The One-Week Prevalence of Neck and Low Back Pain and the Association with Moderate to Extremely Severe Symptoms of Anxiety in University Students

by

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THESIS EXAMINATION INFORMATION

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An oral defense of this thesis took place on August 30, 2022, in front of the following examining committee:

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Chair of Examining Committee	Dr. Shilpa Dogra
Research Supervisor	Dr. Pierre Côté
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The above committee determined that the thesis is acceptable in form and content and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate during an oral examination. A signed copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

ABSTRACT

Objectives: To determine the one-week prevalence of neck and low back pain in undergraduate students, and the association between neck and low back pain and symptoms of anxiety.

Methods: Cross-sectional study in the Faculty of Health Sciences and Faculty of Education at Ontario Tech and the Canadian Memorial Chiropractic College in 2017. Neck and low back pain intensity in the past week were measured with a 10-point numerical rating scale. Anxiety symptoms in the past month were measured with the DASS-21. Log-binomial regression models were built to measure the association.

Results: Almost half of the samples experienced any neck or low back pain in the preceding week. Neck and low back pain was associated with symptoms of anxiety.

Conclusion: Low back and neck pain are common among university students. Students with low back or neck pain are more likely to report moderate to extremely severe symptoms of anxiety.

Keywords: University students; cross-sectional; neck pain; low back pain; anxiety

AUTHOR'S DECLARATION

I hereby declare that this thesis consists of original work of which I have authored. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Alexandra Campbell

STATEMENT OF CONTRIBUTIONS

I hereby certify that I am the sole author of this thesis, and I engaged in the literature search, data analysis, manuscript writing, and thesis writing.

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LIST OF ABBREVIATIONS AND SYMBOLS

LBP	Low back pain
NP	Neck pain
CI	Confidence Interval
NRS	Numeric Rating Scale
CMCC	Canadian Memorial Chiropractic College
DASS-21	Depression Anxiety Stress Scale – 21 item
POR	Prevalence Odds Ratio

Chapter 1. Introduction

1.1 Preface

Low back pain (LBP) and neck pain (NP) are common health concerns and are a leading cause of activity limitation and absence from work throughout the world.[1] Globally, NP is one of the most common musculoskeletal disorders and together with LBP, it is the second leading cause of years lived with disability in young adults aged 20-24 years.[2, 3] The course of LBP and NP is chronic and recurrent, and it is now recognized that biological, psychological and social factors influence their development and progression.[1] NP and LBP have been studied in several populations; however, there is limited literature describing the prevalence of LBP and NP in post-secondary students. Notably, the direction of the association between NP and LBP and anxiety, a common mental health symptom in post-secondary students, has yet to be explored.

1.2 NP, LBP, and Anxiety

1.2.1 NP

Anatomically, NP is defined as pain in the cervical spine, from the superior nuchal line to the spine of the scapula and anteriorly to the suprasternal notch.[4] Among the general population, the experience of NP can be recurrent or chronic, with chronic NP defined as pain that lasts ≥3 months.[5] Previous research found that 19-37% of patients experiencing NP will develop chronic NP.[6] In post-secondary students the prevalence of NP is reported to range from 16.2%-44.8%.[7-10] [11]

Biological and behavioural factors are associated with the prevalence of NP in post-secondary students. These factors include being a higher-year student, using a computer

for entertainment, and keyboard position.[6] Notably, experiencing NP is also associated with anxiety among adolescents, as those with higher anxiety scores were more likely to report comorbid NP.[12] Few studies have investigated the association between NP and anxiety in post-secondary students and to our knowledge no studies have focused on Canadian post-secondary students.[13] Therefore, due to the prevalent and persistent nature of NP, it is necessary to research the impact and association of pain on anxiety because young adulthood offers an opportunity to mitigate the possible transition from acute to chronic pain and therefore prevent disability into adulthood in this population.[2, 14-16]

1.2.2 LBP

Low back pain (LBP) is defined as pain experienced between the lower rib margins and the buttock creases.[17] LBP is not a disease; instead, it is a symptom often diagnosed as non-specific back pain.[17] LBP is pain in the same region as stated prior, but a specific cause for the pain cannot be determined; furthermore, this makes up the majority of LBP cases.[18] This pain is considered chronic when it persists for more than 3 months.[18] LBP is the leading cause of activity limitation and disability in adults.[1] In post-secondary students, the prevalence of LBP ranges from 15.1%-53%. [7-10, 19] Understanding the epidemiology of LBP in post-secondary students is challenging because as LBP tends to follow an episodic course, can start in adolescence and early adulthood, and is influenced by several internal and external factors.[1]

Psychosocial factors are also associated with the experience of physical pain, such as LBP.[20] The relationship between anxiety and LBP in post-secondary students is worthy of investigation because health behaviours at a younger age tend to persist into adulthood [2] and mental distress is elevated in those with LBP.[21] Young adulthood represents an

important time window for health interventions to prevent the development of chronic pain and therefore, possibly aid its associated impact on mental health. Research that focuses on LBP, particularly in post-secondary students, is important as it has been demonstrated that young adulthood presents a period where the onset and persistence of musculoskeletal pain can be modified through strategic and multidisciplinary rehabilitation.[2]

1.2.3 Anxiety

Anxiety symptoms and anxiety disorders are characterized by the experience of excessive fear, worry, and avoidance.[22] These symptoms are diagnosed as anxiety disorders if they persist for at least six months and interfere with functioning.[23] Research assessing mental health diagnoses in Ontario, Canada, from 1997 to 2017 found that by 2017, individuals between the ages of 16 to 25 years were the most common age group diagnosed with anxiety or depression.[24] According to analyses of the Canadian Community Health Survey (CCHS), the prevalence of anxiety disorders among individuals between the ages of 18 to 25 increased by 0.3% (95% CI; -0.3, 0.9) in males and 1.2% (95% CI: 0.5, 1.9) in females between 2011 and 2017. [25] This study shows an increasing trend in the prevalence of anxiety in this age group, an age in which individuals tend to be enrolled in post-secondary education.

In a previous analysis of the Ontario Tech University Mental Health and Wellness Survey, the one-month prevalence of moderate to extremely severe symptoms of anxiety was reported to be 48.6% (95% CI: 44.8, 52.4) in the Faculty of Health Science and 43.0% (95% CI: 36.3, 49.7) in the Faculty of Education.[26] These prevalence estimates highlight that moderate to extremely severe symptoms of anxiety are very common in this population. While anxiety symptoms are part of normal life, moderate to extremely severe

symptoms of anxiety are significant because of their association with impairment in social, occupational, or other areas of individual functioning.[22]

1.2.4 Pain and Anxiety

The literature suggests that a bidirectional relationship exists between pain and mental illness. Bondesson and colleagues[15] conducted a cohort study to investigate whether pain was associated with an increased risk of developing a mental illness (either depression or anxiety) in the general population; they found that those with pain were two times more likely to develop a mental illness.[15] Their results indicate an incidence rate ratio (IRR) of 2.18 (95% CI: 2.14, 2.22) for developing mental illness after pain.[15] To our knowledge, this is the only cohort study that investigated whether anxiety developed after experiencing pain. Notably, the authors did not focus on LBP or NP specifically, but their results, in combination with the aforementioned studies[12, 13], provide a basis for the hypothesis that exposure to moderate to severe NP or LBP could be associated with moderate to extremely severe symptoms of anxiety.

1.3 Association between Neck Pain and Low Back Pain and Anxiety in Young Adults

Understanding the association between NP and LBP severity and anxiety symptoms is important because mental disorders in early adulthood (18 to 29 years) are associated with persistent emotional and physical health problems later in adulthood.[27] Previous research supports the hypothesis that LBP and NP are associated with elevated levels of anxiety symptoms. [28-34] In Canada, post-secondary graduates have demonstrated higher levels of general anxiety than other educational levels.[35] This may be related to the fact that post-secondary studies are a period where students deal with stress related to lifestyle

changes and the anticipation of future career planning.[25] However, as noted above, NP and LBP are prevalent in students, and it is important to understand how this may relate to anxiety in this population. This is important due to the common nature of LBP and NP among this population and the potential for mental health implications.

1.3.1 NP and Anxiety in the General Population

A cross-sectional study by Blozik et al.[31] found that higher NP intensity was positively associated with anxiety scores (measured with the Hospital Anxiety Depression Scale[HADS]). This finding supports another cross-sectional study by Dimitriadis et al.[32] who reported that NP intensity was associated with anxiety in patients with chronic NP. Furthermore, a large cross-national study of the general population conducted in 17 countries, including 85,088 individuals, found that chronic NP is associated with anxiety disorders.[36] Finally, Liu et al.[13] conducted a systematic review and meta-analysis of Chinese literature in this area and reported that anxiety scores were distinctly higher in NP patients than in the healthy control group.[13] Overall, the literature suggests the relationship between anxiety and NP is possibly bidirectional.

1.3.2 LBP and Anxiety in the General Population

Similar to NP, it has been suggested that LBP is associated with anxiety symptoms and disorders. One study assessed the association between anxiety and pain intensity in patients with LBP [29] in Hong Kong. Of their participants, 45 (44%) were probable cases of anxiety disorders, and 32 (31.4%) were possible cases of anxiety disorders. LBP intensity was positively correlated with anxiety and depression using a total Hospital Anxiety Depression Scale (HADS) score, and pain intensity was moderately associated with

anxiety. Additional results from a cross-sectional study by Bair et al.,[30] found that 15 participants who experienced anxiety and LBP demonstrated an average score of 11.4 on the General Anxiety – 7 (GAD-7), illustrating a score of clinically significant anxiety. Both studies above utilized validated measures that assessed the possible presence of anxiety disorders.[37]

A systematic review by Shaw et al.[38] included 17 studies investigating the level of psychological distress in patients with acute LBP. The authors aimed to describe the measurement scales and levels of psychological distress reported in published studies of acute LBP.[38] The results indicate that clinically significant distress varied from 35% to 52% and the prevalence varied with the scale used to measure distress. Of the 17 studies included, only two directly measured anxiety; therefore, limited conclusions can be made about this association. Distress could be similar to the physical symptoms of distress that are present in the experience of anxiety, but this cannot be definitively used as a proxy for anxiety.[23] The two studies from the systematic review by Shaw et al., that examined the association between LBP and anxiety includes work by Philip and colleagues,[39] who found the predominant emotion in LBP patients was "frustration" rather than anxiety. Other study by Newell & Field aimed to assess whether they could predict who would improve with chiropractic treatment and found that females in their "acute" group (<4 weeks) had increased anxiety scores, as measured with the Bournemouth Questionnaire.[40] Their results highlight a possible association between LBP and anxiety. Furthermore, this systematic review highlights that limited research exist to accurately and directly measure the association between LBP and anxiety. In addition, a cross-sectional study completed in Qatar by Bener et al.[14] aimed to determine the prevalence of LBP and examine its

association with psychological distress symptoms, including anxiety. The population included 2180 (79.5% response rate) participants aged 15-65 years. The authors reported that those who experienced LBP had a mean Generalized Anxiety Disorder (GAD-7) score of 8.1 / 21 (±2.9), compared to 6.4 / 21 (± 3.3) in those without LBP. Furthermore, the prevalence of severe anxiety (9.5% versus 6.2%; $p = 0.007$) was higher in LBP patients than in those without LBP.[14]

Overall, these studies suggest that LBP pain may be associated with anxiety, but further investigation regarding the association between LBP and anxiety is warranted.

1.3.3 LBP and Anxiety in Students

A study conducted in Brazil, by Tavares et al.[41] surveyed 629 medical students aged 17-41 to determine the prevalence of LBP in Brazilian medical students, as well as the interference LBP presented in daily activities and its potential mental health associations. The authors found that the prevalence of recurrent LBP was 81.7% (514) and that LBP was correlated with anxiety ($rho = 0.21$; $p < 0.0001$). However, it is important to note that the psychometric properties of the question used to measure anxiety ("do you consider yourself a nervous person?") are unknown, thus the results should be viewed with caution. In addition, a cross-sectional study of American post-secondary students suggests that low back pain (annually) was reported by 42.8% (395) of participants, and feeling overwhelmed (their proxy measure for anxiety) was significantly associated with LBP ($\chi^2[6, N= 967] = 12.992, p = 0.003$).[20] Additionally, those who reported feeling overwhelmed more than 11 times in the last school year experienced back pain (51.6%) compared to 27.8% for those who never reported feeling overwhelmed. The use of a question regarding feeling "overwhelmed" is a limitation for this study because its

psychometric properties are unknown. Moreover, the researchers did not provide adequate definitions or specificity regarding LBP; participants were asked a yes or no question, and it is unknown what the specific question was.

