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# “Sleep? Maybe Later . . . ” A Cross-Campus Survey of University Students and Sleep Practices

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**Abstract:** Sleep deficiency is a significant issue across higher education campuses and has a detrimental effect on students’ academic achievement, physical and mental health, and overall wellbeing. The purpose of this study was to carry out a campus-wide survey determining students’ self-reported sleep patterns, sources of advice for sleep problems, current sleep promoting practices, and preferred mechanisms to receive new information assisting with sleep problems. An anonymous electronic survey was distributed in February 2016 to all levels of students at the University of Alberta in the Western region of Canada. Descriptive data analysis was carried out with SPSS (v23). There were 1294 students (78.0% undergraduates; 87.5% living off-campus, 77.5% female) who participated in the survey. Sleeping less than 6.5 h a night was reported by 30.5% of participants; 66.5% stated they had insufficient sleep; 80.6% had not sought help. The three most frequent behaviours to aid sleep were reading a book, listening to music, and adjusting the heat. Although sleep problems were widely reported, students seldom sought help for this. The survey revealed that students already practice several strategies (listening to music, for example) that lend themselves to serving as a foundation for a strength-based cross-campus social marketing campaign of sleep promoting strategies.

**Keywords:** sleep; insomnia; university students; behaviours; survey

## 1. Introduction

For many students sleep deficiency is a routinely accepted part of higher education [1–5]. This is concerning; we know that sleep deficiency exerts a significant toll on students’ physical and emotional health, and decreases their capacity for critical academic skills including learning, memory, and problem solving [1,2]. Research clearly demonstrates the relationship between sleep deficiency in higher education students and risk-taking behaviours such as drinking and driving, mental health conditions including suicidality, depression, and anxiety, decreased self-efficacy [2,3,6], substance misuse [3], binge drinking and excessive caffeine consumption [7,8], smoking and high rates of social media use [9].

Sleep deficiency in children and adolescents is concerning to the point that the US Centers for Disease Control (CDC) labelled it a priority public health problem [10]. In Canada, as many as 70% of high school students may achieve less than the recommended amount of sleep for their age [11]. Many of these young people bring poor sleep habits and pre-existing sleep disorders (such as untreated sleep apnoea) from adolescence into their pursuit of higher education. Compounding these pre-existing factors, for some students, there are new social and financial pressures, increased anxiety, and sleep-disruptive living environments. In higher education, students will sacrifice sleep in pursuit of higher grades and academic achievement, however, this misinformed decision actually undermines

their ability to achieve academic success. Gomes et al.'s study of over 1600 undergraduate students found that self-reported sleep quality and frequency of sufficient sleep was a significant predictor of end-of-semester marks [12]. Studies with similar findings, illustrating the relationship between sufficient restorative sleep and academic achievement, are growing (see, for example, [1,13]).

An important source of information about student health is the American College Health Association-National College Health Assessment, which collects data from over 30 million college/higher education students across North America [14]. Detailed questions about student sleep habits, insomnia, and the outcomes of sleep deficiency were added in 2013. Of the 43,780 Canadian students who participated in the 2016 survey, 28.2% stated they felt sleep difficulties interfered with their academic performance, 5.3% were treated by a professional for insomnia, and 37.1% reported that they had difficulty handling sleep problems. Additionally, 63.2% felt tired three or more days of the week and 21.7 reported that feeling sleepy in the daytime was a big or very big problem.

Overall, it is clear that sleep deficiency is a risk factor, often modifiable, for poor physical, academic, and psychological health and performance. Interventions to help students maximize their sleep and therefore their academic success are much needed.

### *Study Objectives*

There has been significant anecdotal information and concern about students' sleep issues shared across the researchers' university campus. However, to the best of our knowledge, qualitative self-report data from students about the type of sleep strategies they use, where they go for information, and the format they prefer for receiving any sleep education has not previously been collected. Consequently, there has been no previous formal data collection to inform the development of targeted sleep promoting services and resources. Sleep deficiency in higher education students is a well-documented phenomenon [14]. Although the risk for many sleep problems is modifiable, evidence-based non-pharmacological interventions are still in short supply. There is promising literature suggesting the benefit of public health campaigns that provide psychoeducational materials and education [15], but these programs are often resource intensive and not widely available. Cassoff et al.'s [16] extensive review of school-based sleep education programs revealed that, while these programs can lead to significant change in sleep knowledge, there are complex factors presenting barriers to implementing these programs. They also cautioned that knowledge change cannot be assumed to lead to behavioural change. Clearly identifying students' practices and preferences will help in developing more targeted approaches. Action, based on sound evidence and supported by students' existing preferred habits and valued sources of information, is critical if students are to derive the maximum benefit from the significant financial, personal, and social resource investment made at a personal and social level in pursuing higher education. Addressing this need, the goal of this study was to carry out a campus-wide survey to determine students' self-reported sleep patterns, sources of advice for sleep problems, current sleep promoting practices, and preferred mechanisms to receive new information assisting with sleep problems.

