Relationships Between Sleep Quality, Sleep Hygiene, and Psychological Distress In
University Student-Athletes


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**Abstract**

Post-secondary student-athletes are one of the most vulnerable populations that experience poor sleep quality, which has detrimental effects on psychological distress due to the strong relationship between sleep quality and psychological distress. Research suggests that by improving sleep hygiene behaviours an individual can improve sleep quality, which will improve psychological distress. Few studies have examined sleep quality, sleep hygiene and psychological distress together among a post-secondary population and none have investigated a student-athlete population. The present study examined if sleep hygiene mediates the relationship between sleep quality and psychological distress among post-secondary student-athletes. A sample of 94 student-athletes completed the Kessler Psychological Distress Scale, Pittsburgh Sleep Quality Index, and Sleep Hygiene Practice Scale (Buyess et al., 1989; Kessler et al., 2002; Lin, Cheng, Yang, & Hsu, 2007). A mediation model was used to examine the relationships between the variables using the global scores. Bootstrapping was conducted to increase power of the model, which resulted in confidence interval levels that did not include zero indicating the indirect effect is significant and sleep hygiene mediates the relationship between sleep quality and psychological distress. This study can implicate future studies regarding sleep hygiene interventions changing the lifestyle habits and behaviours affecting their sleep hygiene, which is shown to impact sleep quality and psychological distress. In conclusion, Sleep hygiene mediated the relationship between sleep quality and psychological distress.

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**Chapter 1: Literature Review**

**1.1 Sleep Literature**

Insufficient sleep is a prominent issue amongst Canadians across the general adult population (Gilmour et al., 2013). Research has shown that sleep affects the health and overall lifestyle within this population (Gilmour et al., 2013). Insufficient sleep has damaging effects on an individual's mental health, physical health and well-being. Sleep quantity and quality are at the forefront of public health efforts due to the implications that they have. *Sleep quantity* is measured by average time spent in bed or the average time one sleeps (Pilcher, Ginter, & Sadowsky, 1997). *Sleep quality* on the other hand, is measured by how well an individual sleeps throughout the night, and how restored an individual feels upon waking (Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008).

Chaput, Wong, and Michaud (2017), sampled Canadian adults and asked them to report their sleep patterns with respect to both quality and quantity. On average, adults aged 18 to 79 reported a sleep quantity rate of 7.12 hours of sleep per night finding that only two-thirds of the adults sampled achieve the recommended seven to nine hours a night, while one-third reported less than seven hours of sleep a night. Only 3.3% of participants reported sleeping for an average of nine or more hours a night (Chaput et al., 2017). Research has shown that over the years, trajectory of sleep duration of the general population has been gradually decreasing (Gilmour et al., 2013). Both high-duration (i.e., high sleep quantity) and low-duration (i.e., low sleep quantity) sleepers have experienced a gradual descending trend since 1992 (Gilmour et al., 2013). In the aforementioned sleep study, Canadian women averaged higher sleep duration of 7.24 hours, as compared to Canadian men, who averaged 7 hours per night (Chaput et al., 2017). Of the general

Canadian adult population, 55% of women and 43% of men stated they had difficulty going to sleep and staying asleep, sometimes, most of the time, or all the time (Chaput et al., 2017). The National Sleep Foundation (2015) suggests that adults should sleep anywhere between 7-9 hours per night.

Sleep quantity is not a proper dictator of sleep quality; in fact, they are independent entities (Chaput et al., 2017). This can be seen through the general population that slept the recommended number of hours reporting better sleep quality, compared to those who reported sleeping less or more than the recommended number of hours (Chaput et al., 2017). This means that under or over sleeping will usually result in poorer sleep quality. Having greater sleep quantity does not guarantee greater sleep quality, as there are external circumstances that may disrupt sleep such as, financial situation, age group, sex/gender, frequency of sleep quality, and education (Chaput et al., 2017). Insufficient sleep quantity and lack of sleep quality is connected to a wide array of adverse health outcomes, making it a public health issue that needs to be addressed (Chaput et al., 2017).

Students attending post-secondary institutions experience many external variables that can influence their physical and mental well-being, as well as their sleep (Qin & Brown, 2017). Over the past five decades, sleep quantity has gradually decreased within the Canadian university student population. For university students in 1969, average sleep quantity was reported at 7.5 hours a night (Gilbert & Weaver, 2010). Twenty years later, the average rate had decreased to 6.5 hours a night. By 2001, this rate remained, university students still reporting sleep quantity rates of 6.5 hours a night (Gilbert & Weaver, 2010). In 2017, approximately one-third of the Canadian university population

reported sleeping *less than* 6.5 hours a night; an indication that sleep quantity still continues to drop within this specific population. In support of that, a mere 33.5% of students stated that they received adequate sleep (Brown et al., 2017). Furthermore, university students pursuing their undergraduate degrees may be at the greatest at risk for developing poor sleep habits, as they were significantly more likely to get less than 6.5 hours of sleep, compared to those in graduate level studies (Brown, Qin & Esmail, 2017).

University students are a vulnerable population affected by a multitude of factors and stressors impacting their sleep quantity (Qin & Brown, 2017). Post-secondary students living in residence have their own unique problems due to the residential environment in which they are situated. Sixty-six percent of students living in residence stated they did not have enough sleep due to external factors such as, room temperature and noise levels (Qin & Brown, 2017). Similarly, Qin and Brown (2017) found that across eight Canadian post-secondary institutions 75.6% of students did not get a sufficient amount of sleep.

