported experiencing insomnia; meaning insomnia is a recurrent problem for most of these adolescents. This appears to be congruent with LeBlanc et al.'s (2007) study suggesting that previous episode(s) of insomnia is one of the best predictors of participants' current sleep status (e.g., having an insomnia syndrome, insomnia symptoms, or is a good sleeper) and future likelihood of experiencing insomnia symptoms.

The most common insomnia symptoms experienced by adolescents varied between studies, but difficulty initiating sleep (Johnson et al., 2006) and non-restorative sleep (Roberts et al., 2008a), were some of the most common symptoms noted among adolescents with insomnia. In particular, chronic non-restorative sleep, followed by difficulty initiating sleep, pose the greatest risks for insomnia reoccurrence with adolescents in Roberts et al.'s (2008b) study.

Insomnia, socioeconomic status, and ethnicity. Among adults, the evidence suggesting that income and education pose as independent risk factors for insomnia are not well supported

(Ohayon, 2002). Although the prevalence of insomnia has been found to be higher in individuals with lower incomes, lower socioeconomic status, lower education, among the unemployed, and in individuals working nights or shift work (Katz & McHorney, 1998; Leblanc et al., 2007; Ohayon, 2002), these findings have been inconsistent. Similarly, generalizations also cannot be made for individuals who do not work – although they have been found to be more likely to report having insomnia symptoms, compared to their working counterparts – as this risk appears to be higher among retirees and homemakers (Ohayon, 2002), and retirees and homemakers are variables that are closely related to factors such as age and sex.

Among adolescents, most studies have found no family income effect on the prevalence of DSM-IV-TR insomnia or on the incidence of insomnia over a 12 months period (Johnson et al., 2006; Patten et al., 2000; Roberts et al., 2008a). For example, Patten et al. (2000) found that family income did not predict insomnia chronicity over a 4 year period, meaning that trouble sleeping among adolescents suggested little, if any, association with socioeconomic status. Johnson et al. (2006) and Roberts et al. (2008a), however, did find that adolescents whose parents were less educated had higher lifetime prevalence rates of insomnia compared to their peers who had parents that were better educated, and Roberts et al. (2008a) also found lower family income to be a univariate risk factor for insomnia. Although inconclusive, there appears to be a strong reciprocal relationship between psychosocial risk factors and insomnia (Roberts et al., 2008b); this meant that negative psychosocial factors tend to increase an adolescent's risk of having insomnia and, in turn, insomnia, particularly chronic insomnia, is a good predictor of negative psychosocial outcomes.

There has also been little research on how ethnicity influences insomnia prevalence. Roberts et al. (2008a) found no ethnic status effects on incidence of insomnia over a 12 month in

adolescents, and no significant differences were found in regards to race/ethnicity, parental marital status, or household location between adolescents with insomnia and those with insomnia and a co-morbid psychiatric disorder as well (all $p \geq .20$) in Johnson et al.'s (2006) study. Patten et al. (2000), however, found large racial/ethnic differences between ethnic groups reports of sleep problems, with Asians reporting the highest rates of sleep problems and frequent sleep problems and "Blacks" reporting the lowest rate of sleep problems and frequent sleep problems. Similarly, Katz and McHorney's analysis suggest that "nonwhite" participants were more likely to report insomnia than their "white" participants. Unfortunately, similar to the evidence on education and income, the influence of race/ethnicity on adolescent insomnia is inconsistent, and, therefore, inconclusive, which is usually further compounded by the fact that the role of income, socioeconomic status, race/ethnicity, and education in adolescents' insomnia has been little explored.

Insomnia and age. Of all the demographic risk factors, age is one of the most clearly identified variables associated with insomnia. Survey data have consistently demonstrated that complaints of insomnia are more prevalent with increasing age (APA, 2000; LeBlanc et al., 2007) and are more prevalent in the elderly (Ohayon, 2002). Almost all epidemiological studies report an increased prevalence of insomnia symptoms with age, with insomnia prevalence increasing from the age of 45 years and onward, reaching close to 50% in individuals who are 65 years of age or older (Ohayon, 2002). This association can be seen in Leblanc et al.'s (2007) study, where individuals in their "Good Sleepers" group are significantly younger compared to individuals in their "Insomnia Syndrome Group".

The association with age in adolescences' sleep problems has been inconsistent though, with most studies reporting no age effect (Ohayon et al., 2000; Patten et al., 2000; Roberts et al.,

2008a), while others reported some age effects (Johnson et al., 2006; Roberts et al., 2008a). For example, Roberts et al. (2008a) indicate some age effects on incidence of insomnia over a 12 month period, whereas Patten et al. (2000) found age to not be predictive of insomnia chronicity over a 4 year period. Sleep habits have been observed to change considerably between late adolescence and young adulthood (Ohayon et al., 2000), but the incidence of insomnia may not necessarily increase rapidly during this transition (Johnson et al., 2006).

Insomnia and sex. The other most identified demographic risk factor for insomnia is sex. Survey data have consistently demonstrated that complaints of insomnia and sleep dissatisfaction are more prevalent among women than men (APA, 2000; LeBlanc et al., 2007; Ohayon, 2002). Ohayon (2002) noted that women were more likely than men to report insomnia symptoms, daytime consequences, and dissatisfaction with sleep, and were twice as likely to have an insomnia diagnosis. The insomnia symptoms ratio between men to women was around 1:4, and, after 45 years of age, 1:7. This skewed prevalence can be observed in Daley et al.'s (2009) and Leblanc et al.'s (2007) studies, where the proportion of women was significantly higher in their insomnia syndrome groups when compared to their insomnia symptoms and good sleepers groups. Sarsour et al. (2010) also found that, compared to individuals who were not in the non-restorative sleep group, more of the non-restorative sleep group members in their study were female. Other factors – such as being unmarried, separated, divorced, or widowed – that have been associated with increasing an individual's likelihood of reporting insomnia symptoms were also found to be more pronounced in women (Katz & McHorney, 1998; Ohayon, 2002).

Among adolescents, female adolescents have been found to have significantly higher prevalence and increased incidence of insomnia compared to their male counterparts (Ohayon et al., 2000; Roberts et al., 2008a), with the lifetime prevalence of insomnia to be marginally higher

among girls relative to boys (Johnson et al., 2006). Female adolescents were twice as likely to report nocturnal awakenings, and were significantly more likely to report difficulties in initiating or maintaining sleep, and to report non-restorative sleep ($p < .05$) as opposed to their male peers (Ohayon et al., 2000). Other studies have also found sleep problems, not necessarily insomnia, to be more common among girls than boys (Johnson et al., 2006; Patten et al., 2000; Roberts et al., 2008a).

However, not all studies support the findings that adolescents of the female sex are more likely than males to have insomnia. For example, Johnson et al. (2006) examined the lifetime rates of insomnia among adolescents and found no overall sex differences and no differences in insomnia before puberty between males and females. Patten et al. (2000) also found that sex did not predict chronicity of insomnia over a 4 years period. However, risks for insomnia have been found to be higher among girls than boys after puberty and the onset of menses (Johnson et al., 2006). Alternatively, although not significant, Carskadon et al. (1998) found that boys slept less than girls, and, compared to girls, boys exhibited a delayed sleep onset, woke earlier, and slept less. This pattern of sleep deprivation was, therefore, more pronounced in boys than in girls, with boys being less likely to extend sleep on nonschool nights, causing their total amount of sleep to be significantly less compared to their female peers (Carskadon et al., 1998).

Health and Insomnia

Aside from prevalence rates of insomnia being significantly associated with increased age, being of the female sex, and, inconclusively, in individuals with lower socioeconomic status, the prevalence of insomnia, among adults, has also been significantly associated with poor physical and mental health. In particular, psychological disorders (e.g., mood and anxiety disorders), at least among adults, appears to be the strongest risk factor associated with insomnia, and data

from studies examining adolescent insomnia also suggest somatic and psychological problems to be strong correlates of sleep problems. To better examine how health variables affect sleep and influence incidences of insomnia in adults and adolescents, physical and mental health factors will be examined separately below.

Physical health problems and insomnia. Problems with somatic functioning (i.e., medical disorders or poor physical health) are strongly associated with sleep problems and insomnia prevalence (Roberts et al, 2008a; Taylor et al., 2005). Such association is not surprising considering there is a whole section on Sleep Disorder due to a General Medical Condition categorized under Sleep Disorders in the DSM-IV-TR (APA, 2000), signifying the pervasive effect medical conditions have on Sleep Disorders. Physical ailments can cause sleep disturbances and perpetuate sleep disorders, but the reverse can also be true where individuals with insomnia tend to report more medical concerns (Leblanc et al., 2007). For example, individuals with Primary Insomnia may appear fatigued or haggard, which then leads to increased incidence of stress-related psychophysiological problems such as tension headaches, increased muscle tension, gastric distress, and so forth (APA, 2000), thereby perpetuating their health problems. Ohayon (2002) noted that insomnia sufferers or individuals reporting insomnia symptoms are more likely to report multiple health problems and have a physical illness such as arthritis, heart disease, stroke, respiratory symptoms, and/or back pain.

As a group, individuals with insomnia report more medical problems (e.g., arthritis, vascular disease), more frequent personal history of insomnia, poorer self-rated health, and more use of medications, drugs, and alcohol compared to individuals without insomnia (APA, 2000; Ohayon, 2002; Taylor et al., 2005). Adolescents with symptoms of insomnia have been found to be more fatigued, experience more daytime sleepiness, have less energy, and perceive their overall health

as poor, with increased symptoms of headache, stomachache, and backache compared to their peers with no insomnia symptoms (Wolfson & Carskadon, 1998). Insomnia patients also report more physical problems than patients with depression, and among the elderly, the presence of a co-morbid medical condition is a significant contributor to this population's increased insomnia prevalence rate (Roth, 2007).