1.3.4 Comorbid NP and LBP and Anxiety

Regarding the experience of comorbid NP and LBP, a cross-sectional study of the general Saudi population found that those with NP and LBP were at 2.5 times greater risk of psychological distress; this psychological distress could present as anxiety.[42] Furthermore, the authors gathered information regarding mental health using the General Health Questionnaire (GHQ)-12 scale but then reported their results based on the presence or absence of psychological disease (either depression or anxiety). While the total score on the GHQ-12 has been used to identify psychiatric disorders, it was initially designed to determine whether an individual is experiencing an inability to carry out their normal, healthy functions and the emergence of new phenomena that are distressing and is not a direct measurement of anxiety or depression, but rather a screening tool.[43]

1.4 Contextualizing NP and LBP and Anxiety within the Biopsychosocial Model

NP, LBP and anxiety have a biopsychosocial etiology.[27, 31, 44, 45] The biopsychosocial model used to understand back pain was initially developed by Waddell in 1977 [46] to address the limitations of the biomedical model.[47] The model challenged the traditional Western medical model, which ignored the role of mental health and social factors in the experiences of illness.[46] The biopsychosocial model asserts that biological, social, and psychological factors contribute to the etiology and prognosis of physical and mental disorders.[47, 48] The biopsychosocial model provides a comprehensive view of how illnesses are understood and view disease as a dynamic experience.[49, 50] Therefore, the

model recognizes reciprocal multifactorial influences that may impact an individual's experience over time.[49]

Through the biopsychosocial model, distinctions can be made between pain and nociception. Nociceptors are neuronal mechanisms that work to protect the body and reduce potential injury and the resulting perception of pain.[51] More simply put, nociception (the perception of pain) occurs when the nerves that convey information regarding tissue damage are stimulated and transported to receptors in the brain.[52] Importantly, pain receptors are located in several brain areas, including the limbic (or emotional) system.[52] Pain is often defined as the subjective perception that occurs due to the transduction, transmission, and modulation of sensory information.[52] However, how an individual perceives pain will differ based on their genetics, what they have previously experienced, psychological status and sociocultural influences.[52] With all of these factors discussed in the context of the biopsychosocial model, it is clear how pain can be a highly individualized experience, affecting emotion and cognition. Emotion is an immediate reaction to nociception that is based in the midbrain region (limbic system) and is highly integrated with several parts of the brain. This high level of emotional integration explains how an individual's cognitions can attach a meaning to emotional experiences, therefore priming them to initiate further emotional responses and amplify their pain experience beginning the cycle of nociception, pain, distress, and disability.[52]

1.5 Limitations of the Reviewed Literature, Knowledge Gaps, and Research Potential

1.5.1 Limitations

The overall limitations of the current literature include the measurement methods used to assess anxiety/anxiety symptoms and the statistical methods employed, namely, the use of ORs in cross-sectional studies. Limitations with ORs to quantify association in cross-sectional studies includes the potential for an overestimation of the association due to the highly prevalent nature of both LBP, NP, and anxiety.[53] Regarding the measurement of anxiety, some studies used tools that measured whether participants felt overwhelmed or if they were a nervous person, not necessarily focused on anxiety's clinical traits.[20, 41, 54, 55] Focusing on the clinical characteristics of anxiety would strengthen a study's internal validity to ensure more confidence that the authors measured what they had intended (symptoms of anxiety). It cannot be inferred that the psychological distress the participants were experiencing was symptoms of anxiety.

1.5.2 Gaps and Research Potential

Several studies have assessed LBP, mainly focused on the general adult population, with the mean ages in the forties and fifties.[21, 28-30, 54] Furthermore, much of the current literature has focused on the association from anxiety to LBP or NP.[28, 29, 56] Although these studies are not directly relevant to my thesis, they suggest that an association exists between LBP and NP and anxiety in adults. Additionally, these studies demonstrate the knowledge gap that exists regarding the post-secondary student population. Focusing on a post-secondary population is important to understand the burden of LBP and NP symptoms and their association with anxiety within this population. In Ontario, students starting post-secondary education directly following high school are 17 and 18 years old. As is evident from the existing literature previously addressing LBP, NP and anxiety in a general population, they tend to have participants older than post-secondary students[21, 29, 42], while

studies on adolescents will focus on participants under 17 years.[12, 57-59] Reviewing previous studies provides a better overview of the literature's landscape and highlights the current gap that my thesis addresses.

Our research project aims to fill these gaps by assessing the prevalence LBP and NP in post-secondary students and describing their relationship with anxiety, using valid and reliable measurement tools [60, 61] while controlling for a broad range of covariates.[62]

1.6 Thesis Objectives

The general objective of my thesis is to measure the prevalence of NP and LBP and explore the association between NP and LBP and symptoms of anxiety in post-secondary students. Specifically, I will address the following research questions:

1. What is the one-week prevalence of nonspecific LBP in undergraduate university students enrolled in the Faculty of Health Sciences and the Faculty of Education at Ontario Tech University and the Canadian Memorial Chiropractic College in the Fall term of 2017?
2. What is the one-week prevalence of nonspecific NP in undergraduate university students enrolled in the Faculty of Health Sciences and the Faculty of Education at Ontario Tech University and the Canadian Memorial Chiropractic College in the Fall term of 2017?
3. Is low back pain intensity associated with moderate to extremely severe anxiety symptoms in university students enrolled in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University and at the Canadian Memorial Chiropractic College in the Fall term of 2017?

4. Is neck pain intensity associated with moderate to extremely severe anxiety symptoms in university students enrolled in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University and at the Canadian Memorial Chiropractic College in the Fall term of 2017

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Chapter 2. One-Week Prevalence of NP and LBP

ABSTRACT

Objectives: To determine the one-week prevalence of neck and low back pain of any intensity and moderate to severe pain in undergraduate students.

Methods: We conducted a cross-sectional study of students enrolled in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University and the Canadian Memorial Chiropractic College in the Fall of 2017. Neck and low back pain intensity in the past week were measured with the 10-point numerical rating scale. We report the cumulative, gender- and institution-specific one-week prevalence and 95% confidence intervals (CI).

Results: The one-week prevalence of any neck pain ranged from 45.4-76.9%. Across the three samples. The prevalence of neck pain ≥ 3/10 was 52.1% (95% CI: 48.3, 55.9) in the Faculty of Health Science, 44.4% (95% CI: 37.5, 51.4) in the Faculty of Education, and 58.4% (95% CI: 54.0, 62.7) at CMCC. The one-week prevalence of any low back pain ranged from 60.9-69% across samples. The prevalence of low back pain ≥3/10 was 55.1% (95% CI: 51.2, 58.9) in the Faculty of Health Science, 51.2% (95% CI: 44.1, 58.1) in the Faculty of Education, and 47.8% (95% CI: 43.4, 52.2) at CMCC. Furthermore, the one-week prevalence, and ≥3/10, was higher in females than males.

Conclusion: Experiencing low back and neck pain is common among post-secondary students. An important proportion of students report pain that is moderate to severe in intensity.

Keywords: university students, cross-sectional study, neck pain, low back pain, anxiety

2.1 Introduction

Neck (NP) and low back pain (LBP) are two of the most common musculoskeletal disorders in the general population.[1] Globally, the age-standardized point prevalence of LBP was 6972.5 per 100,000[2] and the global age-standardized point prevalence of NP was 3551.1 per 100,000 .[3] NP and LBP are chronic and recurrent conditions associated with disability in adolescents and young adults.[1, 4, 5] According to the 2019 Global Burden of Disease, NP and LBP are among the top 20 leading causes of disability-adjusted life-years (DALY) among those aged 25-49, [1, 6] while in those aged 10-24 years, only LBP was in the top 20 leading causes of DALY in 2019.[6]

The current evidence suggests that the prevalence of NP and LBP may be particularly high in post-secondary students.[1, 7-10] For example, a study conducted in Saudi Arabia found that the period prevalence of NP ranged from 33% to 44%, and LBP 33.4%.[11, 12] Furthermore, a study of health science students in Saudi Arabia reported a 12-month prevalence of 48%.[10] Similarly, in Malaysian medical students, the one-week prevalence was 24% and 27% for NP and LBP, respectively.[9] Finally, a meta-analysis focused on nursing, and medical students reported a 12-month prevalence of 44% (95% CI: 27%, 61%) of LBP in medical students and 55% (95% CI: 44%, 62%) for nursing students.[13]

Although the prevalence of LBP and NP has commonly been investigated in medical students, few studies have focused on broad samples of undergraduate or Canadian students. Two sources focused on medical students in Saudi Arabia and Malaysia.[11, 12] In Saudi Arabia, Dighriri and colleagues reported a one-week prevalence of 44.8% (95% CI: 40.0, 49.0) for NP, and 33.4% (95% CI: 29.0, 38.0) for LBP.[12] In Malaysia, Alshagga and colleagues reported a one-week prevalence of 24.1% for NP and 27.2% for LBP.[9] A large

cross-sectional study by Ganesan and colleagues (N = 1,355) reported a one-week prevalence of 22.8% for LBP among an Indian sample of young adults.[7] . Potential limitations of these studies include unknown psychometric properties for the questions used to measure neck and low back pain.[9 11 7 12]

Therefore, our study aims to describe the cumulative and gender-specific one-week period prevalence of NP and LBP in three unique samples of undergraduate students enrolled at Ontario Tech University (Ontario Tech) and the Canadian Memorial Chiropractic College (CMCC) in the Fall of 2017.

2.2 Methods

The reporting of our study complies with The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (Appendix A.1).[14]

2.3 Design

The Ontario Tech University Mental Health and Wellness Study is a cross-sectional study of undergraduate students enrolled at Ontario Tech University and the Canadian Memorial Chiropractic College (CMCC) in the Fall of 2017. The general objective of the study was to measure the prevalence of mental health symptoms, LBP and NP in post-secondary students. Students were eligible if they were enrolled full-time in the Faculty of Health Science or the Faculty of Education at Ontario Tech or CMCC and were 18 years of age or older.[15-17]

2.4 Context

Ontario Tech University is primarily an undergraduate university located in Oshawa, Ontario, Canada. Ontario Tech University offers a range of programs under the

Faculty of Science, Faculty of Engineering, Faculty of Social Science and Humanities, Faculty of Health Science, and the Faculty of Education. Ontario Tech has a population of domestic, international, and college transfer students. The Faculty of Health Science students were enrolled in undergraduate degrees (Bachelor of Health Science [Honours], and Bachelor of Allied Health Science [Honours]) in a range of programs, including Public Health, Kinesiology, Medical Laboratory Science, Nursing, and Allied Health Science. Participants from the Faculty of Education were pursuing a Bachelor of Education.

The Canadian Memorial Chiropractic College (CMCC) is Canada's only English-speaking chiropractic program. It is located in Toronto, Ontario and offers professional education for students pursuing a Doctor of Chiropractic degree. Participants from CMCC were pursuing a Doctor of Chiropractic, a four-year program including a mix of courses and clinical placements.

2.5 Recruitment

Students from Ontario Tech University were recruited during three consecutive waves, from mid-September to October of 2017. Students enrolled in 27 mandatory classes from the Faculty of Health Sciences, and the Faculty of Education was invited to participate in the first wave. Compulsory courses were selected to ensure that the largest number of students were provided with the opportunity to participate and had the chance to complete the survey during class time. Recruitment was standardized and included three steps. First, the professor or instructor for each class read a script to introduce the research team. Second, the professor or instructor left the room. The research team addressed the class and delivered a five-minute presentation that outlined the purpose of the study, explained the informed consent process, and offered information for community and school-based mental

health services if needed. Finally, the students were encouraged to ask questions and then given 15 minutes to complete the electronic questionnaire in class.

For the second wave of recruitment, the professor or instructor from each mandatory class sent a follow-up email to all students inviting them to enrol and complete the study questionnaire by clicking on a link. Similarly, the final wave of recruitment included an email reminder from the Dean, who invited all students to enrol and complete the online questionnaire.

Students from CMCC were recruited during mandatory classes for those enrolled in their program's first, second, and third years. Students in the fourth year were recruited during clinic rounds. The in-person recruitment was supplemented with online announcements (i.e., Facebook posts), a post in CMCC's newsletter, and posters within the CMCC facilities. Recruitment began on October 31, 2017, and students who participated outside of class had until November 13, 2017, to complete the survey.

2.6 Data Collection

We developed an online questionnaire that collected variables relating to mental health symptoms, NP, LBP, physical activity, sedentary behaviour, food security, sleep quality, medical diagnoses, and sociodemographic factors. The data was stored securely on Google Forms and Google Drive at Ontario Tech University. To access the questionnaire, students used their student number. Once completed, the student identifier was removed from the data, and students were assigned a unique participant number that had no resemblance to their student identifier. To ensure that duplicate data was not collected, we limited access to one response per participant. A similar protocol was followed at CMCC.

2.7 NP and LBP Measurement

The questionnaire included a body diagram identifying the neck and low back region. Students reported whether they had experienced NP and LBP in the past week. Those who reported pain were asked to rate the intensity of their NP and LBP on an 11-point Numeric Rating Scale (NRS), where 0/10 indicated no pain and 10/10 indicated the worst pain possible.[18] The NRS is a valid and reliable instrument to measure pain intensity in the adult population.[19-25] The evidence suggests that the NRS has adequate test-retest reliability (intraclass correlation coefficient 0.58 to 0.93).[23, 24]

2.8 Statistical Analysis

We computed the cumulative and gender-specific one-week prevalence and 95% confidence intervals (CI) of 1) any (1-10/10 on the NRS) NP and LBP, and 2) moderate to severe NP and LBP (≥3-10/10 on the NRS) for students in each institution. For the prevalence of any NP or LBP, the numerator included those who responded "yes" to experiencing any LBP or NP in the preceding week, and the denominator was the total sample size. Moderate to severe LBP and NP was defined as pain ≥3/10.[26] For the computation of moderate to severe pain, the numerator included those who rated their pain ≥3/10, and the denominator included the total sample. The epiR package (version 2.0.41) in R was used to conduct the analysis.[27]

We assessed the presence of participation bias by comparing the age, gender, and year of study of the students in our sample compared to students enrolled in each faculty/institution and the participants.

2.9 Results

2.9.1 Participation

Study participants in the Faculty of Education was 77% (207/268) and 34% (675/1931) in the Faculty of Health Sciences. Of the 766 eligible students at CMCC, 510 completed the survey with a participation rate of 67%. Differences between our sample and the population at the time of data collection suggest slight differences in age in the Ontario Tech samples, the proportion of females participating from CMCC, and study year in the Faculty of Health Science. (**Table 2.1)**. Our samples were overrepresented by first year students in Health Science compared to the population and by females and third year students at CMCC. Furthermore, there was an underrepresentation of second year students in Education, third year students in Health Science, and fourth-year students at CMCC.

2.9.2 Sample Characteristics

As demonstrated in **Table 2.1**, most participants were female in the Faculty of Health Sciences and Education (79.9%, and 68.1%, respectively). The average age of participants was 22.1 years (SD: 5.5) in the Faculty of Health Sciences and 25.6 years (SD: 4.8) in the Faculty of Education. More than half of the samples at Ontario Tech (52.6% in the Faculty of Health Science and 54.1% in the Faculty of Education) reported being diagnosed with a medical condition by a healthcare provider, with the medical condition most often reported as allergies (29.0% for both faculties).