Sleep quality of university students is also a prominent issue in this population. The number of university students reporting dissatisfaction with their sleep has increased drastically over the years. In 1978, 24% of university students were dissatisfied with their quality of sleep, this increased to 68% in 1992, and 71% in 2001 (Gilbert & Weaver, 2010). A study done by Vail-Smith, Felts, and Becker (2009) indicated that 6.3% of undergraduate students reported very good sleep quality, 76.6% indicated occasional sleep problems, and 11.8% reported poor sleep quality. Although several problems were reported, general morning tiredness and insomnia were amongst the most prevalent (Vail-Smith et al., 2009). Five percent of participants were treated for insomnia, while 37.1%

stated they had difficulties handling sleep problems. Moreover, 63.2% of participants indicated feeling tired three or more days of the week, and 21.7% reported that feeling tired during the day was a substantial issue (American College Health Association, 2016).

Sleep quality has noteworthy effects on university students' cognitive performances (Ahrberg, Dresler, Niedermaier, Steiger & Genzel, 2012). Low academic performance is related to high levels of stress and poor sleep quality, creating a cycle of poor sleep, inadequate academic performance and increased stress (Ahrberg et al., 2012). In 2016, the American College Health Association found that 28% of university students self-reported that their academic performance was suffering due to sleep difficulties.

Sleep quality can affect not only an individual's academic performance, it can also cause adverse health problems, both physical and mental. Pilcher, Ginter, and Sadowsky (1997) stated that average sleep quality was better correlated than average sleep quantity to holistic issues involving emotional, mental, and physical well- being, including depression, anger, feelings of tension, health, fatigue, affect balance, and satisfaction with life. Sleep quality has also been shown to be a more powerful predictor of sleepiness than sleep quantity (Pilcher et al., 1997). This suggests that no matter how long an individual sleeps, if their sleep is not of good quality, they will not feel rested or restored. While sleep quantity has not been shown to be significantly correlated with well-being or health, it is important to look at both sleep quality and quantity to fully understand this detrimental issue that is plaguing university students.

Narrowing the scope within university students, student-athletes can be brought into the light. Due to additional stressors above the average student, this specific population is at an even greater risk for experiencing sleep problems related to both

quality and quantity as a result of many unique stressors added to their plate in addition to their student role. Student-athletes have been acknowledged as poor sleepers with 42.4% experiencing poor sleep quality (Mah, Kexirian, Marcello & Dement, 2018). An astonishing 46% of athletes have sleep disorders (Monma et al., 2018). It has been reported that thirty nine percent of student-athletes receive less than 7 hours of sleep on weekdays and have high levels of daytime sleepiness (Mah et al., 2018). Moreover, 62.1% of student athletes specified that they are "often" or 'always" tired, zero percent indicated that they are "never" tired, and 50.6% of stated they "often" or "always" have difficulty waking up in the morning for class or practice (Mah et al., 2018). To build on these alarming statistics, 85.3% stated having difficulty concentrating and carrying out daily tasks due to tiredness, and 66.2% reported being too sleepy, finding it difficult to watch a video (Mah et al., 2018).

Mah et al. (2018) found that competition brought about a different set of factors affecting student athletes' sleep. Student-athletes experience lower sleep quality on campus than when traveling for competition and 62.3% indicated they had poor sleep prior to competition (Mah et al., 2018). Of those student athletes that experienced poor sleep quality before competition, 12.9% stated it impacted their game performance (Mah et al., 2018). Evidence has shown that student athletes' lack of sleep quality and quantity can lead to a decline in physical performance, but also cognitive function, and increased risk of injury (Monma et al., 2018). Other significant factors influencing student-athletes sleep problems include bedtime, wake up time, jobs, competition, number of morning practices, missing meals, number of meals, among many other lifestyle habits (Monma et al., 2018).

Above, it was stated that 30.5% of students reported sleeping less than 6.5 hours a night; 80.6% of these students did not seek help for their insufficient sleep habits (Brown et al., 2017). In addition, 78.5% of Canadian students indicated that they did not receive any information about sleep difficulties from their respective colleges or universities (Qin & Brown, 2017). This is a very alarming statistic because so many students are struggling from sleep problems, but they are either not seeking help, or do not have the information about how or where to seek help for them.

A study on sleep hygiene education with elite female student athletes was completed to determine if it could aid their sleep quality issues. The authors found that the educational sessions were effective for improving sleep quality for these athletes in an acute setting (O'Donnell & Driller, 2017). This has a lot of promise for future implications for research and interventions improving sleep quality among these vulnerable unique populations.

**1.2 Mental Health Literature**

Mental health has recently been at the forefront of prominent public health issues. The World Health Organization (2015) defined mental health as "a state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community." Smetanin et al. (2011) suggest that by the time Canadians reach 40 years old, one in two have had or are currently experiencing a mental illness. In addition, one in five Canadians experience a mental illness in any given year (Smetanin et al., 2011). In 2012, approximately 2.8 million Canadians above the age of 15 reported experiencing major depressive episodes, generalized anxiety disorder, or bipolar disorder (Pearson,

Janz, & Ali, 2013). Over the course of a lifetime it is estimated that 3.5 million Canadians will experience and meet the criteria for a mood disorder (Pearson, Janz, & Ali, 2013). Psychological distress among Canadians is another alarming issue, with approximately one in five people experiencing high levels of psychological distress (Caron, 2010). Females report significantly higher levels of psychological distress than males and are more likely to experience depressive episodes (Wade & Cairney, 1997). Females have also been shown to have elevated rates of generalized anxiety disorders, as well as mood disorders, as compared to males (Pearson et al., 2013).

However, if an individual is experiencing psychological distress, it does not mean that they cannot be mentally healthy or functioning (Keyes, 2002). This means that no one is immune to psychological distress. Essentially, you cannot either just experience psychological distress or have it not exist; people are able to exhibit good mental health, but still remain psychologically distressed (Adlaf, Gliksman, Demers, & Newton-Taylor, 2001). The presence of one does not dismiss the presence of the other. Keyes (2002) dual model principle suggests that even though students experience psychological distress, it might not impact their global perceived psychological well-being and ability to function on a daily basis. Durand-Bush, McNeill, Harding and Dobransky (2015) mention that high levels of mental health functioning does not necessarily assure the absence of mental health issues.