## **2. Materials and Methods**

An anonymous online survey to determine university undergraduate and graduate students' awareness of basic sleep physiology, healthy sleep habits, and preferred strategies to receive new information and assistance with sleep problems was carried out February 2016 at the University of Alberta, a large, research intensive, Canadian university in Western Canada. The university has a student population of over 35,000 undergraduates and graduate students. There are approximately 6500 international undergraduates and 2500 international graduate students from over 170 host countries. The student population in general is culturally and ethnically highly diverse, reflecting the geographic location and labour market in this region of Canada. To increase recruitment numbers, we selected February, as it was several weeks into the term but well before final examinations in April. The survey gathered basic demographic and student profile information (age, gender,

graduate/undergraduate category, usual location of sleeping, perceived hours of sleep per night, and perceived quality of sleep). We did not ask students to identify what specific program or course they were enrolled in. A review of the literature identified no existing tool to determine students' practices to promote sleep, and consequently, an inhouse tool was developed and piloted. To increase content validity of the questions related to students' sleep promoting practices, the background literature was reviewed to develop a list of strategies students most frequently engage in to promote sleep was generated. Sixteen strategies were identified including drinking alcohol, listening to music, opening windows, exercising, and meditating. Participants were asked to rank each strategy, if they used it at all, by frequency ('always'—5 to 7 nights/wk; 'often'—1 to 4 nights/wk; 'sometimes' <3 nights/month). We did not ask students to rate perceived success of the strategy. The survey was piloted for comprehension with several students and faculty and slight revisions to wordings were made. Students also provided free-text responses to questions about help-seeking behaviour for perceived sleep problems; the results of their help-seeking; alternative strategies they used to promote sleep; and preferences for how they would like to receive additional information and help with sleep. These responses were short, often with little detail and context, and did not lend themselves to conceptually driven thematic analysis. Rather, we employed qualitative description [17], which is a low inference and non-interpretive method of data analysis. The aim of qualitative description is defined as "... neither thick description (ethnography), theory development (grounded theory) nor interpretative meaning of an experience (phenomenology), but a rich, straight description of an experience or an event. This means that in the analytical process and presentation of data, researchers using QD stay closer to the data" [18] (p. 8). Two of the authors read through all of the free-text responses for each question and categorized each response based on the key words in each of the responses. For example, the question about where participants seek advice about sleep generated responses such as "I only listen to my partner's advice", "I check on the internet", "I went to student services on campus" were categorized as *Family/Partner*, *Internet*, and *Student services*, respectively. Additionally, the data were analysed for frequency of response to achieve a general ranking of participant identified actions.

All data collection was anonymous and submission of the survey was considered as consent to participate. Students had an opportunity to enter a prize draw at the end of the survey and were redirected to a separate website such that any survey responses could not be linked to the draw entry. The study was approved by the Health Research Ethics Board of the University of Alberta. The survey tool, once piloted, was hosted on the Fluid Survey ([www.fluidsurveys.com](http://www.fluidsurveys.com)) platform. Final survey data was transferred to SPSS Version 23 for descriptive analysis. Chi-Square statistics are reported with degrees of freedom (df) and sample size ( $n$ ) in parentheses, the Pearson chi-square value rounded to two decimal places ( $X^2$ ), and the significance level ( $p$ ).

Undergraduate and graduate students were recruited through electronic posting, over three consecutive weeks (February 2016), on the campus-wide student announcements email service. The announcement included both a URL and a Quick Response (QR) code image linking students to the survey. Additionally, posters with this same information were displayed in multiple, high traffic, areas on campus.

### 3. Results

#### 3.1. Demographics and Profile

The total student enrolment at the University of Alberta in 2016 was approximately 29,500 students and 3.3% (1294) participated in the survey. Not all students answered each question and so results are reported as percentages of the number of respondents specific to each question (Table 1 for details of number responding to each question). The sample was 78.0% undergraduate, 17.1% Masters, and 5.0% PhD or post-doctoral. Overall, 77.5% of participants identified as female, 20.6% as male, 1.1% used non-binary terms (cisgender female, gender fluid, non-binary, genderqueer, grey femme, demi-sexual, and transgender), and 0.5% were unclear, seemingly unrelated to gender. Age was reported by 81.2%

of participants as 25 years old or younger, 14.7%—26 to 35 years, and 3.2%—36 years or older. The majority slept at home (87.5%) on weeknights. Only 12.3% slept in residences and less than 1% reported they couch surfed.