Table 2.1: Comparison of Age, Gender and Year of Study between the source populations and samples for students enrolled at Ontario Tech and CMCC

	Faculty of Health Sciences (FHS)		Faculty of Education (FEd)		Canadian Memorial Chiropractic College (CMCC)	
Variable	Population (n = 1931)	Sample (n = 675)	Population (n = 268)	Sample (n = 207)	Population (n = 766)	Sample (n = 510)
Age (SD)	24	22.1 (5.5)	28	25.6 (4.8)	25	24.56 (2.7)
Gender = Female	75.9%	79.9%	66.7%	68.1%	55.4%	60.0%
Year of Study						
1	18.1%	25.3%	52.4%	33.3%	26.0%	25.7%
2	26.3%	25.6%	47.6%	34.8%	24.8%	26.9%
3	27.2%	21.0%	0%	0.0	24.3%	29.2%
4	25.5%	26.5%	0%	0.0	24.9%	18.2%
5+	2.9%	1.5%	0%	31.9%	0%	

Similar to the Ontario Tech University sample, few CMCC students (0.2%) identified as a gender other than male or female (**Table 2.2**). The CMCC sample had a

younger average age than the Faculty of Education sample and represented the highest percentage of male participants. Interestingly, the Faculty of Education sample had the highest percentage of diagnosed medical conditions of the three samples. Overall, participants were similarly distributed from first to third years, with fewer fourth-year students (18.2%). Additionally, most students did not work for pay (51.6%). Less than half of the sample at CMCC reported being diagnosed with a medical condition (46.7%). Similar to Ontario Tech, the most reported medical condition was allergies (25.1%).

Table 2.2: Characteristics of participants from Ontario Tech University and CMCC

	Faculty of Health Science	Faculty of Education	CMCC
	N = 675	N = 207	N = 514
Age	22.13 (SD: 5.49)	25.62 (SD: 4.77)	24.56 (SD:2.77)
Gender			
Female	539 (79.9%)	141 (68.1%)	306 (60.0%)
Male	128 (19.0%)	65 (31.4%)	203 (39.8%)
Study Year			
1	171 (25.3%)	69 (33.3%)	131 (25.7%)
2	173 (25.6%)	72 (34.8)	137 (26.9%)
3	142 (21.0%)	0	149 (29.2%)
4	179 (26.5%)	0	93 (18.2%)
5	10 (1.5%)	66 (31.9%)	0
Medical Condition	355 (52.6%)	112 (54.1%)	238 (46.7%)
Allergy	196 (29.0%)	60 (29.0%)	128 (25.1%)
Arthritis	9 (1.3%)	<5 (1.0%)	8 (1.6%)
Asthma	98 (14.5%)	22 (10.6%)	62 (12.2%)
ADD-H-D[1]	21 (3.1%)	11 (5.3%)	13 (2.5%)
IBS[2]	23 (3.4%)	8 (3.9%)	21 (4.1%)
CFS[3]	0	0	<5 (0.6%)
Eating Disorder	19 (2.8%)	<5 (0.5%)	7 (1.4%)
High Blood Pressure	<5 (0.6%)	5 (2.4%)	<5 (0.4%)
Ulcers	6 (0.9%)	0	<5 (0.4%)
Migraine	61 (9.0%)	12 (5.8%)	38 (7.5%)
Mood Disorder	66 (9.8%)	21 (10.1%)	30 (5.9%)
Scoliosis	19 (2.8%)	6 (2.9%)	20 (3.9%)
STI[4]	<5 (0.4%)	5 (2.4%)	11 (2.5%)

Other	22 (3.3%)	7 (3.4%)	8 (1.6%)
Marital Status			
Single	601 (89.0%)	172 (83.3%)	447 (87.6%)
Married/Common Law	59 (8.7%)	32 (15.5%)	59 (11.6%)
Separated/Divorced/Widowed	15 (2.2%)	<5 (1.4%)	<5 (0.2%)
Any LBP (one-week)	455 (67.4%)	126 (60.9%)	392 (76.9%)
Any NP (one-week)	430 (63.7%)	113 (54.6%)	352 (69.0%)

1 – Attention Deficit Hyperactivity Disorder, [2] – Irritable Bowel Syndrome, [3] – Chronic Fatigue Syndrome, [4] – Sexually Transmitted Diseases

2.9.3 One-Week Prevalence of NP

Ontario Tech University

The one-week prevalence of any neck pain (NP) among participants from the Faculty of Health Sciences and the Faculty of Education was 63.7% (95% CI: 59.9, 67.3) and 45.4% (95% CI: 38.4, 52.4), respectively. The one-week prevalence of moderate to severe NP (≥3/10) was 52.1% (95% CI: 48.3, 55.9) in the Faculty of Health Science and 44.4% (95% CI: 37.5, 51.4) in the Faculty of Education. Among males, the one-week prevalence of any NP was 47.1% (95% CI: 39.9, 54.4), and 34.1% (95% CI: 27.5, 41.3) reported moderate to severe NP (≥ 3/10). Among females, the one-week prevalence of any NP was 65.5% (95% CI: 61.8, 69.1), and 55.1% (95% CI: 51.3, 58.9) for moderate to severe NP (≥ 3/10).

CMCC

At CMCC, the one-week prevalence of NP was 76.9% (95% CI: 72.9, 80.4). For female, the one-week prevalence of NP was 85.3% (95% CI: 80.8, 89.0) and 64.5% (95% CI: 57.5, 71.1) in males. Regarding NP ≥3/10, the one-week prevalence of moderate to severe NP was 58.4% (95% CI: 54.0, 62.7). The one-week prevalence of moderate to

severe NP in females was 70.6% (95% CI: 65.1, 75.6) and it was 40.4% (95% CI: 33.5, 47.4) for males.

2.9.4 One-Week Prevalence of LBP

Ontario Tech University

The one-week prevalence of any LBP in the Faculty of Health Science was 67.4% (95% CI: 63.7, 70.9), and 60.9% (95% CI: 53.8, 67.5) in the Faculty of Education. Regarding pain ≥3/10, the one-week prevalence of moderate to severe LBP was 55.1% (95% CI: 51.2, 58.9) in the Faculty of Health Science and 51.2% (95% CI: 44.1, 58.1) in the Faculty of Education. For gender, the one-week prevalence of LBP in males was 54.4% (95% CI: 47.0, 61.5). The one-week prevalence of LBP ≥3/10 in males was 43.0% (95% CI: 35.9, 50.3). For females, the one-week prevalence of any LBP was 68.9% (95% CI: 65.3, 72.4) and 57.6% (95% CI: 53.8, 61.3) for LBP ≥3/10.

CMCC

The one-week prevalence of low back pain was 69% (95% CI: 64.8, 73.0). When assessing prevalence by gender, the one-week prevalence of low back pain in females was 72.5% (95% CI: 67.1, 77.4). For males, the one-week prevalence of low back pain was 64% (95% CI: 57.0, 70.6). Regarding pain ≥3/10, the one-week prevalence of moderate to severe low back pain ≥3/10 was 47.8% (95% CI: 43.4, 52.2). The one-week prevalence of moderate to severe low back pain in females was 51.6% (95% CI: 45.8, 57.3), and it was 42.3% (35.4, 49.4) in males.

3.0 Discussion

The results from the survey suggest that the one-week point prevalence of LBP and NP is high among undergraduate students. The one-week prevalence for NP and LBP was higher than reported in previous studies above from Saudi Arabia and Malaysia [9-12] My results are consistent with the Global Burden of Disease study results, indicating that the prevalence of LBP and NP was the highest in North America than in other countries globally.[2, 3]

Overall, the one-week prevalence of any NP and LBP and NP and LBP ≥3/10 was higher among females than males across all three samples. However, the prevalence of any NP and LBP, as well as pain ≥3/10, was higher in the Faculty of Health Science than in the Faculty of Education. Furthermore, the one-week prevalence for LBP and NP was higher in the CMCC sample than at Ontario Tech.

The strength of my study includes using valid and reliable measures of NP and LBP. Specifically, we used a body map to identify the region for NP and LBP and the NRS to measure pain intensity. The main limitation of this study is the potential for participation bias. As demonstrated in Table 2.1, participants were generally similar to the population but differed in age, gender, and study year. This bias may have led to an overestimation of the prevalence because it has been suggested that neck and low back pain is higher in females than in males.[28] Moreover, the generalizability of our results may be limited due to the small proportion of respondents with gender identities other than male or female (genderqueer, female-to-male transgender, male-to-female transgender).

The most significant implication of this study is that most students experience NP or LBP in any given week. This is significant because pain can impact young adults'

physical and mental health.[29] Furthermore, if the pain becomes chronic, it could affect students' long-term well-being and functioning.[30]

My study highlights the need for further research to explore the nuances of LBP and NP among this population. Future surveys should be completed among other student populations to efficiently recruit participants of different gender identities beyond female and male to investigate further how the current patterns may change when other identities, such as transgender, genderqueer/genderfluid, and agender, are assessed. Furthermore, updating the study results could prove interesting due to changes in lifestyle due to the COVID-19 pandemic.[31] For example, increased sedentary time potentially impacting NP and LBP prevalence or intensity. Overall, the prevalence results indicate that a sizable portion of the populations assessed presented with LBP and NP.

3.1 Conclusion

In conclusion, the presence of LBP and NP, whether any pain level or pain ≥3/10, was common among our sample of students. Furthermore, the prevalence was higher at CMCC than at Ontario Tech, as well as among females. This study adds to the literature assessing the prevalence of LBP and NP among post-secondary students, specifically Canadian students.

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Chapter 3. Association Between Moderate to Severe LBP and NP, and Moderate to Extremely Severe Symptoms of Anxiety in Post-Secondary Students

ABSTRACT

Objectives: To determine the association between moderate to severe neck pain, moderate to severe low back pain and moderate to extremely severe symptoms of anxiety in undergraduate students.

Methods: We conducted a cross-sectional study. Students enrolled in the Faculty of Health Science and Faculty of Education at Ontario Tech University and at the Canadian Memorial Chiropractic College in the Fall of 2017 were eligible. Neck and low back pain intensity in the past week were measured with the numerical rating scale, and anxiety symptoms in the past month were measured with the DASS-21. We built log-binomial regression models to measure the association while controlling for covariates, including stress, depression, sleep quality, and sedentary behaviour.

Results: Moderate to severe neck (range of Prevalence Ratio: 1.21-1.69 [95% CI: 0.73, 2.31]) and low back pain (range of Prevalence Ratio: 1.88-1.97 [95% CI: 1.22, 3.18]) was associated with moderate to extremely severe symptoms of anxiety in both samples after controlling for sleep quality, depression, stress, and sedentary behaviour.

Conclusion: Independent of sleep quality, depression, stress, and sedentary behaviour, students with moderate to severe neck and low back pain in the past week are more likely to report moderate to extremely severe symptoms of anxiety.

Keywords: university students, cross-sectional study, neck pain, low back pain, anxiety

3.1 Introduction

Anxiety is a psychological phenomenon characterized by excessive fear, worry, and avoidance. Anxiety disorders are common mental health conditions in Canada,[1] and young adults are particularly affected.[2] Anxiety disorders and symptoms are the most prevalent psychological difficulties reported in post-secondary students, and the prevalence increased steadily from 2011 to 2017.[3-5] Specifically, the prevalence of anxiety disorders among post-secondary students ranges from 6-10% among males, 13-16% among females, and 11-14% among mixed-sex samples.[3-5] In a study conducted at Ontario Tech University in 2017, the one-month prevalence of moderate to extremely severe symptoms of anxiety was 48% (95% CI: 44.8, 52.4) in the Faculty of Health Science and 43% (95% CI: 36.3, 49.7) in the Faculty of Education.[6] Similarly, we have previously reported that the prevalence of moderate to extremely severe symptoms of anxiety at the Canadian Memorial Chiropractic College was 32% (95% CI: 24.7, 40.3).[7]

One hypothesized cause of anxiety in post-secondary students is musculoskeletal pain, particularly neck pain (NP) and low back pain (LBP). Worldwide, NP and LBP are amongst the most common disabling musculoskeletal disorders and are the second leading cause of years lived with disability in young adults aged 20-24 years.[8-10] Previous studies suggest that LBP is associated with anxiety symptoms and feeling overwhelmed in post-secondary students.[11, 12] In particular, functional impairments due to LBP was associated with anxiety in Brazilian medical students.[11] Understanding the association between LBP, NP and symptoms of anxiety in post-secondary students is important because young adulthood is a period when neck and low back pain are common.[8] Although previous research suggests that patients with LBP report symptoms of anxiety more commonly than

the general population, little is known about the association between NP, LBP and symptoms of anxiety in post-secondary students specifically.[13-15]

We aimed to address this gap in the literature and determine the association between moderate to severe LBP and NP and moderate to extremely severe anxiety symptoms in post-secondary students enrolled at two Ontario post-secondary institutions in the fall of 2017.

3.2 Methods

The reporting of our study complies with The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (Appendix A.1).[16]

3.2.1 Context

Ontario Tech University is located in Oshawa, Ontario. Initially established in 2002, Ontario Tech is a university offering a range of programs to domestic, international, and college transfer students under the Faculties of Science, Engineering, Social Science and Humanities, Health Science, and Education.

Founded in 1945, the Canadian Memorial Chiropractic College (CMCC) is located in Toronto, Ontario. CMCC offers professional education for students pursuing a Doctor of Chiropractic degree.

3.3 Design

We conducted a cross-sectional study of undergraduate students enrolled at Ontario Tech University and CMCC in the Fall of 2017. Students were eligible if they were enrolled full-time in the Faculty of Health Science or the Faculty of Education at Ontario Tech University or at CMCC and were 18 years of age or older.[6, 7, 17]

Students from Ontario Tech University were enrolled during three consecutive recruitment waves and were permitted to complete the questionnaire during class time. In the first wave, students from 27 different mandatory classes were invited to participate. Mandatory classes were selected to ensure all students from both faculties had the opportunity to participate. The wave one recruitment process was standardized to ensure a similar process was followed throughout. The Professor/instructor read a script to introduce the research team to each class. The Professor/instructor then left the room for 20 minutes so the research team could inform students about the study. During a short presentation, the research team described the purpose of the study, explained informed consent, and offered information for community and school-based mental health services if needed. After the presentation, students were encouraged to ask questions and then given 15 minutes to complete the electronic questionnaire in class.