While people at any age experience mental health issues, younger people between the ages of 15-25 are more likely to experience mental illness than any other age group (Government of Canada, 2006: Pearson et al., 2013). The Government of Canada (2006) reported that 70% of mental health problems have their onset during childhood or the

adolescent stage of life. This age group, considered the most vulnerable population for mental illness in Canada, are also the most prone to feelings of stress, which ultimately affects mental health (Government of Canada, 2006). The main causes of stress listed from most stressful to least are school, time pressure, work situation, finances, and personal relationships (Government of Canada, 2006).

There are multiple categories of risk factors that can potentially influence the development and fostering of mental health problems. They consist of individual factors, family or social factors, school context, life events, as well as community and cultural factors (Government of Canada, 2006: World Health Organization & Calouste Gulbenkian Foundation, 2014). Individual factors consist of low intelligence, attachment issues, poor social skills, and low self-esteem (Government of Canada 2006). Family or social factors include having a single parent, neglect, having a large family size, family violence, and rejection. School contextual factors influencing mental health and psychological distress are bullying, peer rejection, failure in school, and poor behaviour management (Government of Canada, 2006). Life event risk factors include transitions between schools, death, poverty, and physical/emotional/ sexual abuse. Finally, community and cultural factors consist of isolation, neighbourhood crime and violence, lack of community support, and social or cultural discrimination (Government of Canada, 2006). These statistics and risk factors are very alarming and need to be addressed immediately.

Post-secondary students are a significant portion of the Canadian population that experiences high prevalence of mental health issues because, on average, post-secondary students fall within the 15-25 year old age category. The American College Health

Association (2016) completed a survey among post-secondary students within Canada with alarming findings due to how high the statistics are. A total of 64.8% felt hopeless, 91.1% felt exhausted (not from physical activity), 48.1% felt so depressed that it was difficult to function, 70.7% felt overwhelming anxiety, and 13.8% seriously considered suicide within the last 12 months (American College Health Association, 2016). Approximately three students attempt to commit suicide daily due to depression, providing evidence that it is a critical disorder along with issues of anxiety that need to be discussed and researched more closely (National Collegiate Athletic Association, 2007).

Stallman (2010) suggests that 83.9% of Australian post-secondary students have extremely high levels of psychological distress, as opposed to the general population, at levels of 29%. Within Canada, there are very similar statistics showing elevated levels of psychological distress among students as compared to the general population (Adlaf, Gliksman et al., 2001). Thirty percent of students reported elevated psychological distress with variants such as sex, year of study, recreational and academic orientations, hours spent on academics, region, and living arrangements (Adlaf et al., 2001). Factors and feelings affecting the psychological distress of students include lost sleep over worry, feelings of unhappiness or depression, and being constantly under strain (Adlaf et al., 2001).

Precautionary measures should be taken with regards to the high levels of psychological distress within post-secondary students. This is because psychological distress is a precursor to mental illness and depressive disorders have been ranked top four conditions to be affecting individuals on a global scale (Adlaf et al., 2001). This not only affects individuals, but also society as individuals that experience depressive

disorders will face issues that affect all facets of their life. Students also reported high levels of stress in areas such as making decisions about their education, getting ripped off and spending too much money, social conflicts, social isolation, being dissatisfied with their physical appearance, and having financial burdens (Wilson & Pritchard, 2005).

The American College Health Association (2016) investigated what students specifically felt was overwhelming to them, and what aspects of their lives were very difficult to handle. Approximately, 63% of students found it very difficult to handle academics and 39.5% of students found difficulty with sleep. As stated above, there is a bidirectional relationship between sleep and mental health, suggesting that if one lacks then the other will often decrease as well. A more vulnerable sub-population of the post-secondary students who are prone to elevated levels of psychological distress and lower levels of mental health functionality are university student-athletes. They are a unique population that is very vulnerable because they are a part of this age cohort, but they also endure the issues of post-secondary students, all while having the stressors of being a student-athlete. In addition to handling similar emotional, academic, and personal stressors that non student-athletes, they have to balance athletics (Van Slingerland, et al., 2018). They deal with athletic concerns such as injuries, time commitments to practices, games, and other team functions, performance levels, work outs, dieting, team roles, starting versus non-starting positions, potential sports scholarships, and pressures to conform to the typical athletic image (Etzel, Watson, Visek, Maniar, 2006: Van Slingerland et al., 2018: Wilson & Pritchard, 2005). Kimball and Freysinger (2003) discuss how stress as a student-athlete can be experienced both negatively and positively and how it can change across situations at different time points. These stressors allow

student-athletes to learn to deal and cope with stress better than their non-athlete counterparts, but it does not take away the copious stressors they experience with being a student-athlete (Kimball & Freysinger, 2003).

The numerous stressors that student athletes need to balance most likely contribute to the 21-37% of student-athletes who reported experiencing depression (Yang et al., 2007: Sheehan, Herring, & Campbell, 2018). Female athletes were 1.32 times more likely to experience depressive symptoms as compared to their male counterparts (Yang et al., 2007). Freshman had increased odds over any other year, with 3.27 times greater odds of experiencing depressive symptoms (Yang et al., 2007). All student athletes that reported having depressive symptoms were also associated with higher scores of anxiety (Yang et al., 2007). Thirty two percent of student athletes were considered poor sleepers and 8% had high anxiety (Sheehan, Herring, & Campbell, 2018). In addition, Sullivan, Cairney, and Lacker (2017) examined psychological distress among the Canadian student athlete population and found it to be significantly higher than non-athletes and a sample from the general population.