**Table 1.** Demographics ( $n = 1294$ ).

<b>Program</b>	<b>Undergrad</b>	<b>Graduate</b>		<b>PhD &amp; Postdoc</b>
	78.0% (1009/1294)	17.1% (221/1294)		5.0% (64/1294)
<b>Gender</b>	<b>Female</b>	<b>Male</b>		<b>Non-Binary</b>
	77.5% (992/1280)	20.6% (267/1280)		1.1% (14/1290)
<b>Age</b>	<b>&lt;26 Years Old</b>	<b>26–35 Years Old</b>		<b>36+ Years Old</b>
	81.2% (1061/1293)	14.7% (190/1293)		3.2% (42/1293)
<b>Location of Sleep</b>	<b>Home</b>	<b>Residence</b>		<b>Varied/Couch Surf</b>
	87.5% (1129/1290)	12.3% (159/1290)		0.2% (2/1290)
<b>Perceived Hours of Sleep</b>	<b>&lt;4.5 h</b>	<b>4.5–6.4 h</b>	<b>6.5–8 h</b>	<b>8 h+</b>
	1.8% (23/1293)	28.7% (371/1293)	61.5% (795/1293)	8.0% (104/1293)
<b>Perceived Sufficient Sleep</b>	<b>Yes</b>			<b>No</b>
	33.5% (432/1289)			66.5% (867/1289)
<b>Statistically Significant Relationships between Demographics and Perceived Sufficient Sleep (Pearson Chi-square)</b>	<ol style="list-style-type: none"> <li>1. Undergrads more likely to sleep &lt;6.5 h/night: (<math>df = 6, n = 323, X^2 = 17.14, p = 0.009</math>) than graduate students</li> <li>2. Students sleeping &lt;6.5 h/night were more likely to report feeling sleep was insufficient: (<math>df = 3, n = 373, X^2 = 267.40, p &lt; 0.000</math>) than students reporting greater than 6.5 h of sleep</li> </ol>			

### 3.2. Hours and Quality of Sleep

Regarding hours of sleep 30.5% reported less than 6.5 h sleep nightly, including 1.2% who reported less than 4.5 h. All those reporting under 4.5 h of sleep nightly were 25 years of age or less (Table 1). There were 61.5% of the participants who stated they received 6.5–8 h of sleep nightly, and a further 8.0% who slept more than 8 h/nightly. Only 33.5% of respondents reported that they received sufficient sleep. Undergraduate students were significantly more likely to have under 6.5 h sleep ( $df = 6, n = 323, X^2 = 17.14, p = 0.009$ ) compared to graduate students, and respondents sleeping less than 6.5 h per night were more likely to report feeling that they were not getting enough sleep ( $df = 3, n = 373, X^2 = 267.4, p < 0.000$ ).

### 3.3. Help-Seeking Behaviours

Only 59.8% of participants responded to the question about where they sought help. Of these, 19.4% had asked someone for help because they were concerned about their sleep. A significant majority (80.6%,  $n = 927$ ) had not sought help. Those that had sought help often listed multiple sources and, in total, 450 responses were made (Table 2). The most frequently identified sources were Family/significant other (29.3%), Physician (25.3%), and Friend/colleague/professor (18.0%). All of the remaining sources of potential advice were identified by less than 6% of the participants. Very few accessed the resources of a sleep specialist or mental health clinician. There was no statistically significant difference between the amount of sleep students reported receiving and the likelihood of seeking help for sleep problems.

**Table 2.** Sources from which students request assistance ( $n = 367$  students making 450 responses).

Sources of assistance	Frequency requested
Family/significant other	29.3% (132)
Physician	25.3% (114)
Friend/colleague/professor	18.0% (81)
Psychologist, mental health counsellor	5.6% (25)
Other healthcare practitioners (nurse, pharmacist, massage therapist)	5.6% (25)
Internet/social media	4.0% (18)
Other medical specialist (psychiatrist, neurologist, respiratory specialist)	3.1% (14)
Sleep specialist/sleep clinic	2.2% (10)
Alternative/naturopathic medicine	1.1% (5)
Student/employee support services	0.6% (3)

### 3.4. Types of Advice Received

A small number of students (249 of 1294) responded to the subsequent question ‘If you sought help, what advice were you given and was it helpful?’ This was a free-text response and several strategies may have been listed by one student. Consequently, percentages are based on frequency of a specific form of advice being listed and the total number of respondents to this question ( $n = 249$ ). Participants identified they had received numerous and diverse types of advice but no one form of advice was identified strongly. The most frequent form of advice, ‘Get more sleep/go to bed earlier’, was identified by only 18.9% of those responding to the question. Avoid electronic technology or use blue light blockers (16.8%); drink hot milk/herbal tea/ don’t drink coffee or eat heavy food before bed (16.0%); modify the sleeping environment (12.0%); and establish a pre-bedtime routine (10.8%) were the only strategies identified by greater than 10% of the respondents to this question. Other forms of advice (in descending order) were; calming pre-sleep activities; exercise/yoga before bed; sleep medication (participants did not differentiate between prescription and non-prescription medication); melatonin specifically; ‘other’ medication (e.g., anti-anxiety prescription medications); relaxation techniques; avoid/reduce stress; avoid non-sleep activities in bed (such as TV and studying); adjust the temperature; use ‘sleep hygiene’; seek professional help; and use herbal supplements.

### 3.5. Sleep Self-Help Behaviours

Ranking the 16 possible responses to the question “What, if anything, do you do to help you sleep?”, in descending order of frequency for ‘ever’ being used (sum of respondents selecting ‘always’, ‘often’, or ‘sometimes’), reading a book, listening to music, adjusting the heat, watching TV, and a warm bath were the most popular responses overall (Table 3: Column a). The strategies that ranked the highest for ‘always’ or ‘often’ being used (1–7 nights/week) were similar (Table 3: Column b). When we looked at frequency of ‘always’ and ‘often’ being used within the group who practiced each strategy (Table 3: Column c) the ones employed by more than 30% of within group participants were: turn down the heat/open a window (49.3%), read a book (45.0%), watch TV (43.6%), warm bath/shower (36.8%), listen to music (31.3%), and have sex (31.3%).