Taylor et al.'s (2007) study is a good example of the reciprocal relationship between insomnia and health problems. Participants with chronic medical problems in this study had a higher prevalence of insomnia than participants without a chronic medical problem (e.g., heart disease, cancer, breathing problems, chronic pain, etc.), and the reverse was also true for participants with insomnia, who were found to have a higher prevalence of co-morbid medical conditions than participants without insomnia. Multiple medical conditions (e.g., cardiopulmonary symptoms, painful musculoskeletal conditions, prostate problems, etc.) were also independently associated with insomnia in Katz and McHorney's (1998) study, and, interestingly, patients whose medical condition was resolved reported improvements in their insomnia compared to patients whose medical condition was not resolved.

Mental health problems and insomnia. Problems with psychological functioning have been found to be strongly associated with the prevalence of sleep problems (Roberts et al., 2008a). In adults, psychiatric disorders – in particular mood disorders (e.g., depression, manic, dysthymia, etc.) – appeared to be the strongest risk factor for insomnia, and are the most common co-morbidities associated with insomnia, more than any other medical illness (Roth, 2007). More than one-third of insomniacs have an associated mental disorder (Ohayon, 2002), with an estimated 40% of all insomnia patients having a coexisting psychiatric condition (Roth, 2007).

Traditionally it was assumed that insomnia was a consequence of a psychiatric disorder, but given the chronicity of insomnia it is possible that insomnia may precede psychiatric disorders since more severe insomnia tends to lead to more daytime consequences and, therefore, leaves the individual more vulnerable to other psychiatric disorders. For example, in a large-scale European population-based study, Ohayon and Roth (2003) found that insomnia often preceded incident cases of mood disorders, rather than followed it. Individuals with insomnia have been characterized by the presence of neurotic symptoms, emotional inhibition, poor coping abilities, an inability to discharge anger, and a reported higher arousal predisposition when compared to good sleepers, suggesting individuals who are susceptible to insomnia are generally more psychologically aroused (Leblanc et al., 2007).

A strong relationship has been shown to exist between insomnia, depression, and anxiety, with insomnia being seen sometimes as a risk factor and precursor for future psychological dysfunctions (Gregory & O'Connor, 2002; Neckelmann, Muekleton, & Dahl, 2007; Taylor et al., 2005). Individuals with insomnia complaints present higher levels of depression and anxiety symptoms compared to those without insomnia complaints (Leblanc et al., 2007; Taylor et al., 2005). Higher levels of depressive and anxiety symptoms have also been consistently associated with insomnia as well (Taylor et al., 2005). Even when sleep difficulties are less severe, anxiety, neuroticism, and depressive symptoms are more prominent in individuals with insomnia (symptoms or syndrome) than in good sleepers (Leblanc et al., 2007). Frequency of non-restorative sleep has also been shown to be greater among those with anxiety, bipolar, and depressive disorders as well (Sarsour et al., 2010).

In particular, insomnia has been found to be a substantial risk in the development of a Mood Disorder, with studies reporting insomnia symptoms in the over 80% of subjects with a major

depressive illness (Ohayon, 2002). In LeBlanc et al.'s (2007) study, depressive symptoms were among the most reliable predictors of sleep group membership (i.e., insomnia syndrome, insomnia symptoms, or good sleepers groups), with a considerable number of individuals in the insomnia symptoms and syndrome groups indicating depressive symptoms of at least moderate intensity. Sarsour et al. (2010) found depression to be associated with non-restorative sleep, and that more individuals in their non-restorative sleep group had current depression compared to individuals who were not experiencing non-restorative sleep. Although, the persistence of insomnia has been associated with higher incidences of depressive disorders, when insomnia is compared to other depressive symptoms (e.g., anhedonia, feelings of worthlessness, mood disturbances, thoughts of death, etc.), insomnia is a less important predictor of future depression (Ohayon, 2002).

Mental health problems and insomnia in adolescents. Adolescents who have psychiatric issues also commonly experience sleep disorders, and sleep disorders may even, in many cases, contribute significantly to daytime symptoms and functioning. Johnson et al. (2006) found about 53% of adolescents with insomnia had a co-morbid psychiatric disorder, and adolescents who have a co-morbid psychiatric disorder had an earlier age of insomnia onset compared to those who only had insomnia. Although it is unclear whether insomnia precedes psychiatric disorders, or vice versa, it is well established that disturbed sleep is often associated with a variety of emotional difficulties among adolescents, which includes: increased reports of depression, anxiety, irritability, fearfulness, anger, tenseness, lower self-esteem, emotional instability, inattention, and conduct problems compared to those adolescents with no, or only occasional, sleep problems (Fredriksen, Rhodes, Reddy, & Way, 2004; O' Brien & Mindell, 2005; Taylor et al., 2005; Wolfson & Carskadon, 1998).

Similar to the results found in adult insomniacs, the prevalence of insomnia symptoms in adolescents is quite high in individuals with an anxiety and/or mood disorder. Analysis (Ohayon et al., 2000) showed nearly three-fourths of adolescents with a DSM-IV-TR anxiety disorder diagnosis and 68% of adolescents with a mood disorder had at least one symptom of insomnia. Adolescents who “worry” more than their peers were also at risk for difficulties with sleep onset and prolonged night waking due to rumination over topics such as social interactions, academic expectations, family problems, and current events (Meltzer & Mindell, 2006). So, although sleep disturbances, such as insomnia, can be symptoms of either an anxiety and/or mood disorder, the consequences of disrupted or insufficient sleep often intensifies these disorders as well.

Sleep deprivation, over time, has also been found to increase risks for depression and lower self-esteem in adolescents, but was not found to increase the risk of poor academic functioning (Fredriksen et al., 2004). This was similarly observed in Gregory and O’Connor’s (2002) study, where the correlations of sleep problems (including symptoms of insomnia) with depression and anxiety were observed to increase over time. Symptoms of insomnia at baseline were also found to increase future risks of poor functioning on multiple indicators of somatic, psychological, and interpersonal functioning, as well as increasing risks for future psychological dysfunction (Roberts et al., 2008b). Not surprisingly, adolescents who reported trouble sleeping were significantly correlated with aggression, attention problems, anxiety/depression, and withdrawal behaviours (Coulombe, Reid, Boyle, & Racine, 2011). However, when psychological comorbidity was accounted for in that study, associations among sleep variables and psychological symptoms appears to accompany specific sleep patterns (e.g., nightmares, sleeping more, etc.) and the associations were of a relatively smaller magnitude. This is not surprising as

psychological co-morbidity often increases stress in an individual, and will, therefore, magnify problem behaviours or psychological symptoms.

Findings have demonstrated that children experiencing sleep problems at age 4 predicted future behavioural and/or emotional problems in mid-adolescence (Gregory & O'Connor, 2002), and that rebelliousness and depression at baseline predicted insomnia symptoms 4 years later among adolescents (Patten et al. 2000). These findings demonstrate how insomnia and behavioural and emotional problems perpetuate one another. O'Brien and Mindell's (2005) study, which explored the relationship between poorer sleep habits and self-reported increased risk-taking behaviours among adolescents, 85.5% of students who reported poorer sleep habits had engaged in some form of unsafe behaviour (e.g., violent behaviours, suicidal/depressive feeling), and 19.3% of the same participants had seriously contemplated attempting suicide during the 12 months preceding the survey. Although not significant, the results indicated students who reported more sleep problems were more likely to report unsafe behaviour and substance use, and that these rates of substance use and unsafe behaviours were higher for individuals in the upper grades than those in the lower grades. In general, adolescents with sleep problems reported more suicidal ideation and attempts, and report more drug and alcohol use than those who showed no, or only occasional, sleep problems (O'Brien & Mindell, 2005; Wolfson & Carskadon, 1998).

Summary. As with insomnia due to chronic health problems, it is unclear whether poor sleep leads to mental health problems, which lead to even worse sleep, or whether mental health problems lead to poor sleep which, in turn, exacerbate the sleep problem leading into a sleep disorder, such as insomnia. Although insomnia and psychopathology are often strongly associated, it is not always easy to differentiate whether insomnia is the cause or effect of the

related psychiatric problems. In the end, co-morbid psychiatric disorders such as depression, anxiety, or substance abuse may be a consequence of, as well as a risk factor for, disrupted sleep.

Consequences of Insomnia

Sleep deprivation is quite common and affects both the sufferer and society as a whole. The incidence and maintenance of insomnia symptoms have been associated with perceived poorer health, depressed mood, physical disability, widowhood/widowerhood, and the presence of a chronic disease (Ohayon, 2002). Compared to patients with congestive heart failure, patients with severe insomnia have been found to have statistically greater loss of function in reported pain, and emotional and mental health variables (Roth, 2007). Individuals who have experienced insomnia in the past are found to be 2.55 times more at risk of being classified with having severe insomnia compared to those who have never experienced insomnia (Leblanc et al., 2007). Similarly, Sarsour et al. (2010) found individuals classified as experiencing non-restorative sleep experienced a decrease in their daytime physical, cognitive, and emotional functioning compared to individuals who were not experiencing non-restorative sleep.