Symptoms of depression and anxiety take a toll on individuals' lives in many ways, especially the lives of student-athletes. Student-athletes can exhibit poorer performance for various reasons, including lack of eating, sleep quality, always feeling exhausted, and increased levels of stress, all of which would impact performance on many domains, especially physiologically (National Collegiate Athletic Association, 2007). The cognitive and emotional functioning of student-athletes also becomes affected through symptoms such as poor concentration, slower reaction time, cognitive impairment due to lack of sleep, low mood, a decline in motivation, and ultimately

overall negative thinking all affecting performance due to inadequate management of anxiety and depression (National Collegiate Athletic Association, 2007). According to Sullivan et al. (2017), student-athletes who are female, non-starters, and do not have a sports scholarship, may be most vulnerable to high levels of psychological distress.

Blanco et al. (2008) found that less than 25% of post-secondary students pursued treatment for a mental disorder within the year prior to the study. Treatments did vary depending on the disorder, but still this rate shows how crucial it is to provide this population with coping tools, outlets, and interventions. Students were also less likely to seek out help as levels of psychological distress increased over time (Ryan, Shochet, & Stallman, 2010). Some perceived barriers that young people exhibit when seeking help are knowledge about mental health services, lack of accessibility, not wanting to burden someone else, public, perceived and self-stigmatizing attitudes towards mental illnesses, lack of confidentiality, preference of other sources of aid, recognition of being in need of help, and difficulty identifying symptoms of mental illness (Gulliver, Griffiths, & Christensen, 2010). In relation to student-athletes, the National Collegiate Athletic Association (2007) mentioned awareness of mental illness among people that are continuously around student-athletes such as coaches. Coaches, among other people, assume that student-athletes are usually healthy because they are constantly engaging in physical activity (National Collegiate Athletic Association, 2007). However, there is a need to realize that student-athletes have the same, if not more, potential for mental illness (National Collegiate Athletic Association, 2007). If barriers are broken down, and athletes and the individuals surrounding them are informed the rates of help seeking may increase.

**1.3 Sleep Hygiene Literature**

Sleep hygiene is defined by Yang et al. (2010) as life style habits, behavioural practices, and environmental factors that affect sleep quality. Sleep hygiene is related to measures of sleep such as sleep quality and quantity (Peach, Gaultney, & Gray, 2016). Sleep hygiene is a separate construct from sleep in the sense that it occurs prior to the onset of sleep, but it promotes good sleep (Peach et al., 2016). Sleep hygiene comprises four main domains. The first domain is Arousal-related Behaviours, which includes behaviours such as falling asleep with TV or music on, checking the time in the middle of the night, doing sleep-irrelevant activities in bed, and pondering about unresolved matters while lying in bed. The second domain is Sleep Scheduling and Timing that comprises not having a consistent bedtime, sleeping in on weekends, napping in bed for over one hour during the day, and staying in bed after waking up in the morning (Yang et al., 2010). The penultimate domain is Eating/Drinking Behaviours that incorporates going to bed hungry, drinking caffeinated drinks within four hours prior to bedtime, drinking alcohol or consuming stimulating substances within two hours prior to bedtime, and eating too much food during the hour prior to sleep (Yang et al., 2010). The fourth domain is Sleep Environment, which consists of uncomfortable bedding and/or pillows, sleep is interrupted by bed partner, sleep environment is either too noisy or quiet, and sleep environment is either too bright or too dark (Yang et al., 2010). Each of these domains that comprise sleep hygiene can ultimately affect overall sleep quality (Lastella et al., 2015; Mah et al., 2018; O'Donnell & Driller, 2017; Yang et al., 2010).

Sleep hygiene's popularity has just begun to pick up with more research beginning to revolve around it. General population sleep hygiene information in Canada

has yet to be researched. A University in Hong Kong investigated the association of sleep hygiene relating to sleep quality in University students. Suen, Tam, & Hon (2010), found that sleep hygiene practice was significantly associated with sleep quality among university students in Hong Kong. They place an emphasis on the need to increase awareness and stress the importance of sleep hygiene practices.

Across many different countries and a multitude of sample populations including athletes sleep hygiene has been shown to correlate with sleep quality (Erkan, 2014; Juliff et al., 2015; Lastella et al., 2015; O'Donnell & Driller, 2017; Yang et al., 2010). Sleep hygiene education has been implicated to be beneficial for athletes because changing their sleep hygiene increases sleep quality and quantity, which in turn allows student athletes to recover both physiologically and psychologically (O'Donnell & Driller, 2017). Mah et al. (2018) found that maximizing good sleep hygiene practices is strongly recommended to manage poor sleep quality among collegiate student-athlete populations. Lifestyle habits such as arousal-related behaviours, environmental factors, and sleep scheduling and timing could prevent sleep issues among student-athlete populations (Monma et al., 2018). Lastella et al. (2015), suggested placing an increased emphasis on sleep hygiene education and practices because this education can provide athletes with strategies to maximize their levels of sleep quality. Some specific strategies suggested were aiding athletes to set up their sleep environment and others were more eating/drinking behaviour related such as consumption of high-glycemic-index carbohydrate meals prior to bed because they promote sleepiness and lower sleep latency levels (Lastella et al., 2015). Juliff, Halson, and Peiffer (2015) discovered that both team and individual sport athletes can benefit from sleep hygiene education and that closer to

competition athletes should be aware and reminded of strategies involving sleep hygiene to aid in performance.  Lastly, research has shown that coaches and athletic support staff have adequate knowledge of overall sleep hygiene, but there seems to be a disconnect when it comes to transferring the knowledge and strategies to athletes (Miles et al., 2019). This is why there is an essential need to develop, implement, and promote sleep hygiene education and sleep hygiene resources to all athletes, as well as athletic staff. This could aid in identifying barriers and improving sleep hygiene knowledge (Miles et al., 2019)