During the second wave of recruitment, the Professor/instructor of the eligible mandatory course sent an email, including a link to the questionnaire, inviting all students to participate. Finally, the third and final recruitment wave included an email reminder from the Dean of each faculty and again had a link to the questionnaire.

At CMCC, students were recruited from mandatory classes at the first, second, and third-year levels. Fourth-year interns were recruited during clinic rounds. The in-person recruitment was supplemented with Facebook posts, posters, and a post in the school's newsletter.

3.4 Data Collection

The data was collected through an online questionnaire. The study questionnaire included tools to measure the presence and severity of mental health symptoms, as well as students' characteristics, including neck and low back pain, physical activity, sedentary behaviour, food security, comorbidities, sleep quality, medical diagnoses, and sociodemographic factors.

The data was stored securely on Google Forms and Google Drive at Ontario Tech University. Students were required to use their student number to access the questionnaire. Upon completion, their student identifier was then removed from the data, and they were assigned a study participant number. Once students submitted the questionnaire, they could not access the platform a second time, therefore ensuring that duplicate data was not collected. A similar protocol was followed at CMCC.

3.5 Exposure: LBP and NP

The study questionnaire included a body diagram used to locate the neck and low back regions. We measured self-rated pain intensity from 0-10 using the Numeric Rating Scale (NRS), with 0 indicating no pain and 10 referring to the worst pain possible.[22] LBP and NP scores were dichotomized into no or mild pain for scores <3/10 and moderate to severe for scores ≥3-10/10.[18] The NRS has acceptable levels of reliability and validity in an adult population.[19, 20]

3.6 Outcome: Moderate to Extremely Severe Symptoms of Anxiety

We measured symptoms of anxiety with the Depression Anxiety Stress Scales 21-item (DASS-21), which includes seven questions related to anxiety. Students were asked to rate the presence of anxiety symptoms in the past week as never (0), sometimes (1),

often (2), or almost always present (3). The responses to the seven anxiety questions were summed with total anxiety scores ranging from 0-21. The total anxiety scores were categorized into one of five categories: normal (0-7/21), mild (8-9/21), moderate (10-14/21), severe (15-19/21), or extremely severe (20-21/21) according to the recommendations by Lovibond & Lovibond.[21] We then dichotomized the anxiety scores into "normal and mild" versus "moderate, severe, and extremely severe" for our study. Anxiety was categorized in this manner because a low level of anxiety symptoms is normal in post-secondary students' experience and less likely to have functional impacts; conversely, anxiety levels reaching the moderate level may have negative impacts from a mental health perspective.[21, 22] The DASS-21 has demonstrated acceptable reliability and validity.[23-25]

3.7 Covariates

3.7.1 Sociodemographic Characteristics

The questionnaire collected information regarding the students' age, gender, marital status, number of dependents, faculty, area of study, number of comorbidities, academic average, year of study, social support, personal income, household income, number of hours working for pay, living arrangement, commute time to the university, international/domestic student status, parental marital status, employment status of parents/guardians, and ethnicity.

3.7.2 Sleep Quality

We assessed sleep quality using The Pittsburgh Sleep Quality Index (PSQI).[26] The PSQI contains 19 items divided into seven domains of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of

sleep medications, and daytime dysfunction.[27] Each domain is scored from 0-3, and the subscores are added together to derive a global PSQI score. The global score ranges from 0 to 21, and scores greater than 5 suggest the presence of significant sleep disturbance.[26] The PSQI has strong validity and reliability in clinical and non-clinical samples.[28]

3.7.3 Substance Use

We assessed substance use with the Alcohol, Smoking and Substance Involvement Screening Tool (ASSIST).[29] The ASSIST measures both lifetime and three-month use of alcohol, cigarettes, and other substances, including marijuana, cocaine, amphetamines, sedatives, hallucinogens, inhalants, opioids, and other drugs.[29] The ASSIST is valid to screen for substance use in individuals who engage in substance use with several different substances and demonstrate varying levels of use.[30] Furthermore, the ASSIST is a reliable tool,[31] and has been validated for use in post-secondary students.[32]

3.7.4 Food Insecurity

The Household Food Security Survey Model (HFSSM) measured food insecurity in the past 12 months. The HFSSM measures the severity of food insecurity on a scale from 0 to 10, with 10 representing severe food insecurity.[33] The HFSSM includes six questions to produce a total score from 0-6. Students responded to two questions regarding their food situation in the past 12 months (often true, sometimes true, never true, don't know or refused). If anyone in the house skipped or cut the size of their meals because there was not enough, then they responded to a question asking how often that happened. Then, they responded whether they ate less than they should or didn't eat because there wasn't enough money. Affirmative responses (often, sometimes, yes, almost every month, and some

months) were summed, and their score determined their food security status. Scores from 0-1 demonstrated high or marginal food security, 2-4 was low food security, and 5-6 was very low food security. These scores were then recoded to demonstrate food insecurity (2 affirmatives) and hunger (5 or more affirmatives).[34] The HFSSM has been demonstrated to be valid and reliable.[35]

3.8 Statistical Analysis

3.8.1 Participation Bias

We assessed the presence of participation bias by comparing the age, gender, year of study, and percentage of domestic students enrolled in the study to the characteristics of students in each faculty/institution.

3.8.2 Associations Between NP, LBP and Moderate to Extremely Severe Symptoms of Anxiety

The associations between NP (≥3/10), LBP (≥3/10), and moderate to extremely severe symptoms of anxiety were assessed in two sequential stages. First, we built a bivariate log-binomial regression model assessing the crude association between NP and LBP and moderate to extremely severe symptoms of anxiety in separate models. All associations are reported as prevalence ratios (PR) with a 95% confidence interval (CI). The bivariate models for Ontario Tech University were first built separately for the Faculty of Health Science and the Faculty of Education. We then assessed if the associations were similar by comparing the PR and 95% CI. Because the associations were similar in these two faculties, we pooled these two samples and applied the third and final stages of analysis. Data from the CMCC sample was assessed separately due to differences between

students enrolled at CMCC and Ontario Tech (**Table 2.1**). Finally, we computed adjusted associations using multivariable log-binomial regression to determine whether the association remained after controlling for covariates. We used the change of estimate method to select the covariates included in the final model.[36] Specifically, we first added all the covariates individually to the model. Variables that changed the crude estimate of the association between NP/LBP and moderate to extremely severe symptoms of anxiety by ± 5% were included in the final model. The change of estimate by 5% has been widely accepted as significant for data with our sample size.[36, 37] The chest package in R (version 0.3.5)[38] was used to assess for potential covariates. The presence of multicollinearity in the final model was evaluated with the mctest package in R (version 1.3.1).[39-41] The *mctest* package detects the existence of multicollinearity by displaying individual variance inflation factor (VIF) value for each variable in the model.[39, 40] VIF starts at 1 and has an upper limit, with a value of greater than 5 means high multicollinearity between this variable and the others.[42] If multicollinearity was detected, then removing one or more of the correlated variables would be employed.[43]

3.9 Results

3.9.1 Participation Bias

Study participation in the Faculty of Education was 77% (207/268) and 34% (675/1931) in the Faculty of Health Science. Of the 766 eligible students at CMCC, 510 completed the survey with a participation rate of 67%. Baseline differences between our sample and the population suggest slight differences in age in the Ontario Tech samples, the proportion of females participating from CMCC, and study year in the Faculty of Health Science (**Table 2.1**). Our samples were overrepresented by first-year students in Health

Science compared to the population and by females and third years at CMCC. Furthermore, there was an underrepresentation of second-year students in Education, third years in Health Science, and fourth-year students at CMCC.

3.9.2 Sample Characteristics

Ontario Tech University

Table 2.2 illustrates that most participants identified as female in the Faculty of Health Science and Education (79.9%, 68.1%, respectively). The average age of participants in the Faculty of Health Science was 22.1 (SD: 5.5) and 25.6 (SD: 4.8) in the Faculty of Education. Few participants (1.7%) identified as a gender other than male or female. Furthermore, there was relatively equal participation throughout the study years at Ontario Tech. A bit more than half of the samples at Ontario Tech (52.6% in the Faculty of Health Science and 54.1% in the Faculty of Education) reported being diagnosed with a medical condition by a healthcare provider, with the medical condition most often reported as allergies (29.0% for both faculties).

CMCC

Similar to the Ontario Tech University sample, few students (0.2%) identified as a gender other than male or female (Table 2.2). Most of the participants at CMCC identified as female (60%). The average age for CMCC participants was 24 (SD: 2.77). Overall, participation was even across first to third years, with fewer fourth-year students (18.2%). Slightly less than half of the sample at CMCC reported being diagnosed with a medical condition (46.7%). Similar to Ontario Tech, the most reported medical condition was allergies (25.1%).

3.9.3 Association Between NP and Anxiety

Ontario Tech University

The crude analysis suggested that moderate to severe NP was associated with moderate to extremely severe anxiety (crude PR 2.38 [95% CI: 1.82, 3.13]) (Table 3.1). Controlling for covariates (stress, sleep quality, and depression) reduced the strength of the association. Nevertheless, the final model suggests that participants with moderate to severe NP were 1.69 times more likely to report moderate to extremely severe anxiety (adjusted PR 1.69 [95% CI: 1.23, 2.31]). No evidence of multicollinearity was documented in the final model, with all individual multicollinearity diagnostics listed as 0 (VIF detection = 1.0-1.5).

CMCC

The crude association suggests that moderate to severe NP was associated with moderate to extremely severe symptoms of anxiety (crude PR: 2.15 [95% CI: 1.44, 3.19) (Table 3.2). However, the relationship diminished once adjustments were made for stress, sleep quality, depression, and sedentary behaviour (adjusted PR: 1.21 [95% CI: 0.73, 2.01]). No evidence of multicollinearity was documented in the final model, with all individual multicollinearity diagnostics listed as 0 (VIF detection = 1.0-1.6).

3.9.4 Association Between LBP and Anxiety

Ontario Tech University

The crude analysis suggested that moderate to severe LBP was associated with moderate to extremely severe anxiety (crude PR 2.35 [95% CI: 1.79, 3.09]) (Table 3.1). However, controlling for stress, sleep quality, and depression reduced the association (adjusted PR: 1.88 [95% CI: 1.54, 2.87]). No evidence of multicollinearity was documented

in the final model, with all individual multicollinearity diagnostics listed as 0 (VIF detection = 1.0-1.5).

CMCC

The crude model suggests that moderate to severe LBP was associated with moderate to extremely severe anxiety (crude PR: 2.63 [95% CI: 1.79, 3.86]) (Table 3.2). Although controlling for covariates (stress, sleep quality, and depression) led to a reduction in the association, the final model suggests that participants with moderate to severe LBP were almost two times more likely to report moderate to extremely severe anxiety (adjusted PR: 1.97 [95% CI: 1.22, 3.18]). We found no evidence of multicollinearity in the final model, with all individual multicollinearity diagnostics listed as 0 (VIF detection = 1.0-1.6).

Table 3.1: Crude and Adjusted Prevalence Ratios for moderate to extremely severe anxiety for Ontario Tech

	Crude Prevalence Ratio	Adjusted Prevalence Ratio
Low back pain	2.35 (95% CI: 1.79, 3.09)	1.75 (95% CI: 1.26, 2.42)[1]
NP	2.38 (95% CI: 1.82, 3.13)	1.69 (95% CI: 1.23, 2.31)[2]

[1]: Log-binomial regression model adjusted for stress, sleep quality, and depression

[2]: Log-binomial regression model adjusted for stress, sleep quality, and depression

Table 3.2: Crude and Adjusted Prevalence Ratios of moderate to extremely severe anxiety for CMCC

	Crude	Adjusted

LBP	2.63 (95% CI: 1.79, 3.86)	1.97 (95% CI: 1.22, 3.18)[1]
NP	2.15 (95% CI: 1.44, 3.19)	1.21 (95% CI: 0.73, 2.01)[2]

[1]: Log-binomial regression model adjusted for depression, stress and sleep quality

[2]: Log-binomial regression model adjusted for sedentary behaviour, depression, stress, and sleep quality

4.0 Discussion

We found that students who reported moderate to severe LBP were more likely to report moderate to extremely severe anxiety in two distinct samples of Ontario post-secondary students. We also found a similar association between moderate to severe NP and moderate to extremely severe anxiety. Our results indicate that moderate to severe spinal pain and moderate to extremely severe symptoms of anxiety are comorbid conditions among post-secondary students. The similarity of associations in the two distinct samples is critical to note because it suggests that our findings may be more generalizable and not related to specific institutions' programs. Our results were similar to Liu et al.,[14] who reported that depression or anxiety was more common among NP patients, and the study conducted by Andias et al.,[44] which found that there were significant differences in anxiety in adolescents with NP.

The biopsychosocial model may help explain the association between LBP, NP, and anxiety symptoms as it views disease as a dynamic experience and acknowledges that the interaction between psychological, social, and cultural factors can influence the resulting experience of disability, pain, and impairment.[45] Experiencing persistent pain may lead individuals to feel anxious for several reasons – pondering if their pain will

increase, if their ability to engage in physical activities will be reduced, and so forth.[46] The link between pain and anxiety can be further extrapolated through understanding nociception and the subjective experience of pain. How an individual perceives pain will differ based on their genetics, previous knowledge, psychological status, and sociocultural influences.[46] Emotion is an immediate reaction to nociception and is based in the midbrain region. The individual's cognitions then attach a meaning to this emotional experience, therefore priming them to initiate further emotional responses and can amplify their experience of pain.

Mental health has been rarely considered when a biopsychosocial approach is taken for LBP[47] despite literature indicating that mental health concerns are high among those experiencing NP and LBP,[15, 48-52] and that a bidirectional relationship may exist between anxiety and pain.[53]

4.1 Strengths and Limitations

4.1.1 Strengths

The strengths of our study include the use of a log-binomial regression model to account for the cross-sectional nature, as well as the calculation of PRs instead of ORs to reduce overestimation.[54] Moreover, the final models are adjusted for important covariates. Finally, using validated tools to gather participants' pain intensity further strengthens the results of our study.