Due to its chronicity, insomnia is associated with substantial impairments in a person's quality of life. Like most disorders, insomnia is a condition associated with significant negative consequences, impairing functioning across a number of emotional, social, cognitive, and physical domains (Roth, 2007), with the degree of impairment increasing with insomnia's severity (Leblanc et al., 2007). Individuals with insomnia symptoms report poorer quality of life compared to good sleepers, with individuals with an insomnia syndrome having the poorest quality of life compared to those with only insomnia symptoms and good sleepers (Leblanc et al., 2007).

The importance of sleep needing to be approached as a major health issue cannot be stressed enough. Insomnia has been shown to have a strong negative impact on health utility, as individuals with insomnia are more likely to make greater use of healthcare services than non-insomniacs (Ohayon, 2002). Aside from direct consultation in regards to insomnia symptoms, insomnia also burdens the health care system in terms of secondary health problems, such as money spent on medication and treatments, and accompanying potential negative consequences (e.g., addiction to prescription sleep medications) (Sarsour et al., 2010). Simon and VonKorff (1997) found – after adjusting for age, gender, and chronic disease – that compared to non-insomniacs, days of restricted activity due to illness and days spent in bed were about twice as common among insomniacs, with the mean total health care expenditures being observed to be 60% higher in the insomnia group relative to the control group.

Aside from the stress and toll insomnia causes for the sufferer, insomnia also burdens the economy in terms of lost productivity. Compared to non-insomniacs, insomniacs have higher rates of work absenteeism, decreased job performance, and more difficulty coping with day-to-day demands and stressors (Daley et al., 2009; Roth, 2007). Work productivity is often compromised among insomniacs due to decreased concentration, difficulty performing duties, increased occurrence of accidents, and other work-related problems (Daley et al., 2009; Léger, Guilleminault, Bader, Lévy, & Paillard, 2002; Roth, 2007). Even when chronic conditions and other health, lifestyle, and socio-economic variables were taken into consideration, individuals with insomnia continued to have significantly higher odds of reporting a disability day and not working compared to non-insomniacs (Tjepkema, 2005). Additionally, the overall increases in occurrences of accidents pose one of the greatest health risks to individuals suffering from insomnia and chronic sleep deprivation, with insomniacs being up to 2.5 to 4.5 times more likely

to have an accident (Roth, 2007), and are found to be more likely to be involved in an industrial accident in the past 12 months compared to good sleepers (Léger et al., 2002).

A study by Daley et al. (2009), with a randomly selected sample of adults in the province of Quebec, Canada, found the costs of untreated insomnia to be significantly greater than the direct costs associated with its treatment. The study indicated insomnia has a significant economic burden to society, with the total annual costs for sleep disorders costing around \$6.5 billion, representing about 1% of the province's gross domestic product for the year 2002. For individuals with an insomnia disorder, the annual per-person insomnia related costs were \$5010 (\$293 in direct costs and \$4717 in indirect costs), which is substantially greater compared to the costs accumulated by good sleepers who averaged \$422 (\$45 in direct costs and \$376 in indirect costs) in insomnia related expenses. Of these costs, 76% of the cost is related to lost in productivity, and alcohol (being consumed as sleep aids) was the highest direct cost associated with insomnia (58%), followed by consultations for insomnia (33%). Despite insomnia's high prevalence and economic burden, however, insomnia continues to remain untreated for the most part.

Consequences of insomnia in adolescents. Sleep disorders can have a significant impact on the adolescents' daytime functioning and development by affecting how they feel and behave. An inability to obtain adequate amount of sleep for optimum functioning, especially during the week, are associated with negative outcomes over time among adolescents (Roberts et al., 2008a). Inadequate sleep can lead to emotional and behavioural difficulties (Roberts et al., 2008b), impairments in academic and intellectual functioning (Carskadon, 1999), poor emotional and physical health, and can adversely affect cognitive functioning and performance (Johnson et al., 2006; Wolfson & Carskadon, 1998). In addition, compared to individuals without sleep

problems, individuals with chronic sleep problems receive more mental health services at school and at other mental health outpatient services (Roberts et al., 2008b). Not all studies shows sleep deprivation leads to poor academic functioning (e.g., Fredriksen et al., 2004); although most studies do suggest sleep deprivation can adversely affect academic performance (e.g., Carskadon, 1999; Meltzer & Mindell, 2006; O'Brien & Mindell, 2005).

Trouble sleeping has also been associated with concurrent problems at school, problems with peers and parents, psychiatric disorders (e.g., depression, anxiety, conduct problems, suicidal thoughts and attempts, etc.), somatic problems (e.g., excessive fatigue and pain), and substance use (Johnson et al., 2006; Roberts et al., 2008a). Inadequate sleep and increased sleep problems can also lead to increased daytime sleepiness, increased risk-taking (Carskadon 1999; Johnson et al., 2006; O'Brien & Mindell, 2005), tardiness, missed school days, moodiness, and irritability, with overall negative effect on growth, behaviour, emotional regulation, mood, attention, learning, and memory (Meltzer & Mindell, 2006). Generally, adolescents with sleep disturbances perceive themselves as having poorer health than their peers who do not have sleep problems (Roberts et al., 2008a).

The implications of insomnia on an adolescent's well-being and future functioning are profound. Sleep deprivation in youths, even with aids (e.g. caffeinated or energy drinks) to help sustain daytime wakefulness – which may not be conducive in addressing the issue – clearly have an impact on their overall well-being. With the exception of peer relations, chronic insomnia has been demonstrated to increase the odds of poor outcomes across multiple aspects of an adolescent's psychological, interpersonal, and somatic functioning (Fredriksen et al., 2004; Gregory & O'Connor, 2002; Roberts et al., 2008b). So, although adolescents may not be affecting the economy on as large a scale as individuals who are working, youth with

unaddressed insomnia will likely become adults with insomnia if their sleep problems are not properly addressed, thereby perpetuating the adolescents' current sleep problems into adulthood.

Summary

The impact of insomnia on adolescents' well-being should be taken as seriously as the impact imposed on individuals suffering from other major psychiatric disorders. Clearly more information is needed on the prevalence of insomnia in adolescents, and additional longitudinal studies examining insomnia's etiology would prove useful in the development of preventative care. Further research on insomnia in adolescents can also help clarify the extent the burden of insomnia may have on current adolescent insomniacs and help mitigate any negative impact insomnia may have on the adolescent's ability to function and live a more fulfilling life.

The effect of insomnia, whether as a primary or secondary symptom, is a major health concern and should be studied and examined across all age groups. The increased risks of comorbidity with other psychological and medical disorders and diseases, and distress to future quality of life, raise the importance of addressing and examining the prevalence of insomnia, or insomnia-like symptoms, in adolescents. Examining the prevalence and variables associated with insomnia in adolescents will aid health care professionals in making more informed assessments and pursuing appropriate prevention and treatment strategies. By doing so it can help prevent the consequences of insomnia from negatively affecting adolescent's functioning and ability to participate as productive members of society when they are adults.

However, due to insomnia's heterogeneous nature, it is difficult to determine insomnia's etiology. So far, the data on adolescent sleep problems suggest that problems with somatic and psychological functioning are strong correlates of insomnia, and of sleep problems in general, but findings with regard to the role of other variables (e.g., sex, age, family structure, stress,

alcohol use, etc.) in adolescent insomnia have not always been consistent. Insomnia in adolescents, like the majority of pediatric sleep disturbances, will most likely persist if left untreated and can have a significant impact on the adolescent's mood, behaviour, development, and functioning. Thus, it is important to examine the prevalence and severity of sleep disorders among adolescents. As discussed earlier, the cost to treat insomnia early is economically more viable than leaving insomnia and sleep problems untreated. When left untreated, insomnia have a far greater negative impact on the individual's mental and physical health, and, therefore, their well-being, quality of life, and productivity. Clearly, insomnia is not only a chronic disorder affecting a substantial proportion of the adolescent population, but also a public health concern.

Purpose of Study

To contribute to the limited academic literature on adolescent insomnia, this study examines insomnia in a group of adolescents, 15 to 19 years of age, in Canada. This study uses data from the 2002 Canadian Community Health Survey (CCHS): Mental Health and Well-being (Cycle 1.2), which consist of a series of survey questions about Canadians' (15 years of age or older) health, lifestyle habits, and demographic variables. Specifically, this study aims to: 1) assess the prevalence of insomnia among Canadian adolescents, 15 to 19 years of age; and 2) identify variables associated with insomnia in this population. Based on the academic literature to date, it is hypothesized that insomnia will be significantly more prevalent among adolescents of the female sex and among those reporting psychological and/or physical health conditions.

Chapter Three: Methodology

Data

The study used data from the Canadian Community Health Survey (CCHS): Mental Health and Well-being (Cycle 1.2), which measures factors linked to the mental health of Canadians. According to the CCHS Master File Documentation (Statistics Canada, 2004), the primary objectives of the survey are to: 1) “[p]rovide timely, reliable, cross-sectional estimates of mental health determinants, mental health status[,] and mental health system utilization across Canada;” 2) assess the impact and burden of mental illness on the population by determining the prevalence rates of selected mental disorders; 3) “[j]uxtapose access and utilization of mental health services with respect to perceived needs; and” 4) “[a]ssess the disabilities associated with mental health problems to individuals and society” (p. 4).

The CCHS, a key component of the Population Health Surveys Program of Statistics Canada, has an overall purpose to: 1) aid in the development of public policy; 2) provide data for analytic studies that will assist in understanding the determinants of health; 3) collect data on the economic, social, demographic, occupational, and environmental correlates of health; and 4) increase the understanding of the relationship between health status and health care utilization.