Substance use was less frequently identified by participants. However, the numbers were still noteworthy, and 36.3% reported ‘sometimes’ (<3 times/month) using alcohol, 31.3% reported using recreational drugs, and 28.8% reported using cigarettes. Only 6.0% (78/1294) used alcohol, 2.4% (32/1294) used recreational drugs, and 1.4% (19/1294) smoked cigarettes as a sleep strategy ‘always’ (between 4–7 nights/wk) or ‘often’ (between 1–4 nights/wk) (Table 3: Column b). Ranking the most consistently ‘always’ or ‘often’ employed by those responding to this section showed that the most popular strategies remained the same but the ranking changed (Table 3: Column c). In summary, while the range of strategies was diverse, there were some that when used, were used with a high degree of regularity. Graduate students were significantly (Pearson Chi-square) more likely than undergraduates to ‘ever’ use; turn down the heat/open a window ( $df = 4, n = 154, X^2 = 10.45, p = 0.033$ ), white noise

( $df = 4$ ,  $n = 119$ ,  $X^2 = 8.22$ ,  $p = 0.045$ ), and read a book ( $df = 4$ ,  $n = 194$ ,  $X^2 = 13.52$ ,  $p = 0.009$ ) as sleep strategies. There was a significant relationship between those participants reporting less than 6.5 h sleep nightly and the use of music ‘always’ or ‘often’ to help with sleep ( $df = 6$ ,  $n = 237$ ,  $X^2 = 13.17$ ,  $p = 0.040$ ). Finally, students aged 26 and older were significantly more likely ( $df = 2$ ,  $n = 82$ ,  $X^2 = 9.54$ ,  $p = 0.008$ ) to ‘always’ or ‘often’ use alcohol as a sleep strategy compared to those students 25 years old and younger.

**Table 3.** Student endorsed sleep strategies ( $n = 1294$  responses).

Strategy	a. Ever (‘Always’, ‘Often’, ‘Sometimes’)	b. ‘Always’ or ‘Often’ (1 to 7 nights/wk)	c. Frequency of ‘Always’ or ‘Often’ within Group Who Identified as Using this Strategy
Reading book *	67.3% (872)	30.4% (393)	45.0% (393/872) *
Listening to music *	55.9% (724)	17.4% (225)	31.0% (225/724)
Adjust heat *	54.9% (711)	27.1% (351)	49.3% (351/711) *
Watch TV *	52.3% (677)	22.8% (295)	44.2% (295/667) *
Warm bath/shower *	49.5% (641)	18.2% (236)	36.8% (236/641) *
Meditate	45.7% (591)	13.2% (171)	28.9% (171/591)
White noise	44.4% (575)	12.1% (156)	27.1% (156/575)
Sleep medication-non-prescription	43.8% (576)	9.6% (125)	21.7% (125/576)
Have sex	42.9% (556)	13.4% (174)	31.3% (174/556) *
Write in diary	40.2% (502)	7.6% (98)	19.5 (98/502)
Answer emails	39.7% (514)	10.2% (132)	25.7% (132/514)
Sleep medication-prescribed	37.7% (423)	3.4% (44)	10.4% (44/423)
Alcohol	36.3% (470)	6.0% (78)	16.6% (78/470)
Sleep mask	35.9% (465)	7.1% (93)	20.0% (93/465)
Recreational drugs	31.3% (405)	2.4% (32)	7.9% (32/405)
Cigarettes	28.8% (373)	1.4% (19/1294)	5.1% (19/372)
<b>Free Text ‘Other’</b>			
Category	Frequency of Comment (n)	Category	Frequency of Comment (n)
Change sleep environment	94	electronic media activity (games, reading, scrolling);	46
Pray or mindfulness method	68	Complementary and Alternative medicine and techniques	25
Warm beverage/bedtime snack	66	Chat/socialize/company	17
Timing/type of exercise	56	Follow schedule/routine	16

Note: \* 5 most frequently selected in category.

### 3.6. “Other” Sleep Strategies

There were 509 usable text responses to the ‘other’ category in the sleep strategy question. Some statements reflect the same strategy offered in the set list of 16 strategies, some comments stated ‘no, nothing to add’, and some comments related to more than one category. In descending order, from most commonly to least commonly mentioned, the categories related to: ways to change the environment (e.g., make room dark, avoid noise by using earplugs); have a warm beverage and/or snack; prayer or mindfulness methods; timing/type of exercise; electronic media activity (games, reading, scrolling); use of complementary and alternative medicine and techniques (e.g., essential oil, massage); keeping to routine and schedule; and having a chat and/or having company before bed (human or pet).