Each of the domains that comprise sleep hygiene can ultimately affect overall sleep quality (Juliff et al., 2015; Lastella et al., 2015; Mah et al., 2018; O'Donnell & Driller, 2017; Yang et al., 2010), but sleep hygiene is also able to affect mental health as well (Barber, Repprecht, & Munz, 2014; Peach et al, 2016).  There is very little research investigating the relationships between sleep hygiene and mental health. Barber et al. (2014) conducted a study that looked at exploring if sleep hygiene was a behavioural factor that could influence psychological and social well-being. This was study was the first of its kind to examine if sleep hygiene could be a potential factor to target in order to aid people with better sleep since sleep hygiene is correlated with sleep quality, as well as sleep quality correlating to mental health as discussed previously. The study showed that poor sleep behaviours or sleep hygiene were associated with lower psychological and social flourishing (Barber et al., 2014). This study suggests that due to sleep hygiene's entirety consisting of behaviours that are modifiable rather than outcomes it should be a key driver for researchers to develop and implement sleep hygiene interventions that will ultimately improve well-being (Barber et al., 2014). Peach et al. (2016) was the second

study to investigate both if sleep quality can predict depression and subjective well-being, as well as if sleep hygiene indirectly predicts depression and well-being through sleep quality. The study had a sample of college students from the United States. The study determined that good sleep hygiene and positive/negative emotions had both direct and indirect pathways (Peach et al., 2016). It is suggested by this study that sleep hygiene practice could potentially serve as a protective factor in college students with regards to depression and promote increased levels of subjective well-being (Peach et al., 2016).

**1.4 Sleep and Mental Health Literature**

Psychological distress and sleep has been implicated to have a bi-directional relationship with one another that can, in turn, become a vicious cycle (Alvaro, Roberts, & Harris, 2013: Monma et al., 2018: Litwic-Kaminska & Kotysko, 2017: Sheehan, Herring, & Campbell, 2018). When one's sleep quality decreases, mental health also declines, and contrariwise. From the above literature on sleep and mental health, it can be seen that post-secondary student-athletes are particularly vulnerable and in need of research to aid in their on-going struggle. Below are three studies that involve both sleep and mental health within post-secondary student-athlete populations. Each study was done in different contexts throughout the world, but none have used a Canadian sample and this location is in crucial need of research. These studies all had one significant conclusion, which was that post-secondary student-athletes have poor sleep quality and poor mental health status. This supports the need to analyze and aid this population to better succeed and reach their potential.

Monma et al. (2018) investigated sleep disorders and risk factors among students. The study further examines to clarify psychological distress, competition activities and life style habits that become potential variables relating to sleep disorder risk factors among student athletes. The sample used within this study was 906 university student athletes in Japan. There were multiple survey items that were used throughout the study. The authors measured height, weight, age, gender, and Body Mass Index. The next survey item that was measured was sleep disorders, where researchers used the Pittsburgh Sleep Quality Index to measure sleep quality among the participants. Lifestyle habits was the third survey item, which included information from the participants on lifestyle habits such as meals, occupations, use of electronics after lights-out, smoking, drinking, and their bed time and wake up time etc. The penultimate survey item examined competition activities, using a scale involving five factors. The five factors include; motivation loss, expectations and pressure from others, competition results, evaluation of one's personal surroundings, and interpersonal relationships. These five factors were measured using a Likert Scale. Finally, the last survey item investigated was psychological distress, where they used the six-item Kessler Psychological Distress Scale (K6).

Analysis used within this study was a univariate and multivariate logistic regression analysis that used sleep disorders as the outcome variable and the rest of the survey items as explanatory variables. The study's results of the univariate analysis showed that the following survey items were related to sleep disorders: psychological distress, several lifestyle habits and competition activities. The multivariate analysis that controlled for mutual influences within the explanatory variables showed that the risk factors independently related to sleep disorders are morning practices, motivation loss,

part-time jobs, psychological distress, wake-up/bed times, and use of phone after lights out. In conclusion, this study can be used to urge the prevention of sleep disorders among student athletes in order to be the most effective in improving numerous lifestyle habits, and psychological distress.

Litwic-Kaminska and Kotysko (2017) investigated the comparison between good and poor sleepers and their stress and life satisfaction among university student athlete populations. The objective of the study was to compare differences in types of stress appraisal, life satisfaction, and levels of perceived stress in university student athletes that claim to have sleep problems (poor sleepers) and also in those who do not have sleep problems (good sleepers). The study investigated 177 Polish university student athletes that played a wide array of sports. The study examined sleep quality, types of stress appraisal, well-being, and perceived stress. Sleep quality was measured in the study with the use of the Pittsburgh Sleep Quality Index to measure the sleep quality among the participants (Buyess et al., 1989). Types of stress appraisal were measured using version B of The Stress Appraisal Questionnaire, which examines the four types of dispositional stress appraisal (Włodarczyk and Wrześniewski, 2010). Participants' well-being was measured using the Satisfaction With Life Scale, quantifying the participants cognitive components of well-being (Diener, Emmons, Larsen, and Griffin, 1985). Finally, perceived stress was measured using the Perceived Stress Scale, which requires the participant to assess their intensity of perceived stress over the past thirty days (Cohen, Kamarck, and Mermelstein, 1983).