Expert consultation was an integral part in the content development for CCHS Cycle 1.2. Content topic selection was created through extensive consultations with experts, community health region stakeholders, the research community, and regional, provincial, and federal representatives, in addition to consultation with representatives of the World Health Organization (WHO), academia, consumers, and professional associations. The discussions within the Mental Health Expert Group (assembled for the survey) and Population Health Advisory Committee resulted in the selection of priority areas in terms of mental well-being (e.g., General Health,

Physical Activities, Psychological Well-being, Spiritual Values, Stress, Social Support, etc.) and mental disorders (e.g., Agoraphobia, Major Depressive Episode, Manic Episode [Mania], Panic Disorder, Pathological Gambling, Social Phobia, etc.)

The format, content, and objectives for Cycle 1.2 were also based on a selection of mental disorders from the World Mental Health – Composite International Diagnostic Interview Instrument (WMH-CIDI) – “a lay-administered psychiatric interview that generates a profile of those with a disorder according to the definitions of the [DSM-IV]” (p. 6, Statistics Canada, 2004). Variables of well-being and determinants of health in Cycle 1.2 are based on sources used in surveys such as the National Population Health Survey (NPHS), the CCHS (Cycle 1.1), the Health Promotion Survey (HPS), and other surveys, with some minor changes made to better meet the needs and purpose of Cycle 1.2. It should be noted, that although the WMH-CIDI questions and algorithms were operationalized to meet the needs of CCHS 1.2 it could not be used, or assumed, to measure all aspects associated with the DSM-IV classification and definitions of mental disorders.

Data collection for Cycle 1.2 began in May, 2002, and ended in December, 2002, spanning approximately eight months. The survey used a multistage, stratified cluster design to select eligible households. A comprehensive explanation of the CCHS sample design can be found in the CCHS Master File Documentation (Statistics Canada, 2004), which can be downloaded from the Statistics Canada website (<http://www.statcan.gc.ca/>). The target population were Canadians age 15 years or older who were living in private occupied dwellings, from the ten Canadian provinces – British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland. Residents from the three territories, Indian Reserves, Crown Lands, Health Care institutions, certain remote regions, and

full-time members of the Canadian Armed Forces were excluded from the survey sampling. The overall response rate for the CCHS was 77% with a total sample size of 36,984 participants. Most interviews for the CCHS were conducted in person, but participants who could not be reached in person were interviewed by telephone. To balance the interviewers' workload, data collection was divided into 3 collection periods: May to July 2002 (Q1; covering three months to allow interviewers to familiarize themselves with the survey), August to September 2002 (Q2; covering two months), and October to November 2002 (Q3; covering two months). To improve response rates, data collection continued beyond November 2002 until the end of December. A detailed outline of the survey questions used in this study can be found in Appendix A.

Ethics

This study was exempt from the Research Ethics Board (REB) review process as review and approval is not required to conduct secondary data analyses. Due to the fact that individual participants cannot be identified in any published reports and the data used cannot be linked to individuals, the study was approved to proceed (Article 3.3 of the Tri-Council Policy Statement: Ethical conduct for Research Involving Humans [1998]).

Participants

To address the research objectives of this study, a sub-sample of 15 to 19 year old participants were selected. This selection resulted in 2,866 participants in total; 1432 of the participants were male and 1434 of the participants were female.

Measures¹

Dependent variable

Insomnia. Insomnia was measured by participants' response to a single question: "How often do you have trouble going to sleep or staying asleep?" There were six response categories: "none of the time", "a little of the time", "some of the time", "most of the time", and "all of the time". Based on previous study (Tjepkema, 2005), these response options were collapsed into two categories: 1) individuals who have insomnia (this comprised of participants who selected "most of the time" or "all of the time" to the question), and 2) individuals who do not have insomnia (this comprised of participants who selected "none of the time", "a little of the time", or "some of the time" to the question).

Independent variables

Sex. Sex was measured by participants identifying themselves as being either "male" or "female" in the CCHS (Cycle 1.2.).

Mental health. Self-rated mental health was assessed by the question "In general, would you say your mental health is: (excellent, very good, good, fair or poor)?" To allow the study to establish whether individuals viewed their mental health as generally good or poor, the categories were collapsed into two groups: 1) "excellent", "very good", and "good"; and 2) "poor" and "fair". Self-reported mental health measures have been noted to be a "potentially useful indicator for monitoring general mental health" (p. 9, Mawani & Gilmour, 2010).

Selected mood disorders. The presence of a selected mood disorders ("yes", have a selected

¹ **Note.** All respondents 15 to 19 years of age were included in the analysis except for respondents who responded with "don't know", refused to answer, or if the variable of interest did not pertain to them.

mood disorder, or “no”, does not have a selected mood disorder) was measured by the presence of depression and/or mania within the previous 12 months. Criteria for depression and mania were derived from the CCHS multivariate algorithm for a mood disorder (refer to Appendix A of this document for a detailed description of how these variables were derived). This algorithm was based on the WMH-CIDI, which “was designed to measure the prevalence of mental disorders at the community level” (p. 2, Mawani & Gilmour, 2010).

Selected anxiety disorders. The presence of a selected anxiety disorders (“yes”, have a selected anxiety disorder, or “no”, does not have a selected anxiety disorder) was measured by the presence of a panic disorder, social phobia, and/or agoraphobia within the previous 12 months. Criteria for panic disorder, social phobia, and agoraphobia were derived from the CCHS multivariate algorithm for an anxiety disorder (refer to Appendix A of this document for a detailed description of how these variables were derived). This algorithm was also based on the WMH-CIDI (Mawani & Gilmour, 2010).

Physical health. Self-rated physical health was assessed by the question “In general, would you say your physical health is: (excellent, very good, good, fair or poor)?” To allow the study to establish whether individuals viewed their physical health as generally good or poor, the categories were collapsed into two groups: 1) “excellent”, “very good”, and “good”; and 2) “poor” and “fair”. This allowed the study to categorized participants into: 1) those who viewed their physical health as generally good, and 2) those who viewed their physical health as generally poor.

Chronic health conditions. The chronic health conditions variable encompasses long-term health problems, and was measured by participants’ disclosure (i.e., responding “YES”) to having any of the following chronic health conditions within the past 12 months which had been

diagnosed by a health professional: asthma, fibromyalgia, arthritis/rheumatism, back problems, high blood pressure, migraine, epilepsy, diabetes, heart disease, cancer, stomach/intestinal ulcers, suffer from the effects of a stroke, bowel disorders (e.g., Crohn's Disease or colitis), chronic bronchitis, thyroid condition, chronic fatigue syndrome (CFS), and multiple chemical sensitivities. Chronic health variables that included respondents aged 18 and older (e.g., "Has glaucoma" and "Has cataracts") were also included in the study, but only respondents 18 and 19 years of age were used in the analysis. Such self-reported measures of chronic diseases have shown to have adequate congruence with physician diagnoses obtained from medical records (Harlow & Linet, 1989).

Variables that contributed to the variable – "Has a chronic condition" – but did not include the participants from the population of interest (e.g., "Has emphysema or chronic obstructive pulmonary disease") or were not considered in this study to be chronic health conditions (e.g., "Has an obsessive-compulsive disorder", "Has a post traumatic stress disorder", and "Has a learning disorder") were excluded from the analysis.

Life stress. Self-perceived life stress was measured by the question: "Thinking about the amount of stress in your life, would you say that most days are: (not at all stressful, not very stressful, a bit stressful, quite a bit stressful, extremely stressful)?" Based on previous study (Tjepkema, 2005), these response options were collapsed into three categories: 1) individuals who were not experiencing any stress (this comprised of participants who selected "Not at all stressful" or "Not very stressful" to the question), 2) individuals who were experiencing some stress (this comprised of participants who selected "A bit stressful" to the question), and 3) individuals who were experiencing a lot of stress (this comprised of participants who selected "Quite a bit stressful" or "Extremely stressful" to the question).

Use of medication to aid sleep. Use of medication to aid sleep was measured by the question: “In the past 12 months, did you take any medication to help you sleep (such as Imovane, Nytol or Starnoc)?” Response categories were “Yes” and “No”

Uses sleep medication. The use of sleep medication, under professional supervision, was measured by the question: “You mentioned taking [medication to help you sleep]. Was that under the supervision of a health professional?” This variable is an extension of the variable – “Use medication to aid sleep”, in which respondents that replied, “Yes” to the prior variable (“In the past 12 months, did you take any medication to help you sleep [such as Imovane, Nytol or Starnoc]?”), was asked if medication use was done under the supervision of a health professional. Response categories were “Yes” and “No”.

Finds sleep refreshing. The frequency that participants found sleep refreshing was measured by the question: “How often do you find your sleep refreshing?” Response categories were “None of the time”, “A little of the time”, “Some of the time”, and “All of the time”. For the purpose of this study, the categories were collapsed into two groups: 1) individuals who did not find their sleep refreshing (this consisted of participants who selected “None of the time” or “A little of the time” to the question), and 2) individuals who found their sleep refreshing (this consisted of participants who selected “Some of the time” or “All of the time” to the question).

Heavy drinking. Heavy drinking was assessed by the question: “During the past 12 months, how often did you drink alcoholic beverages?” Response categories were “Less than once a month”, “Once a month”, “Once a week”, “2 to 3 times a month”, “2 to 3 times a week”, “4 to 6 times a week”, and “Everyday”. For the purpose of this study, the categories were collapsed into two groups: 1) no, does not engage in heavy drinking (this comprised of participants who answered “Less than once a month” “Once a month”, “Once a week”, or “2 to 3 times a month”

to the question); and 2) yes, engages in heavy drinking (this comprised of participants who answered “2 to 3 times a week”, “4 to 6 times a week”, or “Everyday” to the question).