4.1.2 Limitations

Students who chose to participate in our study may have differed from those who decided not to, which could be a potential source of selection bias.[55] Students may not have

felt comfortable completing the survey during in-class recruitment or online due to the questions included. More specifically, the personal nature of the questions ranged from the individual's level of food security/insecurity to any substance use: those who experience a severe level of food insecurity, use stigmatized substances, or have severe mental health issues may not have completed the survey. A cross-sectional study has demonstrated that non-response has been associated with male sex, younger age, lower socioeconomic status, and problematic alcohol and drug use.[56] With more participants from a range of socioeconomic statuses, and drug use, the results could have differed. The results may be biased towards those of a higher socioeconomic status, female, and generally do not use substances. Even though participation bias was assessed, and the sample was similar to the population, there is a chance that those who did not participate would meet the criteria above regarding socioeconomic status, gender, and substance use.

Another potential source of bias in our study is related to the measurement properties of the DASS-21. One study from Canada suggests that the DASS-21 may be best suited as a general score of distress rather than separately measuring symptoms of depression, anxiety and stress.[57] While it was previously stated to be valid and reliable, the scores could be assessed holistically, rather than as separate subscales. Future work can build on these results by utilizing the total DASS scale score. Our adjusted models did differ from the crude once depression was controlled for, and understanding how an overall mental health score differs from just anxiety may provide a better picture of students dealing with moderate to severe NP and LBP.

4.2 Implications

We found an association between NP and LBP intensity on anxiety symptoms and represent an opportunity for a two-pronged approach to addressing musculoskeletal pain and mental health. However, causation cannot be inferred due to the cross-sectional nature of this study. The cross-sectional design offers an insight into prevalent cases that existed at the time of the study in Fall 2017 and indicates the importance of a large cohort study to determine the duration and whether the exposure occurred before the outcome, therefore, providing an opportunity to ascertain the finer details of this association.

The implication of this research is that health care providers at the university should become aware of the association between spinal pain and anxiety. This study can be shared with medical/mental health practitioners on-campus so they are aware of the association between LBP and NP and symptoms of anxiety. They can make necessary changes to their care model to better support students through the assessment of both physical and mental health symptoms. Currently, there is little guidance for rehabilitation clinicians treating anxiety symptoms, and the results of this study highlight the importance of viewing health issues holistically through the biopsychosocial model.[58] Furthermore, this research could provide a starting point for introducing interdisciplinary care, both on-campus and in the community. Future research could build on these results by focusing on pain and anxiety from a qualitative or mixed-methods perspective to better understand the impact that potential covariates may have had on addressing students' healthcare needs better.

4.3 Conclusions

Our study results suggest that both moderate to severe LBP and NP are associated with moderate to extremely severe symptoms of anxiety in post-secondary students. The presence of LBP, NP, and moderate to extremely severe symptoms of anxiety was

notable among the samples of students enrolled at CMCC and Ontario Tech in the fall of 2017.

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Chapter 4. Conclusion

4.1 Thesis Summary

Our results suggest that in the Fall of 2017, most undergraduate students in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University and at CMCC experienced moderate to severe neck or low back pain. Furthermore, our analysis suggests that experiencing moderate to severe NP or LBP is associated with moderate to extremely severe symptoms of anxiety among Ontario Tech and CMCC students. The results of our analyses align with previous studies suggesting that NP and LBP are significantly associated with mental health in several populations,[1-11] including post-secondary students.[7, 12, 13]

4.2 Prevalence

Objective 1: What is the one-week prevalence of nonspecific low back pain in undergraduate university students enrolled in the Faculty of Health Sciences and the Faculty of Education at Ontario Tech University and at the Canadian Memorial Chiropractic College in the Fall term of 2017?

The one-week prevalence of any LBP was high across the three samples, with the highest prevalence among CMCC students at 69.0 (95% CI: 64.8, 73.0). The one-week prevalence of more intense pain scored ≥3/10 was higher among participants at Ontario Tech compared to CMCC.

Objective 2: What is the one-week prevalence of nonspecific neck pain in undergraduate university students enrolled in the Faculty of Health Sciences and the

Faculty of Education at Ontario Tech University, and at the Canadian Memorial Chiropractic College in the Fall term of 2017?

The one-week prevalence of any neck pain was high across the three samples. CMCC students presented with the highest one-week prevalence for any NP (76.8% [95% CI: 72.9, 80.4]), and for pain ≥3/10 in females (70.5% [95% CI: 65.1, 75.6]).

4.3 Association

Objective 3: Is low back pain intensity associated with moderate to extremely severe anxiety symptoms in university students enrolled in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University, and at the Canadian Memorial Chiropractic College in the Fall term of 2017?

Our analysis suggests a positive crude association between LBP ≥3/10 and symptoms of moderate to extremely severe anxiety, as demonstrated with a PR: 2.35 (95% CI: 1.79, 3.09). The strength of the association decreased when controlled for stress, poor sleep quality, and symptoms of depression with a PR: 1.88 (95% CI: 1.54, 2.87). The reduced strength of the association suggests that those with LBP ≥3/10 also experience stress, poor sleep quality, and symptoms of depression, indicating that these factors may confound the association of interest. Therefore, the adjusted PR suggest that those with LBP ≥3/10 have at least a 1.8 prevalence ratio of experiencing moderate to extremely severe symptoms of anxiety compared to those with LBP <3/10, and they may also experience poor sleep, depression, and stress. A similar pattern was evident among the CMCC sample, where the crude PR was 2.63 (95% CI: 1.79, 3.86), but controlling for stress, sleep quality, and depression reduced the adjusted PR to 1.97 (95% CI: 1.22, 3.18).

Objective 4: Is neck pain intensity associated with moderate to extremely severe anxiety symptoms in university students enrolled in the Faculty of Health Sciences and Faculty of Education at Ontario Tech University, and at the Canadian Memorial Chiropractic College in the Fall term of 2017?

Compared to Ontario Tech students without NP, the crude PR of having moderate to extremely severe anxiety symptoms among those with NP was 2.38 (95% CI: 1.82, 3.13), but the association weakened once stress, sleep quality, and depression was controlled for (adjusted PR: 1.81 [95% 1.30, 2.51]). Interestingly, for the CMCC sample, the variable of sedentary behaviour also met the inclusion criteria of covariate such that being added to the final model, sedentary behaviour proved to be a factor in the experience of NP, as determined through regression modelling. The crude association at CMCC was PR: 2.15 (95% CI: 1.44, 3.19), but once stress, sleep quality, depression, and sedentary behaviour were controlled for, this relationship diminished (adjusted PR: 1.21 [95% CI: 0.73, 2.01]).

Overall, these results align with previous studies on university students.[7, 14-17] These results are informative because previous longitudinal research indicates that the presence of anxiety in adolescence predicts future psychiatric disorders, including other anxiety disorders, substance/alcohol use, and depression.[18, 19] The results indicate that exposure to NP or LBP ≥3/10 is associated with moderate to extremely severe symptoms of anxiety and links with previous research highlighting that the mere presence of these symptoms could prove detrimental to young adults' future mental health.

4.4 Strengths

Overall, the strengths of this thesis surround the attempt to understand the presence of participation bias, assessing for potential measurement bias by using validated and reliable tools, and controlling for confounding factors with the appropriate modelling techniques.

4.4.1 Participation Bias

The potential for participation bias was minimized by using three recruitment waves to enroll students in the study. Furthermore, we assessed whether our samples differed from the source population by comparing age, gender, and program year. We found that there were small differences regarding the average age, gender, and program year; therefore, it is possible that participation bias may have affected the results.

4.4.2 Validated Tools

A strength of our study is the use of valid and reliable tools to measure pain severity, symptoms of anxiety, sleep, and food insecurity. The NRS was demonstrated to be valid and reliable, and one of the gaps in the literature was the lack of information surrounding participants' pain intensity. Using the NRS allowed us to not only focus on pain but integrate a nuanced approach regarding students' perceived experience of pain intensity. Furthermore, we can be confident that by using validated and reliable tools, we captured more accurate estimates for symptoms of anxiety, as well as sleep quality and the potential presence of food insecurity.

4.4.3 Measuring LBP and NP

The method used to measure the presence of LBP and NP may have reduced misclassification bias because we used a body diagram to anatomically define the neck and

low back regions. Moreover, LBP and NP were first assessed using a binary yes/no question, and "yes" responses became the numerator when measuring the prevalence of any pain in the preceding week. To measure pain severity and then determine the prevalence of pain >3/10, the 11-point numeric rating scale was used.[20] The NRS is valid and reliable in an adult population.[21, 22] A test-retest analysis demonstrated an interclass correlation coefficient (ICC) of 0.83 ($p < 0.001$) between two measures of the 0-10 NRS score recorded over a span of 7 to 14 days.[23] In comparison to the Ashworth Scale and Spasm Frequency Scale, a significant correlation was found between a change on the 0-10 NRS and the Spasm Frequency Scale ($r= 0.64$; $p < 0.001$).[23] Regarding neck pain, the NRS has demonstrated that pain intensity in the previous week was correlated with the recorded pain intensity ratings during the prior week ($0.79<$Pearson's $r<0.95$).[24] A cut-off of 3 was chosen due to literature indicating that pain from 3-5 corresponds to mild pain, 6-7 moderate, and >8 severe for pain-related interference, meaning a clinically significant pain level.[25]

4.4.4 Measuring Anxiety

Anxiety was measured with the DASS-21, and scores were categorized into normal (≤7/21), mild (8-9), moderate (10-14), severe (15-19), and extremely severe (≥20).[26] As explained below, these scores were then dichotomized into two categories: one for normal and mild scores and the second for moderate, severe, and extremely severe scores. The DASS-21 has been validated for use among post-secondary students in the United States and Korea, which are demographically similar to Canadian university students. The DASS-21 demonstrates construct validity and contains variance specific to each scale.[27] The DASS-21 has good psychometric properties and is a reliable tool to screen for depression

and anxiety symptoms.[28] Correlations between the DASS-21 and the PANAS (Positive Negative Affect Schedule) demonstrated that PA (positive affect) and anxiety had a correlation of -0.29 ($p < 0.001$); therefore, scoring high on the anxiety scale is associated with a decrease in positive affect.[27] The correlation between NA (negative affect) and anxiety was 0.58 ($p < 0.01$), demonstrating that scoring high on the anxiety subscale is associated with an increase in negative affect.[27] Furthermore, the reliability of the anxiety subscale was 0.82; this is deemed to be satisfactory due to the brief nature of the measure.[27] Additionally, depression, stress and anxiety were deemed to possess discriminant validity (r values < 0.85).[29]

4.4.5 Prevalence Ratio and Log-Binomial Regression

Another strength of this project is the data analysis process, specifically using a log-binomial regression. Using a log-binomial regression model and PR instead of OR reduced the possibility of overestimating the association between moderate-severe NP and LBP and moderate to extremely severe symptoms of anxiety.[30] Thereby enabling us to view the results with more confidence. Furthermore, adjusting the cut-off for covariate inclusion from the generally followed ±10% to ±5% based on literature ensured that the statistical analyses were robust.[31] The sample size indicated that following the 5% cut-off was more appropriate.[31]

Due to the common nature of anxiety symptoms, the decision was made to present the association as a prevalence ratio rather than an odds ratio. This decision was made because the odds ratio (OR) from logistic regression would likely overestimate the true measure of association if the prevalence of anxiety symptoms were greater than 10%.[32] A log-binomial regression was appropriate due to the common nature of the outcome variable

and the ability to calculate prevalence ratio (PR). The PR enables us to view the results as a prevalence ratio, therefore interpreting it as students exposed to NP or LBP ≥3/10 had an X prevalence of experiencing moderate to extremely severe symptoms of anxiety.[32] An OR can be interpreted similarly as a PR if the outcome is rare; therefore, using OR in this situation would overestimate the association.[32] Additionally, an initial scatterplot analysis indicated that the variables were not normally distributed, lending to the final decision to have a binary outcome (normal and mild anxiety versus moderate to extremely severe). The binary outcome and decision to calculate the prevalence ratio meant that a log-binomial regression was appropriate.[30] Literature has demonstrated that a log-binomial model was a better alternative for cross-sectional studies with binary outcomes than a logistic regression.[33]

In the log-binomial models, covariates were added individually, and their effect on the crude association determined whether they remained for the final model. Initially, it was commonly noted that a cut-off of ±10% is used, but literature indicated that a cut-off of ±5% would be more appropriate for our sample size.[31, 34] The change-in-estimate approach only controls for the variables that make a notable difference in the exposure-effect estimate.[35] A downside to the change-in-estimate approach is that by considering each variable one at a time and not whether a set of covariates suffice, the covariate generating bias can not be detected. This means that you could change the exposure coefficient with and without a covariate, not because it is a confounder, but due to chance variation.[36]

4.5 Limitations

The limitations of this study include the potential for selection bias (as discussed above in *Strengths*) and reduced ability to engage in decision-making regarding data collection methods. Conducting a secondary data analysis is associated with certain limitations because the data is already collected, and the specific measurement tools and recruitment choices cannot be modified. Expanding the data collection to additional faculties at Ontario Tech could have elicited participation from a more diverse set of students, addressing potential internal validity.

4.5.1 External Validity

The results of our study may not be generalizable to students enrolled at other faculties at Ontario Tech University, other chiropractic programs or, more broadly, to other university students because students enrolled in other programs may differ from students enrolled pour study. For example, students enrolled in dentistry or engineering programs may experience different levels of stress or expectations than students in our study, which could potentially impact their pain and anxiety levels.