The study's preliminary analysis compared good and poor sleepers using the Chi-Square test and the Mann-Whitney U test to test for group differences. The Chi-Square

test was used for gender and type of sport, where the Mann-Whitney U test was used for weekly frequency of trainings and practice time. In the preliminarily analysis there were no differences present. The main analysis within the study used the Mann-Whitney U test to compare good and poor sleepers in relation to psychological variables. The results showed that student athletes who experience poor sleep quality perceive more daily stress, have declined lower life satisfaction, and more often than seldom appraise stressful situations as a threat. This is in comparison to their student athlete colleagues with good sleep quality. In conclusion, the study deemed that sleep quality differences could account for the findings because of the bidirectional relationship between stress, life satisfaction, and sleep quality. High stress, low life satisfaction and poor sleep quality are all interrelated, as when an individual is experiencing one of these variables, it is more likely that they will also experience the other two.

Sheehan, Herring, and Campbell (2018) studied the longitudinal relations of mental health and motivation among student athletes across a condensed season, considering influences of academic and athlete schedules. The primary aim of the study was to measure mental health, motivation and sleep and their relationships while taking into consideration academic and athletic schedules, among student athletes over a thirteen-week season. The study administered questionnaires to measure mental health, depressive symptoms, sleep quality, anxiety symptoms, and motivation. Total mood disturbance was measured using the Profile of Mood States to determine how the participant was feeling in relation to their mood states at that given moment (McNair, Lorr, & Droppleman, 1971). The. Depressive symptoms were assessed using the 16-item Quick Inventory of Depressive Symptomology to determine nine core dimensions of

depression (Rush et al., 2003). Sleep quality was measured using the Pittsburgh Sleep Quality index to examine the participant's overall sleep quality (Buyess et al., 1989). Anxiety symptoms were measured using the State-Trait Anxiety Inventory to classify if they are high trait anxious. Finally, motivation was measured using an 18-item Sport Motivation Scale II (Spielberger, Gorsuch, & Lushene, 1983). This scale provides information on the participant's intrinsic motivation, amotivation, and extrinsic motivation.

The data was analyzed using descriptive statistics, Pearson's correlation coefficients, and prevalence. The results of the study showed that 32% of the sample had poor sleep quality, 8% had high trait anxiety, and lastly 37% of the student athletes reported mild to moderate depression. In addition, the majority of athletes were intrinsically motivated and had high satisfaction of the basic psychological needs. In the study, across the season there were significant improvements in sleep quality, total mood disturbance and depressive symptoms, but no improvements in anxiety symptoms. In conclusion, the study suggests to monitor students psychologically during season, also that mental health and psychological distress can influence performance and well-being.

## Chapter 2: Rationale, Research Question and Hypothesis

### 2.1 Summary of Literature Review

Sleep quality has been shown to have significant implications on an individual's physical, emotional, and mental health (Chaput et al., 2017: Gilmour et al., 2013). Post-secondary students have been experiencing a dramatic increase in their dissatisfaction with their sleep quality over the past few decades affecting their health and academic performance (American College Health Association, 2016; Gilbert & Weaver, 2010; Vail-Smith, Felts & Becker, 2009). Within this post-secondary population are student-athletes, who become more subject to additional issues related to sleep quality because of their dual role involving academics and athletics (Mah et al., 2018: Monma et al., 2018). Specific aspects of sleep hygiene have been shown to correlate with mental health and psychological distress issues (Zhang et al., 2018). O'Donnell and Driller (2017) suggest that aiding one's sleep hygiene has the potential to dramatically increase their sleep quantity and quality. As a result it allows student-athletes to recover both psychologically and physiologically. Therefore, sleep hygiene education has been recognized as beneficial for student-athletes (O'Donnell & Driller, 2017).

Mental health has been shown to affect approximately half of the Canadian population above 15 years of age with the most vulnerable population being age 15-25. (Pearson, Janz & Ali, 2013: Caron, 2010: Smetanin et al., 2011). Post-secondary students are a major portion of the Canadian population that will exhibit higher prevalence of mental health and psychological distress issues (American College Health Association, 2016: Government of Canada, 2006: Pearson, Janz & Ali, 2013). Student-athletes within this age cohort are more vulnerable due to the multitude of stressors placed on them from

being a student-athlete specific to the balancing of athletics and academics (Van Slingerland et al., 2018).

## 2.2 Rationale

Alvaro, Roberts and Harris (2013) compiled a systematic review showing multiple studies implicating both bidirectional and unidirectional relationships between sleep and mental health. A greater understanding of this relationship is needed within the post-secondary student-athlete population. It has been shown that student-athletes are the most vulnerable age cohort, as well as having to deal with substantially more stressors opposed to their non-athlete counterparts (Etzel, Watson, Visek, & Maniar, 2006: Pearson, Janz, & Ali, 2013: Van Slingerland et al., 2018: Wilson & Pritchard, 2005). There have been very few studies that have examined this relationship within student-athletes. These studies are characterized by different analyses, different contexts, and different outcome variables. No research has been done investigating these relationships in Canada within the post-secondary student-athlete populations.  By investigating this crucial issue it can provide vital information that can inform potential future interventions and aid to student-athletes.

## 2.3 Research Question

This study had a primary purpose to examine if sleep hygiene mediates the relationship between sleep quality and psychological distress in university student-athletes. This was explored using a mediated model involving sleep, sleep hygiene, and psychological distress to determine if there is a direct effect or indirect effect on mental health. Below is Figure 1; it is the mediated model being used in this exploratory study.