Heavy cannabis use. Heavy cannabis use was assessed by the question: “How often (did you use marijuana, cannabis or hashish in the past 12 months)?” Response categories were “Less than once a month”, “1 to 3 times a month”, “Once a week”, “More than once a week”, and “Everyday”. For the purpose of this study, the categories were collapsed into two groups: 1) no, does not engage in heavy cannabis use (this comprised of participants who answered “Less than once a month” or “1 to 3 times a month” to the question); and 2) yes, engages in heavy cannabis use (this comprised of participants who answered “Once a week”, “More than once a week”, or “Everyday” to the question).

Education. Education was assessed by the question: “Are you currently attending a school, college or university?” Response categories were “Yes” and “No”.

Household Type. The CCHS respondents’ current living arrangement were categorized into one of these seven categories: “Unattached individual living alone”, “Unattached individual living with others”, “Living with spouse/partner”, “Parent living with spouse/partner, children”, “Child living with single parent with/without siblings”, “Child living with two parents with/without siblings”, and “Other”. For the purpose of this study, the categories were collapsed into three groups: 1) individuals living with both parents (this consisted of participants who were categorized under “Child living with two parents with/without siblings”), 2) individuals living with a single parent (this consisted of participants who were categorized under “Child living with single parent with/without siblings”), and 3) individuals who were living in other living arrangements (this consisted of participants who were categorized as “Unattached individual living alone”, “Unattached individual living with others”, “Living with spouse/partner”, “Parent

living with spouse/partner, children”, or “Other”).

Analysis

Initial analyses involved basic descriptive statistics (frequencies/percentages) to provide an overall demographic and health profile of study participants. A series of bivariate analyses were then conducted examining unadjusted associations between insomnia (the dependent variable) and all of the independent variables. Chi-square tests were conducted to identify which of the independent variables were statistically significantly associated with the presence of insomnia. Finally, simultaneous multiple logistic regressions were conducted to assess the relationship between insomnia and the independent variables, adjusting for all other variables in the model. Data were analyzed using the Predictive Analytics SoftWare (PASW) Statistics 18.0 (Chicago, IL, 2009). It should be noted that several variables from the bivariate analyses, specifically the self-rated physical health and mental health variables, were excluded from the logistic regression analyses to avoid confounding the data due to conceptual overlap with other key variables – chronic health conditions, selected mood disorders, and selected anxiety disorders variables).

Chapter Four: Results

Participants' Profile

Table 4.1 presents the study participants' demographic and health profile. The sample was comprised of a slightly higher proportion of males (51.6%) than females (48.4%). Most participants were attending school (79.8%), and about two-thirds (65.2%) of participants were living with both their parents. Nearly 10% of participants reported having insomnia. Of all the participants, an estimated 5% of participants reported having taken medication to aid their sleep at least once in the past 12 months, with 28.3% of these participants taking sleep medication under professional supervision. Overall, 86% of participants find their sleep refreshing.

The majority of participants rated their mental health and physical health as generally good – 94.0% and 91.5%, respectively, and almost half of the participants were experiencing “none” to “a little” life stress (42%). Only a small percentage of participants reported having a selected anxiety and/or mood disorder - 6.1% and 6.3%, respectively. Similarly, participants who reported engaging in heavy alcohol or cannabis use were also on the lower end, with 7.8% of adolescents reporting engaging in heavy alcohol use and 9.9% of adolescents reporting engaging in heavy cannabis use. However, 51.2% of participants reported having a chronic condition. That is, more than half of the participants reported having one or more of the following conditions: asthma, fibromyalgia, arthritis/rheumatism, back problems, high blood pressure, migraine, epilepsy, diabetes, heart disease, cancer, stomach/intestinal ulcers, glaucoma, cataracts, effects of a stroke, bowel disorders (e.g., Crohn's Disease or colitis), chronic bronchitis, thyroid condition, CFS, and multiple chemical sensitivities.

Table 4.1**Demographic and Health Profile**

Characteristics		n (%)
Insomnia	Yes	273 (9.5%)
	No	2593 (90.5%)
	Missing/Not stated/Refusal	--
Sex	Male	1479 (51.6%)
	Female	1387 (48.4%)
Physical Health	Excellent/Very good/Good	2622 (91.5%)
	Fair/Poor	244 (8.5%)
	Missing/System	--
Chronic Condition	Yes	1468 (51.2%)
	No	1398 (48.8%)
Mental Health	Excellent/Very good/Good	2694 (94.0%)
	Fair/Poor	170 (5.9%)
	Missing/System	3 (0.1%)
Selected Mood Disorders (12 mo.)	Yes	182 (6.3%)
	No	2669 (93.1%)
	Missing/Not stated/Refusal	15 (0.5%)
Selected Anxiety Disorders (12 mo.)	Yes	174 (6.1%)
	No	2670 (93.2%)
	Missing/Not stated/Refusal	22 (0.8%)
Took medication to help sleep (12 mo.)	Yes	143 (5%)
	No	2712 (94.6%)
	Missing/Not stated/Refusal	11 (0.4%)
Takes sleep medication under professional supervision	Yes	40 (28.3%)
	No	103 (71.7%)
Finds sleep refreshing	Some/All of the time	2465 (86%)
	None/A little of the time	400 (14%)
	System	1 (0%)
Household Type	Living with parents	1870 (65.2%)
	Other living arrangements	537 (18.7%)
	Living with single parent	434 (15.1%)

	Missing/System	25 (0.9%)
Currently attending school/college/university	Yes	2286 (79.8%)
	No	566 (19.8%)
	Missing/Not Stated	14 (0.5%)
Life Stress	None/A little	1227 (42%)
	Some	1192 (41.6%)
	Quite a bit/Extreme	477 (15.6%)
Heavy Drinking	Yes	223 (7.8%)
	No	2633 (91.9%)
	Missing/Not stated/Refusal	9 (0.3%)
Heavy Cannabis Use	Yes	282 (9.9%)
	No	2579 (90.0%)
	Missing/Not stated/Refusal	5 (0.2%)

Note. Some percentages do not add up to 100 due to percentages being rounded to the nearest tenth decimal place.

$n = 2866$

Bivariate Results

Table 4.2 shows the results of the Pearson Chi-Square analyses. Insomnia was not associated with sex ($X^2 [1] = 2.71$), student status ($X^2 [1] = 1.33$), or heavy drinking ($X^2 [1] = 2.44$). However statistically significant associations ($p \leq 0.05$ for all variables) were found between the presence of insomnia and: poorer physical health ($X^2 [1] = 82.17$); poorer mental health ($X^2 [1] = 87.74$); the presence of a chronic condition ($X^2 [1] = 26.14$); having a selected mood disorder ($X^2 [1] = 83.31$); having an anxiety disorder ($X^2 [1] = 19.98$); not finding sleep refreshing; ($X^2 [1] = 94.27$); greater perceived life stress ($X^2 [1] = 64.40$); living in a household other than with both parents ($X^2 [1] = 10.22$), heavy cannabis use ($X^2 [1] = 5.74$), and the use of medication to aid sleep ($X^2 [1] = 64.01$).

Table 4.2**Bivariate Associations**

Characteristics	Insomnia, n (%)		<i>p</i> -value*
	No	Yes	
Sex			
Male	1352 (91.4%)	128 (8.6%)	0.10
Female	1242 (89.5%)	145 (10.5%)	
Physical Health			
Excellent/good/very good	2412 (92.0%)	210 (8.0%)	0.001
Fair/poor	181 (74.2%)	63 (25.8%)	
Chronic Condition			
Have chronic condition	1288 (87.7%)	180 (12.3%)	0.001
Does not have chronic condition	1305 (93.3%)	93 (6.7%)	
Mental Health			
Excellent/good/very good	2471 (91.8%)	222 (8.2%)	0.001
Fair/poor	119 (70.0%)	51 (30.0%)	
Selected Mood Disorders (12 months)			
Have mood disorder(s)	130 (71.4%)	52 (28.6%)	0.001
Does not have mood disorder(s)	2452 (91.9%)	217 (8.1%)	
Selected Anxiety Disorder (12 months)			
Have anxiety disorder	141 (81.0%)	33 (19.0%)	0.001
Does not have anxiety disorder	2436 (91.2%)	234 (8.8%)	
Took Medication to Help Sleep (12 months)			
Yes	102 (71.3%)	41 (28.7%)	0.001
No	2481 (91.5%)	231 (8.5%)	
Finds Sleep Refreshing			
None/A little of the time	309 (77.3%)	91 (22.8%)	0.001
Some/All of the time	2283 (92.6%)	182 (7.4%)	
Heavy Drinking			
Yes	196 (87.5%)	28 (12.5%)	0.12
No	2388 (90.7%)	245 (9.3%)	
Heavy Cannabis Use			
Yes	245 (86.6%)	38 (13.4%)	0.02
No	2346 (91%)	233 (9.0%)	

Life Stress				
None/a little	1140 (92.9%)	87 (7.1%)		
Some	1095 (91.8%)	98 (8.2%)		
Quite-a-bit/extreme	359 (80.3%)	88 (19.7%)		0.001
Household Type				
Living with parents	1719 (91.9%)	151 (8.1%)		
Other living arrangements	476 (88.5%)	62 (11.5%)		
Living with single parent	381 (88.0%)	52 (12.0%)		0.01
Currently Attending School, College, and/or University				
Yes	2075 (90.8%)	210 (9.2%)		
No	505 (89.2%)	61 (10.8%)		0.25

* $p < 0.05$

Multiple Logistic Regression Results

The results of the logistic regression analysis predicting insomnia are shown in Table 4.3. The strongest association with insomnia was the presence of a mood disorder, with the probability of having insomnia being 3.16 greater times among adolescents with a mood disorder compared to those without (Odds Ratio [OR] = 3.16). The odds of insomnia were also higher for those experiencing “quite a bit or a lot” of stress (OR = 1.91) or a chronic condition (OR = 1.60). Living arrangement also remained associated with insomnia with adolescents living with a single parent (OR = 1.41) or in some type of “other” living arrangement (OR = 1.45) reporting greater odds of insomnia than those in two-parent households. In addition, the logistic regression results are consistent with the bivariate analyses indicating that being female or a heavy drinker does not significantly increase adolescents’ odds of having insomnia. The presence of an anxiety disorder or heavy cannabis use, though statistically significant in the bivariate analysis, was no longer associated with insomnia once other variables are taken into account.