### 3.7. Perceived Need for Additional Information and Preferred Format

The majority (78.1%) of students stated that they would like more information while indicating a preference for format. Their preferences strongly skewed towards an email with information (59.4%) distantly followed by, “a handout/booklet I can read and then contact the author with question,” (16.0%). There were no significant differences in perceived need for more information or preferred style of information delivery between undergraduate and graduate students. A final 2.0% of students selected ‘other’ and provided a free text response to identify their preference. Most comments related more to qualifying the acceptability/availability of the provided options as opposed to presenting new information delivery options (for example: “I would like one-on-one but live off campus so it would be hard to access”). Overall, participants’ free text comments reflected (1) a desire for accessible,

self-selected options collected together on a web-based platform, and (2) a comfort level with electronic delivery formats (e.g., archived presentations/webinars, electronic question/answer forums, blogs, electronic self-assessment tools, apps, visual aids such as infographics and videos as opposed to highly text dependent resources). One in five (21.9%) stated that they had no need for additional information. Their stated reason for not seeking additional information was predominantly that they had no problems with sleep. However, several comments reflected frustration that nothing had worked previously or a perception that nothing could be done about the causes of their sleep problems. For example, participants mentioned stress, noisy living spaces, the need to use electronics late at night, and lifestyle choices involving social activities and sports.

### 3.8. Final Comments

The final question in the survey asked participants if there was “Anything else you think we should know about students’ sleep?” After excluding those responses stating that they had nothing to add and those with irrelevant content, there were 337 comments that students made about their sleep. Using Sandelowski’s [17] qualitative descriptive method, the following six categories emerged:

#### 3.8.1. School Schedule and Academics

One hundred and twenty-four (36.7%) comments related to the class schedule and academics. Heavy study load was identified as a large factor in sleep deficiency. For example, one student said, “Homework load and assignment/exam distribution are a major contributor to poor student sleep”. Early class start times were also a common concern for students. For example, as one participant described, “8 a.m. class means I have to get up at 5:30 a.m. to catch a bus at 6:45 a.m. to be at school on time”. Others mentioned that the number of exams and major assignments in a given week could greatly affect their sleep.

#### 3.8.2. Lifestyle Choices and Sleep Hygiene

Eighty-eight (26.1%) of the comments related to this category. Certain words, reflecting lifestyle choices appeared with regularity in participants’ comments and included “discipline”, “habits”, “night owls”, “nap”, “screens”, and “food.” One thought-provoking comment was that, “I often feel guilty getting enough sleep! I feel as though I should be working harder and sleeping less based on how other students describe their sleeping habits”. As one student said, not sleeping is “a horrible attitude and it needs changing. I think that the university needs to integrate a sleep awareness campaign with their mental health strategy”.

#### 3.8.3. Stress and Mental Health

There were 42 (12.4%) students who specifically mentioned the effect of stress and mental health issues. Comments such as, “Most of the time I go to bed at a decent hour but stress keeps me up” and “The issue is the mind being too active with all the stresses that life and work impose, resulting in having insomnia”. These comments reflect a cognitive/emotional inability to rest the mind to sleep and as such are different from those that reflect a lack of time to sleep.

#### 3.8.4. Sleep Quality and Quantity

Fifteen participants (4.5%) stressed that, in their opinion, effective sleep should not be measured just by duration. Rather, they felt it was the quality of sleep that mattered. These types of statement illustrated that some students held erroneous beliefs that a short sleep duration (only five hours, for example), was fine as long as it was perceived to be of ‘good quality’. As one participant put it, interventions need to focus on “Sleep quality improvement and not just length, I think that is the real problem”.

### 3.8.5. Sleep Environment

Only eight (2.4%) participants mentioned the sleep environment. The major problems identified were the negative effects of roommates and the noise in residence.

### 3.8.6. Other

There were 36 (10.7%) additional valid comments about sleep strategies that participants personally found successful or not. There were no unique strategies that came from this that were not identified in question 5.

## 4. Discussion

The aims of this survey were to determine students' self-reported sleep patterns and help-seeking practices, what sleep strategies they engaged in, and their preferences for receiving information and assistance with sleep problems. Key findings relevant to these aims emerged from the survey and included: sleep location; amount of sleep; help-seeking behaviours; existing popular strategies that can be modified and adapted to better support restorative sleep; and preferences for accessing additional information and help. Each of these key findings will be explored in more depth below, including discussion of how a strengths-based approach [19] to intervention and education about sleep can be built on these key findings.

### 4.1. Sleep Location

Findings revealed two significant gaps in the representativeness of this survey. Only 159 (12.3%) of participants slept in residences. This figure aligns in general with the percentage of University of Alberta students who live in residence, however, there are some important and unique challenges to living in high-density student accommodations (for example, degree of control over environmental noise and temperature) that might not have been captured within this larger study. Additionally, although only two students identified that they 'couch surfed', it is most likely that this population is under-represented in the survey. Homelessness is a sensitive area and students may be reluctant to self-disclose. As such, it is difficult to determine the extent of homelessness amongst higher education students. However, a review by faculty at the University of Alberta, Canada [20] concluded that the issue of housing insecurity in vulnerable students was under-recognized and poorly addressed. These findings are echoed by other researchers in the US [21,22]. Students with housing insecurity will experience unique and significant challenges to achieving restorative sleep and this population should be a priority for further study and resource development.