*Figure 1.* Mediated Model
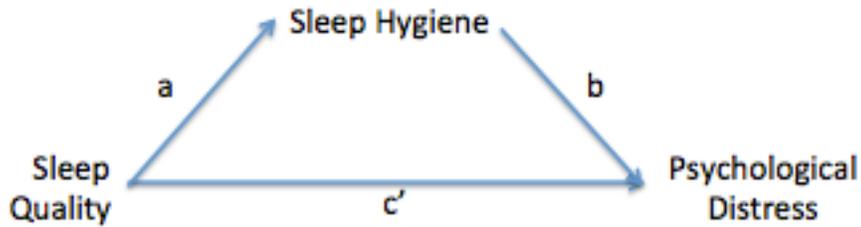


## 2.4 Hypotheses

After examining previous literature and research the following hypotheses were brought

forth:

1. There will be a direct effect between the relationship of sleep quality and

psychological distress.



*Rationale:* A direct effect will occur due to the fact that there has been many

studies showing the relationships between sleep and mental health examining how

reliant they are on each other (Alvaro, Roberts, & Harris, 2013: Monma et al.,

2018: Litwic-Kaminska & Kotysko, 2017: Sheehan, Herring, & Campbell, 2018).

When one's sleep quality and quantity decreases their mental health also declines

and contrariwise. Low life satisfaction, increased stress, and poor sleep quality

among student-athletes are all interrelated and shows that an increase in one of

these will more likely result in an increase in the other two out of the three, which

could be low life satisfaction, stress and poor sleep quality (Litwic-Kaminska &

Kotysko, 2017). Also sleep disorders among student-athletes are independently related to psychological distress and lifestyle habits (Monma et al., 2018).

2. There will be a direct effect between the relationship of sleep quality and sleep hygiene (i.e., the a pathway).
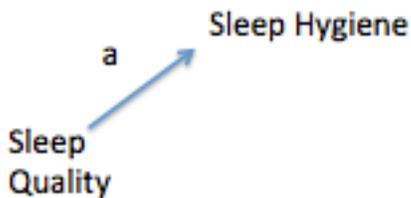


*Rationale:* Suen et al. (2010), discovered that sleep hygiene practice was significantly associated with sleep quality among university students. More specifically within athlete populations sleep hygiene has been shown to correlate with sleep quality (Erkan, 2014; Juliff et al., 2015; O'Donnell & Driller, 2017; Lastella et al., 2015; Yang et al., 2010). Sleep hygiene education has been shown to be beneficial for athletes because aiding their sleep hygiene increases sleep quality and quantity, which in turn allows student athletes to recover both physiologically and psychologically (O'Donnell & Driller, 2017). Mah et al. (2018) found that maximizing good sleep hygiene practices is strongly recommended to manage poor sleep quality among collegiate student-athlete populations.

3. Sleep hygiene will mediate the sleep quality- psychological distress relationship. There will be an indirect effect on the relationship between sleep quality, sleep hygiene, and psychological distress when the mediator is included lowering the strength between the predictor and the outcome on the c' pathway.
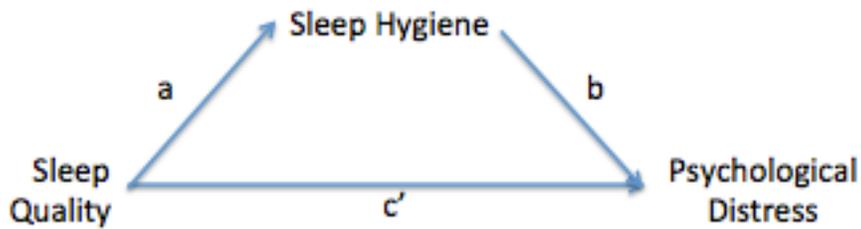
*Rationale:* Barber et al. (2014), found that poor sleep hygiene was associated with both less social and psychological well-being. Another study found that on both direct and indirect pathways good sleep hygiene was related to both positive and negative emotions (Peach et al., 2016). It suggested that sleep hygiene could be a protective factor among college student populations due to its correlations with depression and promotion of subjective well- being (Peach et al., 2014).

**2.5 Limitations**

Multiple limitations must be considered when examining the design of this exploratory study. First, not every sport may participate in the study completing the questionnaires. This means that results may potentially derive from specific sports and lack a wide variety of sports, it also can inhibit getting results from both team and individual sports. This can inhibit generality among different sports, as well as the team and individual sports. Second, the questionnaires being used in this study the Pittsburgh Sleep Quality Index, Kessler's K6 Psychological Distress Scale, and the Sleep Hygiene Practice Scale are all self-reported questionnaires (Buyess et al., 1989; Kessler et al., 2002; Lin, Cheng, Yang, & Hsu, 2007). This leaves the participants with all the power to report on their experiences and feelings potentially creating a bias response.

**2.6 Delimitations**

      This exploratory study was the first known study to investigate the relationships between sleep quality, sleep hygiene and psychological distress in university student-athletes. There are several delimitations that have been identified in the study. First, the average university student age is between 17 to 23 years old. The majority of this study's sample will contain student-athletes between the ages of 17 and 23, even though it has been implicated that the most vulnerable population for mental health issues is individuals between the ages of 15 and 25 years old (Pearson, Janz & Ali, 2013). Second, the sample of this study is only investigating student-athletes from one Canadian university. Third, since there was a low number of respondents to the study, there was a lower power influencing significance between the relationships in the mediated model (Figure 1).

**Chapter 3: Methodology**

**3.1 Participants**

Participants were student-athletes from a southern Ontario university. The sample used in this study comprised a total of 94 student-athletes, with 47 being males and 47 being females. The age of the participants ranged from 18-25 years old with an average of 20.09 years old. The average stage of year in University was 2.19 years. The sample of student-athletes averaged playing 1.98 years at the university level. The participants averaged playing their sport for a total of 9.5 years throughout the entirety of their life. The 94 student-athlete sample were taken from 10 different sports teams. Out of the participants Rugby comprised 18.1% of the sample (n=17), Volleyball 9.6% (n=9), Track and Field 9.6% (n=9), Swimming 11.7% (n=11), Curling 4.3% (n=4), Basketball 8.5% (n=8), Wrestling 8.5% (n=8), Softball 3.2% (n=3), Cross Country 9.6% (n=9), Hockey 10.6% (n=10), Baseball 2.1% (n=2) and Soccer 4.3% (n=4).