Table 4.3

Odds Ratio

Characteristics	B	Stand- ard Error	Odds Ratio	95% Confidence Interval for Odds Ratio		<i>p</i> - value*
				Lower	Upper	
Sex						
Male [†]						
Female	-0.08	0.14	0.92	0.70	1.22	0.57
Chronic Condition						
No [†]						
Yes	0.47	0.14	1.60	1.21	2.12	0.001
Selected Mood Disorders (12 mo.)						
No [†]						
Yes	1.15	0.20	3.16	2.14	4.67	0.001
Selected Anxiety Disorder (12 mo.)						
No [†]						
Yes	0.43	0.23	1.54	0.99	2.39	0.06
Heavy Drinking						
No [†]						
Yes	0.20	0.24	1.23	0.76	1.98	0.41
Heavy Cannabis Use						
No [†]						
Yes	0.21	0.21	1.23	0.81	1.87	0.33
Life Stress						
None/a little [†]						
Some	0.06	0.16	1.06	0.77	1.45	0.72
Quite a bit/extreme	0.66	0.19	1.93	1.34	2.79	0.001
Household Type						
Living with parents [†]						
Living with single parent	0.35	0.17	1.41	1.02	1.97	0.04
Other living arrangements	0.37	0.18	1.45	1.03	2.06	0.04

[†] Reference category.

* $p < 0.05$

Summary

The results indicated that the prevalence of insomnia in the Canadian adolescent population (15 to 19 years of age), according to the 2002 CCHS data, was 9.5%. The prevalence of insomnia did not vary by sex ($X^2 [1] = 2.71; p \geq 0.05$).

Overall, the odds of experiencing insomnia were significantly greater among those with a chronic condition, selected mood disorder, those experiencing “quite a bit” to “extreme” life stress, and in adolescents living a household other than with both parents compared to adolescents without a chronic condition, a selected mood disorder, adolescents experiencing “no” to “some” stress, and with adolescents living with both parents. The odds of experiencing insomnia were not significantly related to those who engage in heavy cannabis use, heavy alcohol use, sex, and, surprisingly, having a select anxiety disorder(s), which in adults, according to the literature, usually increases an individual’s chance of having insomnia.

Chapter Five: Discussion

Summary of Findings

Most adolescents in the present study were attending school and living with their parents. Generally, the majority of participants rated their mental and physical health as generally good, were experiencing little to no stress, and found their sleep refreshing. The prevalence rate of insomnia was 9.5%, with an estimated 5% of participants reported having taken medication to aid their sleep at least once in the past 12 months. Of the estimated 5% of adolescents who took medication to aid their sleep, 28.3% of them were taking sleep medication under professional supervision. Interestingly, when the use of sleep medication under professional supervision was analyzed with sex (analysis is not shown), adolescent males were less likely than their female counterparts to use sleep medication under professional supervision (16.9% and 36.1% respectively).

As anticipated, a substantial proportion of adolescents who use medication to help with sleep had insomnia (28.7%), and only a small percentage of adolescent with insomnia felt refreshed after awakening (7.4%). Adolescents who reported having insomnia were also significantly more likely to describe their days as being “quite a bit” or “extremely” stressful (19.7%). Overall, the odds of experiencing insomnia were found to be significantly greater among adolescents with a chronic condition, selected mood disorder (12 month), in those experiencing “quite a bit” to “extreme” stress, and in adolescents living in households other than with both parents.

Findings as They Relate to the Current Literature

According to the most recent data on sleep behaviours in Canadians, Tjepkema (2005) found that around 13% of Canadians, aged 15 and over, met the criteria for insomnia. Using the same

data set, and the same criteria, this study found the prevalence rate of adolescent insomnia to be 9.5%, which is fairly close to the national average presented by Tjepkema (2005). This study's prevalence rate is, however, the exact same as those found in a study by Morin et al. (2006), who also reported an insomnia prevalence rate of 9.5%.

Contrary to some studies that found adolescents of the female sex to have significantly higher prevalence rates and increased incidences of insomnia (Ohayon et al., 2000; Roberts et al., 2008a), the sex of the adolescent was not significantly associated with insomnia in any of this study's analyses, which is congruent with findings from previous studies (e.g., Johnson et al., 2006; Patten et al., 2000; Roberts et al., 2008a).

Given the well-documented co-morbidity between insomnia, psychiatric disorders, and physical illnesses, the results of the current study lend further support to the existing literature. Similar to most adult insomniacs who report having depression and/or anxiety disorders, adolescents who reported having insomnia in this study were also significantly more likely to report having an anxiety and/or mood disorders in the bivariate analyses. The current study's findings also support evidence of mood disorders (e.g., depression, manic, dysthymia, etc.) being one of the strongest risk factors for insomnia. Unlike selected anxiety disorders (12 month), which were not significantly associated with insomnia in the multivariate analysis, selected mood disorder (12 month) had the strongest association with insomnia (OR = 3.16). This finding compliments earlier research with adults that show mental health variables to be strongly associated with insomnia.

Links between poor physical health and insomnia have also been repeatedly demonstrated to be strongly associated, as many diseases and illnesses involve pain and/or distress that may interfere with sleep. For instance, over 20% of adults with asthma, arthritis/rheumatism, back

problems, or diabetes have reported experiencing insomnia compared to around 12% of adults who did not have these conditions (Tjepkema, 2005). Such findings are also supported by the current study's analysis, where adolescents with insomnia were found to be significantly more likely to report having a chronic condition than adolescents without insomnia (51%).

Findings for life stress were also consistent with earlier research (Tjepkema, 2005) where adolescents, in this study, who reported "quite a bit" or "extreme" stress were significantly more likely to report having insomnia than those who report having "none" to "some" stress. Such associations persisted even when physical and mental health, along with demographic, socio-economic, and lifestyle factors were taken into consideration. Unfortunately, due to amount of missing data (651 adolescents did not state their family income on the survey) family income could not be examined in this study to assess whether lower income was associated with insomnia in this population group, as too much data was missing from the data set to provide an accurate analysis. Past studies, however, have had varying findings on the association of income and education levels with insomnia, with some studies noting significant associations (Leblanc et al., 2007; Roth, 2007) and others finding no significant associations between insomnia and education level and/or income (Roberts et al., 2008a; Patten et al., 2000; Johnson et al., 2006).

The trend of insomniacs engaging in more alcohol use (usually as a mean to aid sleep) (Daley et al., 2009) was also observed in this study. Though the association was not significant, adolescents with insomnia were more likely to report engaging in more alcohol use than adolescents who did not have insomnia. A less examined factor associated with insomnia – cannabis use – was also found to be significantly associated with insomnia when all other variables were not held constant. This finding may be related to the literature examining insomnia in individuals who were cigarette smokers. Cigarette smokers were significantly more

likely than non-smokers to report problems initiating sleep, problems staying asleep, daytime sleepiness, depression, being in minor accidents, consuming higher daily intake of caffeine, and were more likely to sleep for less than 6 hours per night than non-smokers (Ohayon, 2002).

Limitations of the Current Study

There are several limitations in this study on the contribution of various variables to the prevalence of insomnia. Particularly, the Canadian Community Health Survey (CCHS): Mental Health and Well-being survey often employed single questions to cover a wide range of socio-demographic, behavioural, health and mental health variables. This is particularly problematic when attempting to examine variables like insomnia and mental health conditions (e.g., depression, anxiety, etc.), which are considered to have multiple criteria and lists of individual symptoms. So, although the WMH-CIDI questions and algorithms were operationalized to meet the needs of CCHS 1.2, the use of this measure to assess various DSM disorders (e.g., anxiety, depression, etc.) could not be used, nor assumed, to measure all aspects associated with the DSM-IV classification and definitions of mental disorders. In particular, the distinction between chronic insomnia and occasional transient/acute insomnia (e.g., insomnia symptoms due to current, but short-lived, stressors) cannot be made because the questions asked in the CCHS do not precisely measure the duration or intensity of the insomnia episodes. This meant primary, secondary (e.g., mental disorders, medical condition, breathing disorders during sleep, other sleep disorders, etc.), and self-induced (e.g., life style; use, abuse or withdrawal of substances; etc.) insomnia could not be distinguished nor was it possible to separate between incident and prevalent cases. Therefore, important differences between these types of insomnia, which have been shown to have different risks and outcomes, could not be ascertained.

The inability to distinguish between those who suffer from insomnia – a sleep disorder –

from those who suffer from insomnia as a secondary symptom of a mental or health disorder has been a concern other researchers have raised in the past in regards to epidemiological studies. Due to the lack of differentiation between primary insomnia and secondary insomnia, interpretations of the results (i.e., deductions of prevalence rates for primary insomnia) should be done with caution. In short, the CCHS measure used in this study primarily examines the presence of insomnia symptoms and their frequency, but whether significant physical and mental health problems are contributing confounding factors in sleep status cannot be determined. This lack of differentiation between the two types of insomnia can be problematic as psychological distress and quality of life impairments are often associated with increases in insomnia frequency and severity.