Additionally, there might be low participation among students who identified as genders other than male or female. This could limit the prevalence estimate in those who identified as queer/gender fluid, trans-male-to-female, or trans-female-to-male. There is scarce literature to demonstrate prevalence estimates for diverse gender identities which presents a future research opportunity. These identities would be considered an individual's gender identity, which is how they identify psychologically and see themselves, rather than how society may see them.[37] Whereas sex is the biological category an individual is categorized into at birth based on their reproductive function.[37]

4.5.2 Internal Validity

While our assessment of participation bias suggested that the participants were generally similar to the target population, it is unclear if they are similar in other characteristics. It has been suggested that non-response in a cross-sectional study may be associated with male sex, younger age, lower socioeconomic status, and problematic alcohol and drug use.[38] We do not have access to such information from the target population. Moreover, students' real-world use of substances or economic status is often unavailable. This could lead to selection bias, as the participating students (Faculty of Health Science and Education) may be more likely to be female, older, have a higher socioeconomic status, and may not use substances.

Related to substance use, a low number of students reported using of a number of substances; cocaine ([FHSC[5.2%], FED[7.7%], CMCC[8.0%]), amphetamine (FHSC[9.2%], FED[9.7%], CMCC[15.5%]), inhalant (FHSC[0.9%], FED[2.9%], CMCC[0.4%]), sedative (FHSC[7.4%], FED[9.2%], CMCC[6.3%]), hallucinogen (FHSC[5.9%], FED[8.7%], CMCC[10.6%]), and opioid (FHSC[2.7%], FED[2.4%], CMCC[2.4%]). To maintain the efficiency of our statistical models, substance use was not considered for the final model, leaving the possibility for the unadjusted effect of these covariates on the association between pain and anxiety symptoms unclear. Some literature indicates a strong association between problematic substance use and any anxiety disorder.[39] This could impact the adjusted PR, as those with problematic substance use could make up a portion of those experiencing moderate to extremely severe symptoms of anxiety, and it may not be the exposure to LBP or NP ≥3/10 leading to the experience of anxiety symptoms.

4.6 Implications

This thesis describes the one-week prevalence of nonspecific neck and LBP and the association with moderate to extremely severe anxiety symptoms. The cross-sectional design provides a snapshot of students during the Fall 2017 semester. Furthermore, this project highlights how prevalent anxiety is among students. This provides an opportunity for future projects to assess what supports are available to students on campus and how these can be bolstered. Similarly, the results provide an opportunity for policy change, as there is literature to indicate that Canadian students' health insurance offers limited coverage for counselling and psychotherapy.[40]

Finally, the last implication of this thesis is the opportunity to begin understanding the mental health landscape of Ontario Tech and CMCC students. These results can inform both institutions of their students' physical and mental health landscape. As well as be used to implement better interventions on campus. The association between pain and anxiety further highlights issues presented in the literature, that mental and physical health concerns are common. Furthermore, literature highlights that only a small percentage of students receive mental health care,[41] and of those seeking care, Canadian students face barriers to accessing information regarding their student health insurance[40] to be able to seek the healthcare services they require. Experiencing mental health concerns and not receiving treatment could prove alarming. Among college students without a mental health diagnosis and experiencing current depression and/or anxiety symptoms, the adjusted odds ratio of them experiencing suicide ideation and plan or attempt was 11.6 (95% CI: 9.7, 13.8). For that same group, the adjusted odds ratio of experiencing suicide ideation, plan, and an attempt was 8.7 (95% CI: 5.5, 13.9).[42]

4.7 Future Research

Future research could further assess possible treatment routes and promote healthcare services to students to reduce attrition and any potential adverse effects on the student's academic performance. Specifically, from a clinical perspective, clinicians treating university students with nonspecific NP or LBP should be aware of the potential psychological symptoms the individual might be experiencing and be equipped to screen and refer those students for proper care. Early intervention is crucial, as literature indicates that a common mental disorder (like anxiety) in young adulthood can independently predict a common mental disorder at age 35.[43] This is important as there is little guidance for clinicians screening/treating an individual's anxiety symptoms[44] while the chief complaint was physical problems such as LBP and NP. This can become possible in future research and clinical practice.

In addition, while the regression models indicate a relationship between LBP and NP ≥3/10 and moderate to extremely severe symptoms of anxiety, the cross-sectional design cannot be used to determine if the relationship is causal, meaning that the results of this thesis cannot be used to infer whether LBP or NP directly causes symptoms of anxiety. However, the cross-sectional design offered an insight into prevalent cases that existed at the time of the study in Fall 2017 and indicates a significant association between LBP and NP and symptoms of anxiety. Such evidence suggests the importance of a cohort study to ascertain the finer details of this possible association. Particularly, a cohort study can be helpful to determine whether the exposure (moderate to severe NP or LBP) occurred before the outcome (moderate to extremely severe anxiety) and how the duration and severity of individuals' pain impact the development of symptoms of anxiety.

Finally, future research could also take a mixed-methods approach to better tease out information regarding the individual's pain and anxiety experiences. For example, engaging in surveys that include open-ended questions where students can further elaborate on their physical and mental health experiences. This could prove helpful as there is literature to indicate that chronic NP may not trigger anxiety and could instead be alexithymia, where individual struggles to conceptualize their fear, anger, or sadness, which could occur in those with a tendency to somatize.[45]

4.8 Conclusions

In conclusion, the prevalence of LBP and NP was high across the three samples of students, with CMCC presenting the highest prevalence, as well as females. Furthermore, our analysis suggests that experiencing moderate to severe NP or LBP is associated with reporting moderate to extremely severe symptoms of anxiety

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Appendices

APPENDIX A. STROBE Checklist

A1. STROBE Checklist – One-Week Prevalence of Moderate to Severe NP and LBP in Post-Secondary Students

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	18	Line 695
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	18	Line 698
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	19	
Objectives	3	State specific objectives, including any prespecified hypotheses	20	Line 749
Methods				
Study design	4	Present key elements of study design early in the paper	20	Line 756

Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	20	765-819
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	22	797
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	23	812
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	23	821
Bias	9	Describe any efforts to address potential sources of bias	24	845
Study size	10	Explain how the study size was arrived at	24	835

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	23	820
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	23	820
		(*b*) Describe any methods used to examine subgroups and interactions		
		(*c*) Explain how missing data were addressed		
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed		
		(b) Give reasons for non-participation at each stage		
		(c) Consider use of a flow diagram		
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	26	864
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		

		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures	26	864
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included		
		(*b*) Report category boundaries when continuous variables were categorized		
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		
Discussion				
Key results	18	Summarise key results with reference to study objectives	27	867-902
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	29	917
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	29	904
Generalisability	21	Discuss the generalisability (external validity) of the study results	29	921
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org

A2.STROBE Checklist – Association Between Moderate to Severe NP and LBP on Moderate to Extremely Severe Symptoms of Anxiety in Post-Secondary Students

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	34	Line 1049
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	34	1055-1073
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	35	1090
Objectives	3	State specific objectives, including any prespecified hypotheses	36	1102
Methods				
Study design	4	Present key elements of study design early in the paper	36	1118
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	36	1122
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	37	1118

		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	38	1154
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group		
Bias	9	Describe any efforts to address potential sources of bias	37	1125
Study size	10	Explain how the study size was arrived at		

Continued on next page

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	41	1222
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	41	1215
		(*b*) Describe any methods used to examine subgroups and interactions		
		(*c*) Explain how missing data were addressed		
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses		
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed		
		(b) Give reasons for non-participation at each stage		
		(c) Consider use of a flow diagram		
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders		
		(b) Indicate number of participants with missing data for each variable of interest		
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)		
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		

		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures	26	864
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	45	1312
		(*b*) Report category boundaries when continuous variables were categorized	38	1154
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		

Continued on next page

Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses		
Discussion				
Key results	18	Summarise key results with reference to study objectives	46	1321
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	47	1357
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	49	1401
Generalisability	21	Discuss the generalisability (external validity) of the study results	48	1360
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based		

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

APPENDIX B. UOIT Mental Health and Wellness Study

B1. UOIT Mental Health and Wellness Study

Thank you very much for your willingness to participate in this survey. Your answers to the questionnaire will remain confidential. Once completed and submitted, the researchers will not be able to trace your answers back to you. If you agree to participate please check the box which is located at the bottom of the informed consent form.

The purpose of this study is to assess the test feasibility of a conducting a large study to describe the burden and lifestyle factors associated with mental health and wellness in undergraduate university students.
This questionnaire inquires about mental health and wellness and factors that may be related to it. These factors include sleep quality, physical activity, food access, neck and back pain, substance use and
socio-demographic variables.

You must be 18 years or older to participate in this study.

We would like to remind you that if you are concerned about your well-being, or feel that, you may benefit from support and assistance, please contact Student Mental Health Services to set up an appointment. You can contact student services in one of three ways:

- email studentlifeline@uoit.ca
- call 905.721.3392
- drop by Student Life suite (U5 Building at North Campus or 2nd floor of 61 Charles St for the downtown campus) for a chat.

There are also community resources available 24/7, they are: Distress Centre Durham at 905-430-2522 and Durham Crisis Line at 905-666-0483
Thank you very much for considering participating in this important study which will help us better understand mental health and wellness in university students.

* Required

Informed Consent

Title of Research Study:
UOIT-CMCC Mental Health and Wellness study

Researcher(s):
Dr. Pierre Côté, Dr. Victoria Smye, Dr. Robert Weaver, Dr. Efrosini Papaconstantinou, Dr. Jennifer Laffier, Dr. Ellen Vogel, Dr. Tyler Frederick, and Dr. Cindy Malachowski, Kathy Smith, MHSc, Nayantara Hattangadi , Andrew Reynolds, Michael Short and Nancy Flynn

Faculty of Health Sciences,
University of Ontario Institute of Technology Contact number: (905) 721-8668 Ext 3674
Email: Kathy.smith@uoit.ca

You are invited to participate in a research study at the University of Ontario Institute of Technology in the Faculty of Health Sciences and Faculty of Education. This study (REB File # 17-xxxx) has been reviewed by the University of Ontario Institute of Technology Research Ethics Board and has been approved as of Month day 2017 Please read this form carefully, and feel free to ask any questions you might have. If you have any questions about your rights as a participant in this study, please contact the Ethics and Compliance Officer at 905 721 8668 ext 3693 or compliance@uoit.ca.

Before agreeing to participate in this study, it is important that you read and understand the following explanation of the proposed study procedures. The following information describes the purpose, procedures, benefits, and risks associated with this study. It also describes your right to refuse to participate or withdraw from the study at any time. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is known as the informed consent process.

Please read through this document carefully, and ask Kathy Smith or Dr. Pierre Côté to explain anything that you don't understand before consenting to this study. Make sure all your questions have been answered to your satisfaction before signing this document.

Purpose and Procedure:
The purpose of this study is to enhance our understanding of lifestyle factors that may be associated with mental health issues and help identify students who may be at risk of developing mental health problems. This information is necessary to mitigate the disabling effects of mental health problems.

The mental health and well being in university students is a public health concern in Canada. However, we know very little about the prevalence of depressive symptoms, anxiety and stress among undergraduate university students. Therefore, we need to investigate these issues to better prevent and manage mental health problems in university students.

We would appreciate if you could work with us in gaining knowledge about mental health and wellness in undergraduate students by consenting to participate in this study and completing an online questionnaire. You will complete this questionnaire once during the class time. The questionnaire will take approximately 15 minutes to complete, and all information provided is confidential.

Time commitment:
The questionnaire is a one-time, only, administration and will take approximately 15 minutes to complete. The one-time administration will be in-class first. However if you are not able to participate in class there will be two follow emails sent that will provide a

link to the questionnaire to enable you to complete the questionnaire.

Potential Benefits:
There are no direct benefits for participating in the study. However, participating will provide indirect benefits to the student community by reducing stigma and improving awareness of mental health and wellness.

Potential Risk or Discomforts:
There are no known risks associated with participating in the study. However, participants may experience psychological or emotional discomfort. We remind you that UOIT students who needs support or help should feel free to contact UOIT Student Mental Health services at the Student life suite.

We're here to support you! UOIT offers a range of services for students to support their positive mental health, strengthen their resilience, and help them manage the multiple demands of university life. If you are concerned about your well-being, or feel that, you may benefit from support and assistance, please contact Student Mental Health Services to set up an appointment. You can email (studentlifeline@uoit.ca), call 905.721.3392 or drop by Student Life suite (U5 Building at North Campus or 2nd floor of 61 Charles St for the downtown campus).

For more information, and to learn about the services offered please visit the Student Mental Health website: http://studentlife.uoit.ca/mentalhealth/index.php

Informed Consent (Continued)

Storage of Data:
All data and consent forms will be kept on a secure UOIT network, which the UOIT IT Department has assisted with. The IT department at UOIT will have access to the raw data and will remove and destroy all identifiers (Banner ID, UOIT.net login and date of birth). This data will be stored on a secure Google Drive account. Dr. Pierre Côté, Dr. Efrosini Papaconstantinou, Ms. Kathy Smith, Ms. Nayantara Hattangadi, Mr. Andrew Reynolds, Mr. Michael Short and Ms Nancy Flynn will have access to the de-identified amalgamated data but not to the raw data.

Confidentiality:
You will be using your UOIT.net account to login and answer the questionnaire. Once the data is collected, the UOIT net administration will take the data from the first administration of the questionnaire and assign a Study ID. The Study ID will bear no resemblance to any of your personal identifiers. The Study ID will maintain your anonymity. The UOIT net administration will then send a study data file without identifiers to Dr. Pierre Côté; the IT department will also destroy any original data files with identifiers once the study data file has been sent to Dr. Pierre Côté. Data files will be stored within UOITs Google Drive Suite for Education instance, which is hosted by Google.

Anonymity:
The raw data will be de-identified of any Banner ID or UOIT.net login information and replaced with a Study ID. The de-identified files will be sent to the research team to ensure your anonymity is maintained. Neither Dr. Côté, nor any of the researchers, will have information relating to personal identifiers so the release of these findings will be completely anonymous.

Right to Withdraw:
Your participation in this study is completely voluntary and will not affect your standing within this course. You are free to withdraw at any point in time. If you do not wish to take part in the study, you do not need to complete the consent form and may remain seated in the class. If you wish to withdraw after giving informed consent but before submitting the questionnaire, you may do so by leaving the webpage where the questionnaire is available. This data will not be recorded.