### 4.2. Amount of Sleep Related to Health and Academic Outcomes

Encouragingly, of the 1293 students who responded to this question, 69.5% (899) stated they received 6.5 h of sleep nightly or more. However, a full 30.5% (394) of the participants reported less than 6.5 h nightly, including a worrying 23 participants (1.2%) who reported less than 4.5 h. Notably, all of the participants who reported under 4.5 h of sleep a night were 26 years of age. The number of students who sleep less than 6.5 h a night on average is very concerning. Six and one-half hours of sleep or less has been identified as significantly increasing the risk of developing a number of chronic health conditions such as diabetes, cardiovascular disease, and depression [23,24]. Additionally, there is overwhelming evidence that sleep deficiency has an extensive negative impact on cognitive performance, memory, learning, and academic success [12]. For example, Gaultney's study of 1845 college students at a large, southeastern US public university found that a relationship existed between students with sleep disorders and risk of low grade point averages (GPA) such that they were in academic jeopardy [1].

Mental health issues are a significant priority concern across Canadian higher-education institutions. Indeed, the Mental Health Commission of Canada (MHCC) report, *Changing directions*,



changing lives: The mental health strategy for Canada, emphasizes that, “many students experience problems with mental health and addictions; suicide is the 1st or 2nd most common cause of student death; more students are coming forward to seek help for mental health problems; more students are taking psychotropic medications; more students with chronic mental illnesses are attending college/university; and, mental health issues are identified by students as having the greatest impact on their academic success” [25].

Participants frequently mentioned that both personal and academic stress takes a negative toll on sleep. Indeed, in the final ‘Comments’ section (Findings: item 7), a full 12.4% reported stress was the main issue preventing restorative sleep. This finding aligns with the Canadian Campus Survey of student mental health and addictions which found that 29.2% of undergraduates reported four or more symptoms indicative of elevated distress measured on the General Health Questionnaire mental health screen, 47% of all students reported being constantly under strain, 31% reported being unhappy or depressed, and 32% lost sleep over worry [26]. Some research suggests that students in higher education are 4 times more likely to have psychological problems than similarly aged persons in the general population [27]. We did not ask students specifically about stress and, as such, the 12.4% who provided comments in the free text boxes may actually under-represent the degree that this is a concern for the participants in this study.

Growing evidence demonstrates a relationship between mental health and short sleep duration. For example, Augner’s study of 196 Austrian university students found a strong negative correlation between sleep quality and both depression and trait-anxiety scores [6]. Research reveals that receiving less than 6.5 h was a particular risk factor for reduced resilience and overall poorer emotional and physical health [28]. Encouragingly, the evidence also supports that there is a bidirectional relationship such that improvement to sleep will most likely contribute to improved mental health and overall functioning, including academic achievement [29]. Given this evidence, it seems reasonable to assume that interventions to improve sleep for the 30.5% of participants who reported less than 6.5 h of sleep nightly would have a positive outcome for overall mental health and resiliency.

Further study and development of resources for the high-risk group of students reporting less than 6.5 h of sleep nightly is a priority need. Knowledge translation research clearly demonstrates that providing information in itself is insufficient [30]. Knowledge must be applied to affect behavioural change and further research should also test delivery strategies that promote uptake and application of new information. Cassoff et al.’s review of school-based programs [16], and their conclusion that individualization and tailoring is needed for sustained sleep behaviour change, speaks to this issue. Evidence from the fields of social marketing, such as the ‘Social Marketing Wheel’ concept [31,32], and knowledge translation studies [33] should be incorporated into further educational activities to ensure resource delivery systems are built on best practice in order to optimize the likelihood of achieving meaningful, lasting, change in behaviour.

#### *4.3. Help-Seeking Behaviours*

Only one in five students had sought help for sleep problems. The most frequently identified sources of help were family/significant other, physician, and/or friend/colleague/professor. This flags three key opportunities for intervention. The first opportunity is to educate students that they should seek help if they have problems sleeping and where they can go for help. Because insight about sleep is low in Canada in general, this information will not necessarily be sought out by students. Rather, evidence-based knowledge translation strategies should be developed that facilitate advertising available sleep resource information to students in attention-getting ways. According to marketing research, 43% of college students pay attention to advertisements recommended by friends and family, 29% to advertisement distributed as sample products, 24% to direct mail, and 23% to advertisements seen on TV [34]. Other forms of advertising, including billboards, text messages, screen pop-ups, student newspapers, and events/street team stunts, were attended to by less than 20% of students. One example of how this opportunity could be operationalized is to distribute entertaining promotional

sleep related samples of low cost items (such as ear plugs, eye masks, or postcards with URL and QR code links to downloadable blue spectrum light filtering apps for electronic devices) at numerous campus events. Each product can have a 'get sleep help at...' information magnet or postcard attached. Students should be encouraged to take multiple samples to share with friends and members of their family. From the survey we know that family and friends are highly influential sources of advice for students, and so strategies to increase their knowledge, engagement and attention to sleep-related information can have significant impact as they, in turn, relay sleep knowledge to others. Indeed, directly targeting sleep awareness campaigns to family and friends is an important opportunity. Education, with a focus on 'how to help someone who cannot sleep', can build the capacity of these individuals to help others while at the same time providing information family member and friends can use themselves. Part of the educational materials for parents, family, and friends should provide clear information about how to help the student navigate through the healthcare system to access a healthcare provider who is knowledgeable about sleep. Additionally, information and education for this group should provide sleep resources and materials that are developed to be most relevant to higher education students.