Limitations of cross-sectional data. Another, and quite common limitation, to studies done with data from large surveys (including this study) is that they are often cross-sectional in nature, which mean the data set, and subsequent analysis, represents only a “snapshot” of a given population at the time of data collection. Given this limitation, we cannot determine which variables are predisposing factors, precipitating factors, or consequences, making it difficult to trace causal pathways between insomnia and other associated variables of interest. As mentioned earlier, possible confounders cannot be determined in cross-sectional studies and undiagnosed illnesses and/or disorders, which may also cause insomnia or masks as insomnia symptoms (e.g., fatigue), may have been overlooked and/or were not taken into consideration making it difficult to make causal associations. For instance, it is unclear whether a chronic condition is a cause or a result of insomnia or if they both share a common pathology.

Comparisons with other studies also have to be done with caution between cross-sectional studies as well due to the differences in question wording, response categories, time frame used,

and collection methods. In addition, because variables such as past history of insomnia, other sleep disorders (e.g., sleep apnea), and caffeine intake were not included in the CCHS multivariate analysis, an overestimated association between some factors and insomnia may have occurred. Cross-sectional designs also do not capture the complexity of the constructs of interest as well as detailed diagnostic interviews, but such interviews, although desirable, are not practical to implement. This unfortunately means temporal and empirical ordering of events cannot be inferred (i.e., whether mental health problems led to insomnia or whether insomnia led to mental health problems could not be determined). In conclusion, this study's cross-sectional nature prohibits any definite conclusions about the direction of the relationship between insomnia and its correlated variables, but it can provide an estimate of insomnia's prevalence in the adolescent's age group along with the their associated variables.

Limitations of self-reports and sample. The CCHS data used in this study were also based on self-reports and answers were not validated by an independent source. For example, self-reported weight and height are known to underestimate the prevalence of overweight and obesity, and measures of physical activities are usually underestimated, as respondents do not account for activity at work or while doing household chores (Mawani & Gilmour, 2010). Individuals with insomnia may have a tendency to overestimate sleep difficulties and daytime impairments relative to objective measures (Daley et al., 2009). It is also not known what point of references individuals were comparing their current mental health status with – past mental health status or with the mental health status of others in their age groups, families, or communities – which can increase disparities in participants answers (Mawani & Gilmour, 2010). Additionally, problem sleeping may mean different things to different individuals, thus providing a heterogeneous sample of perceive sleep difficulties.

In addition, the World Mental Health- Composite International Diagnostic Interview (WMH-CIDI) version used in the Canadian Community Health Survey (CCHS): Mental Health and Well-being has not been validated, unlike previous versions of the Composite International Diagnostic Interview (Mawani & Gilmour, 2010). Therefore, it is not known to what extent classifications based on these survey data would agree with the clinical assessments made by a health care professional. For example, the WMH-CIDI depression module in the CCHS has been validated with only clinical samples, not community-based samples for which it was designed (Mawani & Gilmour, 2010). Last, but not least, for specific morbidities self-rated mental health cannot be used to monitor trends, investigate etiology, predict the need for treatment, or determine if those who need treatment are receiving it. It is unclear if “fair/poor” self-rated mental health predicts mental morbidities or if the presence of mental morbidities resulted in the self-rating of “fair/poor”.

Strengths of the Current Study

Despite these limitations, this study offers a number of strengths and contributions to the literature on insomnia. This is the first nationally representative study to examine the associations between insomnia and select self-rated health measures in adolescent Canadians, using the latest measures available from Statistics Canada. It supports previous research in demonstrating that, unlike their adult counterparts, sex in insomnia is not a significant predictor in adolescent insomnia – which is congruent with a number of existing studies (e.g., Johnson et al., 2006; Patten et al., 2000). The large national population-based survey and the multivariate approach utilized in this study also adds strength to this analysis, by being representative of the adolescent group in Canada, with strong and consistent associations across a wide range of health variables. Such findings may provide potentially useful indicators for monitoring

adolescents' sleep patterns and general health (physical and mental).

Although it has its limitation, the self-rated CCHS does capture individuals' perception of their health and what they perceive as concerns, which can have implications for future service use and treatment compliance (Mawani & Gilmour, 2010). This study also shed new light on a variety of insomnia correlates, in which a number of socio-demographic, health, and neighborhood characteristics could be controlled for in future studies. In addition, with a sample that included both good sleepers and individuals with different degrees of insomnia, this study may have captured a more accurate representation of the association between sleep quality and psychological and health related quality of life correlates.

Implications for Future Research and Intervention

The study continues to highlight the importance of developing a standard methodology to conduct research on insomnia. Since cross-sectional data can only tell us prevalence of certain variables at the time of data collection, future studies using longitudinal data are needed to further clarify the co-morbid relationships between insomnia and various variables. Longitudinal research is needed to assess the relative contribution of these factors during the onset and evolution of insomnia over time. Repeated follow-up assessments may aid in the identification of insomnia risk factors and predictors or moderating variables of insomnia remission and relapse. Longitudinal studies will also allow us to estimate the prevalence of transient and seasonal patterns of insomnia complaints found within this population group.

It would also be interesting to consider an interaction analysis across variables (e.g., sex, chronic health, and insomnia) and examine the interactions between variable categories. For example, we know chronic health problems are significantly related to insomnia, but is that true for both males and females? Additionally, is the effect of mental health on insomnia equally as

significant for either sexes, or does it affect one sex more than the other? Such an examination would provide an interesting insight on the existing data, and would provide a valuable addition to the current findings in this study and to the existing literature on adolescent insomnia.

Differentiating between insomnia, tiredness, and not feeling rested after sleep would also provide a more accurate portrait of insomnia, as such research can better gauge the accuracy of a person's quality of sleep due to a particular variable. There is still much to learn about insomnia and these results provide compelling data to further study and improve insomnia's definition and in the measurement of insomnia. By developing and using a rigorous definition of insomnia, through the utilization of established and well-constructed diagnostic criteria from the DSM-IV-TR or other standardized definitions and/or measures (e.g., International Statistical Classification of Diseases and Related Health Problems - 10th Revision [ICD-10], WMH-CIDI), we can better estimate the quality of participants sleep. Through a better defined construct, studies can examine other associated variables with better accuracy by eliminating redundant overlaps in concept development, thereby reducing possible confounds in the variable of interest – which in this case is insomnia. Additionally, by developing a better construct of insomnia, it will aid health practitioners in acquiring a better understanding of sleep disorders and help promote awareness of how patients may not always describe sleep problem symptoms in a direct manner (e.g., complaints of frequent headaches, sore backs, and so forth may be a consequence of poor sleep).

With studies indicating individuals with a history of insomnia being four times more likely to develop a new major depressive disorder in the 3.5 years following the initial interview (Ohayon, 2002), it is important to follow up on individuals who indicate having insomnia at a young age to provide strategies and/or treatments to prevent the development of a major

depressive disorder. Follow-up studies needs to be implemented to track the progress of insomnia symptoms and the development of future mood and anxiety disorders. By understanding the degree of association between insomnia and mental disorders, and the impact of insomnia on the future development of a mental disorder, we as practitioner and researchers can begin to address the cause and/or concerns with better efficiency and accuracy.

Conclusion

Even with the noted limitations, a number of significant associations did emerge from the study's analysis. This study provided a quantified measure of the most current prevalence rate of adolescent insomnia in the Canadian population with the most recent data set from CCHS. This study also examined whether variables (e.g., sex, mental health, and chronic health conditions) that were often associated with adult insomniacs were also as pronounced in adolescents. This study analysis supported some well-established variables that are associated with adult insomniacs – such as chronic health conditions and mood disorders – are also associated in adolescents with insomnia. The study also supported some previous findings that there are no sex differences in adolescent males and females in insomnia prevalence, while concurrently at variance with other findings that have found a significant difference in the sex of the adolescent and insomnia.

This study also adds to the limited data available on adolescents' insomnia by analyzing the role that various individual health and demographic variables play in insomnia's prevalence. Unfortunately, many of these variables may be interrelated and a casual association cannot be inferred, although attempts to control for other variables were done by employing a logistic regression. However, health encompasses and affects many factors of life and such

categorizations of variables, with define and rigid boundaries may be impossible to achieve, since many health concerns are bi-directional in nature with other health concerns.

In the end, this is not a causal study, it is a correlational, and therefore, relational study looking at the power of the relationship between health and insomnia. The current study has achieved its' goal in examining whether adolescents with insomnia complaints present higher levels of depression and anxiety symptoms than those without insomnia, and whether sex has a significant association with insomnia in adolescents. However, more studies need to done to examine the consequences of insomnia in adolescents, as insomnia tends to be chronic in nature. In particular, longitudinal data can provide insight on whether insomnia becomes more severe over time or whether insomnia severity in an individual remains steady into adulthood from adolescence.