You can also withdraw at anytime before November 15, 2017 by contacting Neil Hopkins or Bevin Moolenschot from the UOIT IT Department by emailing Ask@uoit.net. They will delete your data and you information will be used in the analysis.

Compensation for Participation:
There will be no compensation to participants for involvement with this study.

Debriefing and Dissemination of Results:
The results of this study will be completed by December 2017. If you desire to receive information regarding the results of this study, please contact the researchers at (905) 721-8668 Ext 5922 or by email at kathy.smith@uoit.ca or pierre.cote@uoit.ca. You will also be invited to a debriefing session were the results of the study will be presented to participants.

Participant Concerns and Reporting:
This research project has been approved by the University of Ontario Institute of Technology Research Ethics Board (REB File # 17-xxxxx) as of Month day 2017.

If you have any questions concerning the research study, or experience any discomfort related to the study please contact the researcher(s) at (905) 721-8668 Ext 5922 or by email at kathy.smith@uoit.ca or pierre.cote@uoit.ca.

Any questions regarding your rights as a participant, complaints or adverse events may be addressed to Research Ethics Coordinator at researchethics@uoit.ca or (905) 721 8668 ext 3693.

1. **Informed Consent *** *Check all that apply.*

☐ I consent to voluntarily take part in the study with the understanding I may withdraw at any time. I have had an opportunity to ask questions and my questions have been answered. I am aware of all the risks and benefits associated with my participation and have read the entire consent form. I am free to ask questions about the study in the future.

2. Secondary Use of Data

The information collected for this study may be used for secondary research in the future. This could include secondary data analysis, future research studies etc.

Check all that apply.

☐ I agree to allow the data collected in the study to be used for future secondary research

Ready to begin

Thank you for participating in the University of Ontario Institute of Technology Student Mental Health and Wellness study. Your answers will remain completely confidential. Once completed and submitted, the researchers will not be able to trace your answers back to you. The questionnaire includes questions regarding lifestyle behaviours (sleep habits, physical activity, alcohol and drug use, food access, socio- demographic variables, neck and back pain) on mental health.

About yourself

3. How old are you? *

Mark only one oval.

- 18
- 19
- 20
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4. What gender do you identify with? *

Mark only one oval.

Female
Male
Transgender Male/Trans Man/Female-to-Male (FTM)
Transgender Female/Trans Woman/Male-to-Female (MTF)
Genderqueer, neither exclusively male nor female (or Gender Fluid, or Non-Binary Gender)
Choose not to disclose
Other:

5. What is your program of study? *

Mark only one oval.

Nursing
Kinesiology
Public Health
Human Health
Medical Laboratory Science
Allied Health Science
Health Science Comprehensive
Fitness and Health Promotion Bridge
Nursing (Registered Practical Nurse Bridge)
Other:

6. What is your year of study? *

Mark only one oval.

1st year
2nd year

3rd year
4th year
5+ year

7. Have you been diagnosed with any of the following medical conditions by a healthcare provider?
Please check all that may apply
Check all that apply.

Allergies (including hay fever or nasal allergy)
Arthritis, for example osteoarthritis, rheumatoid arthritis, gout or any other type, excluding
fibromyalgia
Asthma
Attention disorder or learning disability (e.g., attention deficit disorder, attention deficit
hyperactivity disorder, learning disability)
Bowel disorder such as Crohn's Disease, ulcerative colitis, Irritable Bowel Syndrome or bowel
incontinence
Chronic fatigue syndrome
Eating disorder (e.g., anorexia nervosa, bulimia nervosa)
High blood pressure
Intestinal or stomach ulcers
Migraine headaches
Mood disorder such as depression, bipolar disorder, mania or dysthymia
Scoliosis
Sexually transmitted infection(s)
Other:

About your physical activity in the past 7 days

Please answer the following questions based on what you do in a typical week. To increase accuracy, you may wish to think about your physical activity and sedentary behaviour for one week prior to answering the questions.

Aerobic Physical Activity

8. In a typical week, how many days do you do moderate-intensity (like brisk walking) to vigorous-intensity (like running) aerobic physical activity ? *
Mark only one oval.

1 day
2 days
3 days
4 days
5 days
6 days

7 days

9. On average for days that you do at least moderate-intensity aerobic physical activity (as specified above), how many minutes do you do?

Please answer the following questions based on what you do in a typical week. To increase accuracy, you may wish to think about your physical activity and sedentary behaviour for one week prior to answering the questions.

Muscle Strengthening Physical Activity

10. In a typical week, how many times do you do muscle strengthening activities (such as resistance training or very heavy gardening)?

Please answer the following questions based on what you do in a typical week. To increase accuracy, you may wish to think about your physical activity and sedentary behaviour for one week prior to answering the questions.
Perceived Aerobic Fitness

11. In general, would you say that your aerobic fitness (ability to walk/run distances) is: * *Mark only one oval.*

Excellent
Very Good
Good
Fair
Poor

Please answer the following questions based on what you do in a typical week. To increase accuracy, you may wish to think about your physical activity and sedentary behaviour for one week prior to answering the questions.

Sedentary Behaviour

12. On a typical day, how many hours do you spend in continuous sitting: at work, in meetings, volunteer commitments and commuting (i.e., by motorized transport)? * *Mark only one oval.*

None
less than 1 hour
1 to less than 2 hours
2 to less than 3 hours
3 to less than 4 hours
4 to less than 5 hours
5 to less than 6 hours
more than 6 hours

13. On a typical day, how many hours do you watch television, use a computer, read, and spend
sitting quietly during your leisure time? *
Mark only one oval.

None
less than 1 hour
1 to less than 2 hours
2 to less than 3 hours
3 to less than 4 hours
4 to less than 5 hours
5 to less than 6 hours
more than 6 hours

14. When sitting for prolonged periods (one hour or more), at what interval would you typically take a break to stand and move around for two minutes? *
Mark only one oval.

less than 10 minutes
10 to less than 20 minutes
20 to less than 30 minutes
30 to less than 45 minutes
45 to less than 1 hour
1 to less than 1.5 hours
1.5 to less than 2 hours
more than 2 hours

About your Mental Health

Please read each statement and place a check beside the option which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.
The rating scale is as follows:
- Never: Did not apply to me at all
- Sometime: Applied to me to some degree, or some of the time
- Often: Applied to me to a considerable degree, or a good part of time
- Almost Always: Applied to me very much, or most of the time

15. Your Mental Health *
Check the one best response (below) regarding your mental health in the past week.
Mark only one oval per row.

Never/Sometimes/Often/Almost Always

a) I found it hard to wind down
b) I was aware of dryness of my mouth
c) I couldn't seem to experience any positive feeling at all
d) I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)
e) I found it difficult to work up the initiative to do things

f) I tended to over-react to situations
g) I experienced trembling (e.g. in the hands)
h) I felt that I was using a lot of nervous energy
i) I was worried about situations in which I might panic and make a fool of myself
j) I felt that I had nothing to look forward to
k) I found myself getting agitated
l) I found it difficult to relax
m) I felt down-hearted and blue
n) I was intolerant of anything that kept me from getting on with what I was doing
o) I felt I was close to panic
p) I was unable to become enthusiastic about anything
q) I felt I wasn't worth much as a person
r) I felt that I was rather touchy
s) I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)
t) I felt scared without any good reason
u) I felt that life was meaningless

16. Please think about the last 30 days, taking both good and bad days into account. For each
question, please tell me how much of a problem it is for you on a scale from 1 to 5. 1 means
no problem and 5 means extreme problem. *
Mark only one oval per row.

1/2/3/4/5/Don't Know

a) How much of a problem do you have with feeling sad, low or depressed?
b) How much of a problem do you have with feeling worried, nervous or anxious?
c) How much of a problem is handling stress, such as controlling the important things in your life?
d) How much of a problem is coping with all the things you have to do?

About your Sleep

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

17. During the past month when have you USUALLY gone to bed at night? *
Please indicate the hour (Hrs) and minute (Mins) and ensure you have chosen AM or PM.
Example: 8:30 AM

18. During the past month, how long has it USUALLY taken you to fall asleep each night? *

Mark only one oval.

15 minutes or less
16 - 30 minutes
31 - 60 minutes
more than 60 minutes

19. During the past month, when have you USUALLY gotten up in the morning? *
Please indicate the hour (Hrs) and minute (Mins) and ensure you have chosen AM or PM.
Example: 8:30 AM

20. During the past month, how many HOURS of actual sleep did you get a night? (This may be different than the number of hours you spend in bed.) *
Please indicate the number of hours (Hrs) and minutes (Mins).
Mark only one oval.

more than 7 hours sleep/night
6 to 7 hours sleep/night
5 to 6 hours sleep/night
less than 5 hours sleep/night

21. During the past month, how often have you had trouble sleeping because you... *
For each of the remaining questions, check the one best response.
Mark only one oval per row.

Not during the past month/Less than once a week/Once or twice a week/Three or more times a week

a) Cannot get to sleep within 30 minutes
b) Wake up in the middle of the night or early morning
c) Have to get up to use the bathroom
d) Cannot breathe comfortably
e) Cough or snore loudly
f) Feel too cold
g) Feel too hot
h) Have bad dreams
i) Have pain
j) Other reason(s), please describe, including how often you have had trouble sleeping of this reason(s):

22. If you have checked Other reason(s) above, please describe:

23. During the past month... *
For each of the remaining questions, check the one best response.
Mark only one oval per row.

Not during the past month/Less than once a week/Once or twice a week/Three or more times a week

a) During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

b) During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
c) During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?

24. During the past month, how would you rate your sleep quality overall? *
Mark only one oval.

a) Very good
b) Fairly good
c) Fairly bad
d) Very bad
e)

f) About your access to Food

g)

These next questions (statements) are about the food eaten in your household in the last 12 months, since March of last year and whether you were able to afford the food you need. Select the appropriate option from the choices listed below each statement depending on the number of persons in the household.

25. "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." * Was that often, sometimes, or never true for (you/your household) in the last 12 months?
Mark only one oval.

a) Often true
b) Sometimes true
c) Never true
d) Don't know/refuse to answer
e)

26. "(I/we) couldn't afford to eat balanced meals." *

a) Was that often, sometimes, or never true for (you/your household) in the last 12 months?
b) Mark only one oval.
c) Often true
d) Sometimes true
e) Never true
f) Don't Know/refuse to answer
g)

27. In the last 12 months, since last March, did you and/or other persons in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? *

a) Mark only one oval.
b) Yes *Skip to question 28.*
c) No *Skip to question 29.*
d) Don't know *Skip to question 29.*
e)

28. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

a) Mark only one oval.
b) Yes, almost every month
c) Yes, some months but not every month
d) Yes, only 1 or 2 months
e) No

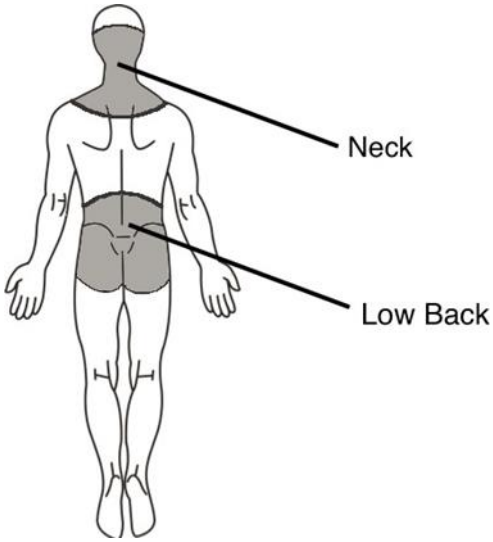
29. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? *

a) Mark only one oval.
b) Yes
c) No
d) Don't Know
e)

30. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

a) Mark only one oval.
b) Yes
c) No
d) Don't Know
e)

About your Neck and Back Pain



31. In the past 7 days, have you experienced any pain in your NECK? *
Mark only one oval.

a) Yes
b) No *After the last question in this section, skip to question 33.*
c)

32. If yes, please indicate the intensity of your average NECK pain over the past 7 days on a scale of 0 (no pain) to 10 (worst pain imaginable).
Mark only one oval.

a) 0 1 2 3 4 5 6 7 8 9 10
b)

About your Low Back Pain

33. In the past 7 days, have you experienced any pain in your LOW BACK? *
Mark only one oval.

Yes
No *After the last question in this section, skip to "About your Alcohol and Drug use."*

34. If yes, please indicate the intensity of your average LOW BACK pain over the past 7 days on a scale of 0 (no pain) to 10 (worst pain imaginable).
Mark only one oval.

0 1 2 3 4 5 6 7 8 9 10

About your Alcohol and Drug use

This is a brief survey about alcohol, tobacco products and other drugs. Some questions will be asked about your experience of using these substances across your lifetime and in the past three months. These substances can be smoked, swallowed, snorted, inhaled, injected or taken in the form of pills. Some of the substances listed may be prescribed by a doctor (like amphetamines, sedatives, pain medications). Please do not report MEDICATIONS AS PRESCRIBED by your doctor unless used outside the prescription (e.g. increased frequency or higher doses). While we are also interested in knowing about your use of various illicit drugs, please be assured that information on such use will be treated as strictly confidential.

Tobacco use
cigarettes, chewing tobacco, cigars, etc.

35. In your life, have you ever used tobacco products (cigarettes, chewing tobacco, cigars, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 41.*
Yes

Tobacco use
cigarettes, chewing tobacco, cigars, etc.

36. In the past 3 months, how often have you used tobacco products (cigarettes, chewing tobacco, cigars, etc.)? *
Mark only one oval.

Never *Skip to question 39.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Tobacco use
cigarettes, chewing tobacco, cigars, etc.

37. During the past three months, how often have you had a strong desire or urge to use tobacco products (cigarettes, chewing tobacco, cigars, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

38. During the past three months, how often has your use of tobacco products (cigarettes, chewing tobacco, cigars, etc.) led to health, social, legal or financial problems?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Tobacco use
cigarettes, chewing tobacco, cigars, etc.