Strategies targeting students, their families, and their friends could be strengthened by incorporating evidence from social marketing principles. Specifically, sleep awareness campaigns must clearly demonstrate that sleep deficiency has a negative impact on outcomes that are relevant to higher education students [32]. Clearly demonstrating relevance to students' current needs and objectives is of critical importance because research indicates that a number of young people hold feelings of 'invincibility' and are unconcerned about the relationship between current lifestyle choices and future illness or accident. Linking sleep deficiency to research about increased risk of future cardiac disease [35], or the increased likelihood of dangerous risk-taking behaviours [36], are not sufficiently relevant to act as motivating factors for change.

A third opportunity is present within the existing higher education institution's health centre and counselling services programs. Because most students do not seek help even though they report having poor sleep, standardized routine screening questions for sleep issues could be imbedded into other health/wellbeing monitoring and intake systems. For example, the University of Alberta Student Health Services sees over 21,000 undergraduate and 7500 graduate students yearly. Many of the services are offered in-person, on a drop-in basis and additional sleep education materials could also be made available at these times and in the waiting areas. This can also be an outlet for 'free' sleep product and information samples as proposed in the preceding section.

Finally, the study revealed that a lack of knowledge is not the only, nor necessarily the primary, barrier to help-seeking for some young people. A small but significant number of the participants made comments indicating that they were reluctant to seek help because they perceived that their sleep issues were a consequence of having experienced bullying, victimization, and high levels of anxiety. Their concern was that seeking help would be dismissed so that they would feel even worse and more isolated. Several were concerned that help-seeking would have negative repercussions if it became known to others. One participant wrote "*No one likes to hear complaints . . . cause they don't care if I am victimized, some of them attempt to solve the problem by intimidating the victim.*" These concerning comments, while few in number, indicate that outreach and privacy around seeking help is particularly important given some students' circumstances.

#### 4.4. Sleep Strategies

The other most consistently employed strategies: were turn down the heat/open a window, read a book, watch TV, take a warm bath/shower, and listen to music. Turning down the heat, reading a book, and using white noise filters were significantly more likely to be employed by graduate students than by undergrads ( $p = 0.033, 0.009, \text{ and } 0.045$ , respectively). It is possible graduate students have more control over their environments and so can adjust heat and ambient sound more readily, but this is only speculative and would require more study to determine.

It is encouraging that these simple sleep interventions are already being practiced by a number of students. This enables a strengths-based approach [19]. A strengths-based approach “emphasizes an individual’s or community’s existing strengths, capabilities and resources . . . This perspective replaces a primary emphasis on problems, vulnerabilities and deficits. A strengths-based approach is developmental and process-oriented. It identifies and reveals a person’s internal strengths and external resources as they emerge in response to specific life challenges” [19] (p. 8). In the case of university students’ sleep habits, we could take a strength-based approach by building on students’ existing habit of listening to music before bed. The target, to build on the existing strength of habitual music listening to promote sleep, would be to increase the understanding of what constitutes sleep-conducive music [37] and students’ access to sleep conducive music resources in the form of podcasts or other social media platforms where music can be downloaded. Student Health Services, Student Union representatives, and Student Housing Services can all play an important role in facilitating access to the information and the actual music resources to modify behaviour. Taking a strengths-based approach allows us to form a partnership with students. Being told what they do is wrong and that they need to change can be alienating for students and, instead, we should look for opportunities to modify the sleep practices they already have to be more effective. Each of the common practices students identified in this survey has a relationship with sleep physiology. However, how that strategy is practiced can facilitate or hinder sleep. For example, cool ambient temperatures allow the drop in core body temperature needed to initiate and maintain sleep, so the practice of opening a window is useful. On the other hand, an open window can let in noise that causes the release of stress hormones that disturb sleep. Ambient noise and temperature can be controlled in the bedroom through other strategies such as fans and air conditioners, electric blankets, and white noise machines. Helping students understand the physiology behind the strategy will ensure they can generalize this science and problem-solve based on their own context. Similarly, a strengths-based approach can be taken to the practice of reading a book, the second most popular strategy. Depending on the light source and whether the book is electronic backlight or paper, reading a book could in fact be counter-productive to students’ sleep. Educating students about how to use blue spectrum filtering lightbulbs in the bedroom, blue spectrum suppressing filters if they use electronic readers and tablets (blue spectrum light suppresses melatonin production needed for sleep onset and maintenance), to substitute a paper book for electronic when possible, and to consider using an audiobook which can be placed on a timer and listened to with the lights out completely, are all sleep-promoting strategies that build on a student’s practice of reading at bedtime.