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Appendix A

Variables used from the 2002 Canadian Community Health Survey (CCHS): Mental

Health and Well-being Data Set

Demographic Variables

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Sex (DHHB_SEX)	(SEX_Q01)	Male Female	15
Currently attending a school, college, or university (SDCB_8)	Are you currently attending a school, college or university? (SDE_Q8)	Yes No Don't know Refusal Not Stated	1990
Living arrangement of selected respondent - (D,G) (DHHBGLVG)	*Based on relationship matrix (RE_REL of selected respondent only).	Unattached individual living alone Unattached individual living with others Living with spouse/partner Parent living with spouse/partner, children Child living with single parent with/without siblings Child living with two parents with/without siblings Other Not stated	2007- 2008

Sleep Variables

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Frequency - trouble sleeping (GENB_04)	How often do you have trouble going to sleep or staying asleep? (GEN_Q04)	None of the time A little of the time Some of the time Most of the time All of the time Don't know Refusal	21
Frequency - find sleep refreshing (GENB_05)	How often do you find your sleep refreshing? (GEN_Q05)	None of the time A little of the time Some of the time Most of the time	22

		All of the time Don't know Refusal	
Took medication to help sleep – 12 month (MEDB_11A)	In the past 12 months, did you take any medication to help you sleep (such as Imovane, Nytol or Starnoc)? (MED_Q01A)	Yes No Don't know Refusal Not stated	1767
Sleep medication under professional supervision (MEDB_A1)	You mentioned taking [medication to help you sleep]. Was that under the supervision of a health professional? (MED_Q01A_1) *Respondents who answered "Yes" to MEDB_11A	Yes No Not applicable Don't know Not stated	1774

Self-perceived Health Variables

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Self-perceived physical health (SCRB_081)	In general, would you say your physical health is: (excellent, very good, good, fair or poor)? (SCR_Q08_1)	Excellent Very good Good Fair Poor Don't know Refusal	30
Self-perceived mental health (SCRB_082)	In general, would you say your mental health is: (excellent, very good, good, fair or poor)? (SCR_Q08_2)	Excellent, Very good, Good, Fair Poor Don't know Refusal	31
Self-perceived stress (GENB_07)	Thinking about the amount of stress in your life, would you say that most days are: (not at all stressful, not very stressful, a bit stressful, quite a bit stressful, extremely stressful)? (GEN_Q07)	Not at all stressful Not very stressful A bit stressful Quite a bit stressful Extremely stressful Don't know Refusal	24

Chronic Condition Variable

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Has a chronic condition (CCCBF1) *This variable represents whether or not the respondent had any chronic health conditions that were diagnosed by a health professional.	* This variable is based on whether respondents have responded “YES” to any condition in variables: CCCB_011, CCCB_021, CCCB_031, CCCB_041, CCCB_051, CCCB_061, CCCB_071, CCCB_081, CCCB_91A, CCCB_91B, CCCB_101, CCCB_111, CCCB_121, CCCB_131, CCCB_141, CCCB_151, CCCB_171, CCCB_181, CCCB_191, CCCB_201, CCCB_211, CCCB_251, CCCB_261, CCCB_271, CCCB_281, CCCB_291, CCCB_301, CCCB_311, CCCB_321, CCCB_331, CCCB_341 and CCCB_901.	Yes No Not stated	88

The chronic condition variable was based on these variables:

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Has food allergies (CCCB_011)	(Now I'd like to ask about certain chronic 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). Do you have food allergies? (CCC_Q011)	Yes No Don't know Refusal	61
Has allergies other than food allergies (CCCB_021)	Do you have any other allergies? (CCC_Q021)	Yes No Don't know Not stated	62

Has asthma (CCCB_031)	Do you have asthma? (CCC_Q031)	Yes No Don't know Not stated	63
Has fibromyalgia (CCCB_041)	Do you have fibromyalgia? (CCC_Q041)	Yes No Don't know Not stated	64
Has arthritis or rheumatism (CCCB_051)	Do you have arthritis or rheumatism, excluding fibromyalgia? (CCC_Q051)	Yes No Don't know Not stated	65
Has back problems excluding fibromyalgia and arthritis (CCCB_061)	Remember, we're interested in conditions diagnosed by a health professional. Do you have back problems, excluding fibromyalgia and arthritis? (CCC_Q061)	Yes No Don't know Not stated	66
Has high blood pressure (CCCB_071)	Do you have high blood pressure? (CCC_Q071)	Yes No Don't know Not stated	67
Has migraine headaches (CCCB_081)	(Remember, we're interested in conditions diagnosed by a health professional.) Do you have migraine headaches? (CCC_Q081)	Yes No Don't know Refusal Not stated	68
Has chronic bronchitis (CCCB_91A)	(Remember, we're interested in conditions diagnosed by a health professional.) Do you have chronic bronchitis? (CCC_Q091A)	Yes No Don't know Not stated	69
Has diabetes (CCCB_101)	Do you have diabetes? CCC_Q101	Yes No Don't know Not stated	71
Has epilepsy (CCCB_111)	Do you have epilepsy? (CCC_Q111)	Yes No Don't know Not stated	72
Has heart disease (CCCB_121)	Do you have heart disease? (CCC_Q121)	Yes No Don't know Not stated	73
Has cancer (CCCB_131)	Do you have cancer? (CCC_Q131)	Yes No	74

		Don't know Refusal Not stated	
Has stomach or intestinal ulcers (CCCB_141)	(Remember, we're interested in conditions diagnosed by a health professional.) Do you have stomach or intestinal ulcers? (CCC_Q141)	Yes No Don't know Refusal Not stated	75
Suffers from the effects of a stroke (CCCB_151)	Do you suffer from the effects of a stroke? (CCC_Q151)	Yes No Don't know Refusal Not stated	76
Has a bowel disorder/Crohn's Disease or colitis (CCCB_171)	Do you have a bowel disorder such as Crohn's Disease or colitis? (CCC_Q171)	Yes No Don't know Refusal Not stated	77
Has cataracts (CCCB_191) *Respondents aged 18 and over	Do you have cataracts? (CCC_Q191)	Yes No Not applicable Don't know Refusal Not stated	78
Has glaucoma (CCCB_201) *Respondents aged 18 and over	Do you have glaucoma? (CCC_Q201)	Yes No Not applicable Don't know Refusal Not stated	79
Has a thyroid condition (CCCB_211)	Do you have a thyroid condition? (CCC_Q211)	Yes No Don't know Refusal Not stated	80
Has chronic fatigue syndrome (CCCB_251)	Remember, we're interested in conditions diagnosed by a health professional. Do you have chronic fatigue syndrome? (CCC_Q251)	Yes No Don't know Refusal Not stated	81
Suffers from multiple chemical sensitivities (CCCB_261)	Do you suffer from multiple chemical sensitivities? (CCC_Q261)	Yes No Don't know Refusal Not stated	82

Mood Disorder – 12 month Variable

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Selected mood disorders - 12 month (MHPBFYM)	*Based on DEPBDY and MIABDEY.	Yes No Not stated	1056

The mood disorder variable was based on these variables:

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Major Depressive Episode Algorithm - 12 month (D) (DEPBDDY)	*Based on DEPBDYA, DEPBDYB, and DEPBDYC.	Yes No Not stated	497
Manic Episode Algorithm - 12 month - (D) (MIABDEY)	*Based on MIABDYA, MIABDYB, and MIABDYC.	Yes No Not stated	641

Anxiety Disorder – 12 month Variable

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Selected Anxiety Disorders – 12 month (MHPBFYA)	*Based on AGPBDPY, PADBDDY, and SOPBDPY.	Yes No Not stated	1057

The anxiety disorder variable was based on these variables:

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Agoraphobia Algorithm - 12 month - (D) (AGPBDPY)	*Based on AGPBDAP, AGPB_17, AGPB_03A, AGPB_03B, AGPB_06, AGPB_17B, and DHHB_AGE.	Yes No Not stated	1045

Panic Disorder Algorithm - 12 month - (D) (PADBDDY)	*Based on PADBDYA, PADBDYB, and PADBDYC.	Yes No Not stated	815
Social Phobia Algorithm - 12 month - (D) (SOPBDPY)	*Based on SOPBDYA, SOPBDYB, and SOPBDYC.	Yes No Not stated	929

Cannabis Drug Use – 12-Month Variable

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Frequency – marijuana, cannabis, hashish – 12 month (IDGB_03)	How often (did you use marijuana, cannabis or hashish in the past 12 months)? (DRG_Q03) *Base on respondents who answered “YES, MORE THAN ONCE” to variable IDGB_01 and “YES” to variable IDGB_02	Less than once a month 1 to 3 times a month Once a week More than once a week Everyday Not applicable Don’t know Refusal Not stated	1178

The cannabis drug use variable was based on these variables:

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Used - marijuana, cannabis, hashish - life (IDGB_01)	Have you ever used or tried marijuana, cannabis or hashish? (DRG_Q01)	Yes, just once Yes, more than once No Don’t know Refusal Not stated	1176
Used - marijuana, cannabis, hashish - 12 month (IDGB_02)	Have you used it in the past 12 months? (DRG_Q02)	Yes No Not applicable Don’t know Refusal Not stated	1177

Alcohol Use – 12-Month Variable

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Frequency - drinking alcohol – 12 mo (ALCB_2)	During the past 12 months, how often did you drink alcoholic beverages? (ALC_Q2) *Base on respondents who answered “YES” to variable ALCB_1.	Less than once a month Once a month 2 to 3 times a month Once a week 2 to 3 times a week 4 to 6 times a week Everyday Not applicable Don’t know Refusal Not stated	1063- 1064

The alcohol use variable was based on this variable:

Concept (Variable Name)	Question (Question Name)	Content	Position in Survey
Drank alcohol in past 12 months (ALCB_1)	During the past 12 months, have you had a drink of beer, wine, liquor or any other alcoholic beverage? (ALC_Q1)	Yes No Don’t know Refusal Not stated	1062

Note. The information and data presented here were gathered from the *CCHS Cycle 1.2: Data Dictionary, Public Use Microdata File* (2004).