39. Has a friend or relative or anyone else ever expressed concern about your use of tobacco products (cigarettes, chewing tobacco, cigars, etc.)?
Mark only one oval.

- No, Never
- Yes, in the past 3 months
- Yes, but not in the past 3 months

40. Have you ever tried and failed to control, cut down or stop using tobacco products (cigarettes, chewing tobacco, cigars, etc.)?
Mark only one oval.

- No, Never
- Yes, in the past 3 months
- Yes, but not in the past 3 months

Alcohol use
beer, wine, spirits, etc.

41. In your life, have you ever used alcoholic beverages (beer, wine, spirits, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

- No *Skip to question 48.*
- Yes

Alcohol use
beer, wine, spirits, etc.

42. In the past three months, how often have you used alcoholic beverages (beer, wine, spirits, etc.)? *
Mark only one oval.

- Never *Skip to question 46.*
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Alcohol use
beer, wine, spirits, etc.

43. During the past three months, how often have you had a strong desire or urge to use alcoholic beverages (beer, wine, spirits, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

44. During the past three months, how often has your use of alcoholic beverages (beer, wine, spirits, etc.) led to health, social, legal or financial problems?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

45. During the past three months, how often have you failed to do what was normally expected of you because of your use of alcoholic beverages (beer, wine, spirits, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Alcohol use
beer, wine, spirits, etc.

46. Has a friend or relative or anyone else ever expressed concern about your use of alcoholic beverages (beer, wine, spirits, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

47. Have you ever tried and failed to control, cut down or stop using alcoholic beverages (beer, wine, spirits, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Cannabis use
marijuana, pot, grass, hash, etc.

48. In your life, have you ever used Cannabis (marijuana, pot, grass, hash, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 55.*
Yes

Cannabis use
marijuana, pot, grass, hash, etc.

49. In the past three months, how often have you used Cannabis (marijuana, pot, grass, hash, etc.)? *
Mark only one oval.

Never *Skip to question 53.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Cannabis use
marijuana, pot, grass, hash, etc
.
50. During the past three months, how often have you had a strong desire or urge to use Cannabis (marijuana, pot, grass, hash, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly

Daily or Almost Daily

51. During the past three months, how often has your use of Cannabis (marijuana, pot, grass, hash, etc.) led to health, social, legal or financial problems?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

52. During the past three months, how often have you failed to do what was normally expected of you because of your use of Cannabis (marijuana, pot, grass, hash, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Cannabis use
marijuana, pot, grass, hash, etc.

53. Has a friend or relative or anyone else ever expressed concern about your use of Cannabis (marijuana, pot, grass, hash, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

54. Have you ever tried and failed to control, cut down or stop using Cannabis (marijuana, pot, grass, hash, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Cocaine use
coke, crack, etc.

55. In your life, have you ever used Cocaine (coke, crack, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 62.*
Yes

Cocaine use

coke, crack, etc.

56. In the past three months, how often have you used Cocaine (coke, crack, etc.)? *
Mark only one oval.

Never *Skip to question 60.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Cocaine use
coke, crack, etc.

57. During the past three months, how often have you had a strong desire or urge to use Cocaine (coke, crack, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

58. During the past three months, how often has your use of Cocaine (coke, crack, etc.) led to health, social, legal or financial problems?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

59. During the past three months, how often have you failed to do what was normally expected of you because of your use of Cocaine (coke, crack, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Cocaine use
coke, crack, etc.

60. Has a friend or relative or anyone else ever expressed concern about your use of Cocaine (coke, crack, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

61. Have you ever tried and failed to control, cut down or stop using Cocaine (coke, crack, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Amphetamine type stimulant use
speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.

62. In your life, have you ever used Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 69.*
Yes

Amphetamine type stimulant use
speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.

63. In the past three months, how often have you used Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)? *
Mark only one oval.

Never *Skip to question 67.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Amphetamine type stimulant use
speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.

64. During the past three months, how often have you had a strong desire or urge to use Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

65. During the past three months, how often has your use of Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.) led to health, social, legal or financial problems?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

66. During the past three months, how often have you failed to do what was normally expected of you because of your use of Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Amphetamine type stimulant use
speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.

67. Has a friend or relative or anyone else ever expressed concern about your use of Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)?
Mark only one oval.

- No, Never
- Yes, in the past 3 months
- Yes, but not in the past 3 months

68. Have you ever tried and failed to control, cut down or stop using Amphetamine type stimulants (speed, diet pills, ecstasy, Adderall, Dexedrine, bennies, uppers, amps, etc.)?
Mark only one oval.

- No, Never
- Yes, in the past 3 months
- Yes, but not in the past 3 months

Inhalant use
nitrous, glue, gas, paint thinner, etc.

69. In your life, have you ever used Inhalants (nitrous, glue, gas, paint thinner, etc.)? (NONMEDICAL USE ONLY) *
Mark only one oval.

- No *Skip to question 76.*
- Yes

Inhalant use
nitrous, glue, gas, paint thinner, etc.

70. In the past three months, how often have you used Inhalants (nitrous, glue, gas, paint thinner, etc.)? *
Mark only one oval.

- Never *Skip to question 74.*
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Inhalant use
nitrous, glue, gas, paint thinner, etc.

71. During the past three months, how often have you had a strong desire or urge to use Inhalants (nitrous, glue, gas, paint thinner, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

72. During the past three months, how often has your use of Inhalants (nitrous, glue, gas, paint thinner, etc.) led to health, social, legal or financial problems?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

73. During the past three months, how often have you failed to do what was normally expected of you because of your use of Inhalants (nitrous, glue, gas, paint thinner, etc.)?
Mark only one oval.

- Never
- Once or Twice
- Monthly
- Weekly
- Daily or Almost Daily

Inhalant use
nitrous, glue, gas, paint thinner, etc.

74. Has a friend or relative or anyone else ever expressed concern about your use of Inhalants (nitrous, glue, gas, paint thinner, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

75. Have you ever tried and failed to control, cut down or stop using Inhalants (nitrous, glue, gas, paint thinner, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Sedative or Sleeping Pill use
Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.

76. In your life, have you ever used Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 83.*
Yes

Sedative or Sleeping Pill use
Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.

77. In the past three months, how often have you used Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.)? *
Mark only one oval.

Never *Skip to question 81.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Sedative or Sleeping Pill use
Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.

78. During the past three months, how often have you had a strong desire or urge to use Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.)?

Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

79. During the past three months, how often has your use of Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.) led
to health, social, legal or financial problems?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

80. During the past three months, how often have you failed to do what was normally expected of you because of your use of Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax,
Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Sedative or Sleeping Pill use
Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.

81. Has a friend or relative or anyone else ever expressed concern about your use of Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

82. Have you ever tried and failed to control, cut down or stop using Sedatives or Sleeping Pills (Valium, Rohypnol, Ativan, Xanax, Clonazepam, downers, tranks, blue heaven, yellow jackets, etc.)?
Mark only one oval.

No, Never

Yes, in the past 3 months
Yes, but not in the past 3 months

Hallucinogen use

LSD, acid, mushrooms, PCP, Special K, etc.

83. In your life, have you ever used Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)?
(NON-MEDICAL USE ONLY) *
Mark only one oval.
No *Skip to question 90.*
Yes

Hallucinogen use
LSD, acid, mushrooms, PCP, Special K, etc.

84. In the past three months, how often have you used Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)? *
Mark only one oval.
Never *Skip to question 88.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Hallucinogen use
LSD, acid, mushrooms, PCP, Special K, etc.

85. During the past three months, how often have you had a strong desire or urge to use Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)?
Mark only one oval.
Never
Once or Twice
Monthly
Weekly

Daily or Almost Daily
86. During the past three months, how often has your use of Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.) led to health, social, legal or financial problems?
Mark only one oval.
Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

87. During the past three months, how often have you failed to do what was normally expected of you because of your use of Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Hallucinogen use
LSD, acid, mushrooms, PCP, Special K, etc.

88. Has a friend or relative or anyone else ever expressed concern about your use of Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

89. Have you ever tried and failed to control, cut down or stop using Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)?
Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Opioid use
heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.

90. In your life, have you ever used Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)? (NON-MEDICAL USE ONLY) *
Mark only one oval.

No *Skip to question 97.*
Yes

Opioid use
heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.

91. In the past three months, how often have you used Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)? *
Mark only one oval.

Never *Skip to question 95.*
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Opioid use
heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.

92. During the past three months, how often have you had a strong desire or urge to use Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

93. During the past three months, how often has your use of Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.) led to health, social, legal or financial problems?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly

Daily or Almost Daily
94. During the past three months, how often have you failed to do what was normally expected of you because of your use of Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)?
Mark only one oval.

Never
Once or Twice
Monthly
Weekly
Daily or Almost Daily

Opioid use
heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.

95. Has a friend or relative or anyone else ever expressed concern about your use of Opioids
(heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)?

Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

96. Have you ever tried and failed to control, cut down or stop using Opioids (heroin, morphine, methadone, codeine, Percocet, Fentanyl, Ts, cody, vike, etc.)? *

Mark only one oval.

No, Never
Yes, in the past 3 months
Yes, but not in the past 3 months

Injection

97. Have you ever used any drug by injection? (NON-MEDICAL USE ONLY) *

Mark only one oval.

No, never
Yes, in the past 3 months
Yes, but not in the past 3 months

Student Life and Experience

The following section will ask questions about how you feel about your universities policies and environment, and about your relationships with other people.

98. I find university's learning environment conducive. *

Conducive meaning: favourable, beneficial, advantageous, encouraging etc

Mark only one oval.

Never
Sometimes
Always

99. I find academic policies of my university student-friendly. *

Mark only one oval.

Never
Sometimes
Always

100. I have no close relationships that make me feel good. *

Mark only one oval.

Strongly Disagree
Disagree
Agree
Strongly Agree

101. There is no one I feel comfortable talking about my problems with. *

Mark only one oval.

Strongly Disagree
Disagree
Agree
Strongly Agree

Demographic information

General information

102. What is your marital status? *
Mark only one oval.

Single, never married
Married/Common law
Separated/Divorced
Widowed

103. Number of Dependents *
Dependent is a person who relies on another person for support (especially financial support)
Mark only one oval.

0 - None
1
2
3
4
5
6 or more

104. What was your academic average in your last year? *
If you are in 1st year, then report the average for your last year of high school. If you are in 2nd year, then report the average for your 1st year.
Mark only one oval.

below 60
between 60 to 65
between 66 to 69
between 70 to 75
between 76 to 79
between 80 to 85
between 86 to 89
between 90 to 95
between 95 to 100

105. What is your annual personal income?
Mark only one oval.

$0 - $4,999

$5,000 - $9,999
$10,000 - $19,999
Above $20,000

106. What is your households' annual combined personal income?
Mark only one oval.

$0 - $49,999
$50,000 - $59,999
$60,000 - $79,999
Above $80,000

107. How many hours a week do you work for pay? *
During the academic calendar year (i.e. September - April)
Mark only one oval.

0
1 - 9 hours
10 - 19 hours
20 - 29 hours
30 - 39 hours
more than 40 hours

108. What is your current household living arrangement? *
During the academic calendar year (i.e. September - April)
Check all that apply.

Living with relatives
Living with non-relatives (roommates/housemates)
Living in a student residence
Living alone
Living with a partner

109. On average how long is your commute time to the University? *
Mark only one oval.

Less than 15 minutes
15 to 29 minutes
30 to 44 minutes
45 minutes or more

110. Were you born in Canada? *
Mark only one oval.

Yes *Skip to question 111.*
No

111. Please check if you are registered at the University as: *
Mark only one oval.

An International student
A Domestic student

112. What were the ethnic or cultural origins of your ancestors? *
An ancestor is usually more distant than a grandparent.
Check all that apply.

- Aboriginal/First Nations/Métis
- Black
- Caucasian
- East Asian
- South Asian
- South East Asian
- Latin American
- Middle Eastern
- Don’t know
- Other:

113. What is your parents marital status? *
Mark only one oval.

- Single, never married
- Separated/Divorced
- Married/Common law
- Widowed

114. What is the employment status of your primary guardian? *Please check all that apply *
Check all that apply.

- Full-time employment
- Part-time employment
- Homemaker
- Temporary or seasonal work
- Retired
- Disability leave
- Unemployed
- Student
- Not applicable
- I Don't know

115. What is the employment status of your secondary guardian? *Please check all that apply *
Check all that apply.

- Full-time employment
- Part-time employment
- Homemaker
- Temporary or seasonal work
- Retired
- Disability leave
- Unemployed

Student
Not applicable
I Don't know

Appendix A. Covariate Selection

C1. Table 3: Covariate Selection - Change in Estimate for Crude Association – NP for Ontario Tech

Variable	Est	Lb	Ub	Change	n
Crude	2.38	1.82	3.13		882
Stress	1.76	1.28	2.41	-26.21	882
Sleep Quality	1.69	1.23	2.31	-4.03	882

C2. Table 4: Covariate Selection – Change in Estimate for Crude Association – LBP for Ontario Tech

Variable	Est	Lb	Ub	Change	n
Crude	2.35	1.79	3.09		882
Stress	1.81	1.32	2.48	-23.01	882
Sleep Quality	1.74	1.26	2.39	-4.04	882
Depression	1.75	1.26	2.42	0.67	882

C3. Table 5: Covariate Selection – Change in Estimate for Crude Association – NP for CMCC

Variable	Est	Lb	Ub	Change	n
Crude	2.15	1.44	3.19		510
Stress	1.34	0.83	2.15	-37.46	510
Sleep Quality	1.27	0.79	2.06	-4.88	510
Depression	1.25	0.76	2.06	-2.02	510
Sedentary Behaviour	1.21	0.73	2.01	-2.69	510

C4: Table 6: Covariate Selection – Change in Estimate for Crude Association – LBP for CMCC

Variable	Est	Lb	Ub	Change	n
Crude	2.63	1.79	3.86		510
Stress	2.15	1.37	3.40	-18.10	510
Sleep Quality	2.04	1.29	3.24	-5.21	510
Depression	1.97	1.22	3.18	-3.39	510