As mentioned above, a third strategy popular with students in the survey that could form the basis of a strength-based approach is listening to music before bed. This is a particularly important area to frame as a strength, if at all possible, because of the significant relationship that emerged between using music to help sleep and reporting less than 6.5 h sleep nightly. This relationship was particularly pronounced for those students who used music 5–7 nights a week. We believe that, because of the high prevalence of using music to aid sleep onset in the group that also reported the greatest difficulty with sleep, this practice presents some unique opportunities. A recent literature review [37] found a growing body of evidence for music as a sleep transition tool and proposed that music with 60–80 beats/min, and combined with other relaxation techniques, can be effective in reducing stress responses that interfere with sleep onset. It appears logical that higher education students, already frequent users of music to aid in getting to sleep, will be receptive to information about how music affects sleep physiology and how to use it more effectively. This strengths-based approach does not require a behavioural change; rather, the opportunity builds on an existing, highly used practice that is not necessarily effective in its current form. Determining beats/minute is fairly easy and inexpensive; several smartphone applications ([www.songbpm.com](http://www.songbpm.com) and [www.bpmdatabase.com](http://www.bpmdatabase.com)) exist that allow individuals to assess the beats/minute of music tracks for themselves. Information about these tools and the basic physiology underlying music and relaxation can empower students to problem-solve and self-manage this technique, thereby building feelings of control and mastery.

Lastly, students' use of alcohol as a sleep strategy warrants discussion. Around one in three students reported using alcohol, recreational drugs, and/or cigarettes occasionally as sleep strategies. Encouragingly, the frequency of these strategies occurring 'always' or 'often' (5–7 nights/week) was quite low (6.0%, 2.4%, and 1.4%, respectively). However, given the clear evidence that substance misuse has a significant negative impact on students' emotional health and academic performance [38], these findings should still be viewed as important. A study with 723 American adolescents found that cigarette smoking and weekend sleep, and marijuana use and total sleep were bi-directionally related [39]. Some young people's uses of substances are an effort to self-manage sleep deficiency and better education about the negative consequences of substance use to promote sleep is warranted. To that end, sleep deficiency, the impact of substance use on sleep, and alternative healthy sleep strategies should be incorporated into campus initiatives targeting student mental health and substance misuse. Sleep interventions for these students are particularly important, as the relationship between mental health and sleep deficiency also appears to be bidirectional. For example, research involving young adults in high schools has shown reduced rates of substance misuse and improved emotional health consequent to sleep interventions [40,41]. A strengths-based approach to substance use as self-medication for sleep will be challenging but could potentially be framed in a non-judgemental manner so that students are portrayed in a positive light for trying to improve their sleep and that substituting a different strategy would build on their good intentions and sleep awareness while at the same time reducing the negative side-effects of substance use.

#### 4.5. Preferences for Accessing Additional Information and Help

It is encouraging that most students wanted more information about sleep (Table 4). Their preferred method to receive information was relatively low cost, "an email with information" (59.4%, 613/1032). The second most popular way to receive information, "a handout/booklet and the option to contact someone with questions afterwards with questions," was selected by only 16.0% (165/1032) of participants. Other options were selected by fewer students and perhaps could be made available on an as-needed basis. Comments in general reflected (1) a desire for accessible, self-selected options collected together on a website, and (2) a comfort level with electronic delivery formats (e.g., archived presentations/webinars, electronic question/answer forums, blogs, electronic self-assessment tools, apps, visual aids such as infographics and videos as opposed to highly text dependent resources). It is possible that students who felt that nothing would help did not respond to the question and so we are not sure what format assistance for them should take. A few comments reflected frustration that nothing could be done about the causes of their sleep problems. For example, participants mentioned stress, noisy living spaces, the need to use electronics late at night, and lifestyle choices involving social activities and sports. For these students, psycho-educational resources to help them understand how the environment affects sleep and what can be done to modify the environment are one approach. Additionally, some issues, such as shared living spaces or late night opening hours of student resources that encourage students to engage in academic activities well into the night, are administrative/staff responsibilities and an effective campaign to create a sleep-friendly environment on campus would require some policy review and possible modifications.

**Table 4.** Preferred format of sleep education ( $n = 1032$  responses).

Response	Percentage	Count
an email with information would be enough	59.4%	613
a workshop where I can ask questions of the presenter at the end	5.9%	61
a recorded webinar where I can email the presenter questions afterwards	7.1%	73
a one-on-one session with a healthcare provider who knows about sleep	9.6%	99
a handout/booklet I can read and then contact the author with questions	16.0%	165
Other, please specify . . .	2.0%	21

## 5. Limitations

This was a cross-sectional survey with a disproportionate number of female versus male participants. The results should not be considered generalizable. A second limitation is that the survey was developed in-house, and although pilot tested, it did not undergo psychometric testing. Although additional standardized measures of daytime fatigue and perceived sleep quality were considered for inclusion in the survey and would have provided rich data, we elected to keep the survey short, focused, and with minimal participant burden so as to maximize survey completion rates. Because students were asked to identify if they were willing to participate in future research related to sleep, the option of more controlled study in the future is present. It is possible that participant bias occurred and we did not achieve a representative sample. However, our findings regarding students' perceived lack of sleep align with research on other North American campuses and highlight the need for education and action.

## 6. Conclusions

Sleep deficiency is a significant problem for higher education students and has serious negative consequences to their physical and emotional wellbeing and academic performance [42]. Students identified that they most often sought information from friends and families and so any campus strategies to improve student sleep should include a component to improve family and friends' sleep knowledge as well. For the most part, students already practice several sleep strategies that, employing a strengths-based approach, can be modified and adapted to reflect an evidence-based physiologically sound approach to better sleep. The next steps are to use these survey findings to inform development and testing of a campus-wide student sleep awareness and intervention strategy addressing the specific priority areas identified in this survey.

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