Table 1

*Participants Age in University & Years Played*

| Year in University | % | Years Played at University Level | % |
|---|---|---|---|
| 1st Year | 43.6% (n=41) | 1 Year | 48.9% (n=46) |
| 2nd Year | 20.2% (n=19) | 2 Years | 21.3% (n=20) |
| 3rd Year | 17.0% (n=16) | 3 Years | 15.9% (n= 15) |
| 4th Year | 12.8% (n=12) | 4 Years | 11.7% (n=11) |
| 5th Year | 5.3% (n=5) | 5 Years | 1.1% (n=1) |
| 6th Year | 1.1% (n=1) | 6 Years | 1.1% (n=1) |

**3.2 Procedures**

After receiving ethics approval for the study recruitment occurred. Recruiting consisted of contacting teams through multiple sources such as their coaches or team captains, team high performance sessions, and practice sessions. Once individuals expressed interest in participating letter of consent was given to each individual stating the purpose of the study, the requirements of the study such as the three questionnaires and demographics that were to be completed, as well as the potential benefits and risk factors that could occur during the data collection process. The demographic information collected was as follows: Year of study, Total years playing in university, Total years played over the entirety of life, and Sport played. Data collection was done online using a secure website called Survey Monkey to collect the demographics and questionnaires from each participant. All data can only be accessed by the investigator for privacy and confidentiality purposes. Student-athletes were reminded to be honest in all of their answers and that their information would be confidential and private since no names were required during the process.

**3.3 Data Collection**

Three questionnaires or scales were used in this study measuring each of the three components stated in the previous mediation model. The Pittsburgh Sleep Quality Index (PSQI) explored sleep quality among the sample, The Kessler Psychological Distress Scale (K6) examined student-athlete distress, and finally the Sleep Hygiene Practice Scale assessed student-athlete daily living activities and sleep habits that have potential negative implications on sleep (Buyess et al., 1989; Kessler et al., 2002; Lin, Cheng, Yang, & Hsu, 2007). Global scores were used in this study from each of the scales.

Buyess et al. (1989) created the Pittsburgh Sleep Quality Index (PSQI). It is a multiple component questionnaire designed to measure sleep quality within clinical and non-clinical populations. The questionnaire contains 19 individual items that generate 7 scores pertaining to the following components that create sleep. The components entailed are sleep latency, sleep quality, sleep duration, daytime dysfunction, sleep efficacy, sleep disturbances, and use of sleeping medication. The PSQI prompts the individual to complete a self-rated questionnaire regarding the last month of their sleep in relation to sleep quality under the above stated components. After completing the questionnaire scoring is completed by adding each of the seven components that will have a minimum score of 0 and a maximum score of 3. The total global score is calculated by adding each of the seven components scores to reach a total score out of 21. The higher the score, the worse sleep quality the individual experienced over the past 30 days. The PSQI has been shown to have above satisfactory test-retest reliability (r=0.85), as well as Cronbach (1951) $\alpha$ = .83 showing high internal consistency (Buysse et al., 1989). This study only uses four of the seven components of the PQSI. It only uses Sleep latency, Sleep duration, Sleep efficiency, and Sleep disturbance excluding the others which are components use of sleep medication, Daytime dysfunction, and subjective sleep quality for a total global score out of 12 instead of 21. The Cronbach's alpha for this current study for the PSQI with those four components was $\alpha$ = .71.

The term mental health and psychological distress will be used interchangeably due to the K6 measure referring to measuring psychological distress. Despite the name of the K6 scale it is ultimately still measuring aspects of mental health. Kessler et al. (2002) developed a shortened Psychological Distress Scale (K6) from his previous 10-item

distress scale. The Psychological Distress Scale (K6) is a non-specific brief tool that screens for distress and severe mental illness. It does this by asking six questions in specific about anxiety and depression where the individual is required to record their answers on a 5 point Likert Scale ranging from 1 (All of the time) to 5 (None of the time). It requires the individual to choose a number on the Likert Scale that best describes how often they had the feeling within the last 30 days. "During the last 30 days about how often did you feel… nervous, hopeless, restless or fidgety, so depressed that nothing could cheer you up, that everything was an effort, and worthless (Kessler et al., 2002). Scoring the K6 is fairly simple taking their number from the Likert Scale on each of the answers to have a total combined score determining psychological distress of the individual. The lower the score the more psychologically distressed the individual. The K6 Psychological Distress Scale has very high test-retest reliability r=0.97 and a Cronbach's score of $\alpha$= 0.89 (Kessler et al., 2003). The Cronbach's alpha for the current sample for the K6 was $\alpha$= 0.84.

Yang et al. (2010) created the Sleep Hygiene Practice Scale (SHPS) that measures an individual's Sleep Hygiene. The SHPS is a 30 item self-reported rating scale that assesses the daily living activities and sleep habits that have potential negative implications on an individual's sleep. The SHPS separates sleep hygiene into four different domains. The first domain is Arousal-related Behaviours including items such as worry about not being able to fall asleep in bed, not enough time to relax prior to sleep, checking the time in the middle of the night, falling asleep with TV or music on, and doing sleep-irrelevant activities in bed. The second domain identified is Sleep Scheduling and Timing with items that include sleeping in on weekends, lack of regular exercise, bed

time not being consistent daily, and getting out of bed at inconsistent times. The third domain is Eating/Drinking Behaviours that entails items such as going to bed hungry, drinking alcohol within the two hours prior to bedtime, consuming stimulating substances, and eating too much food during the hours prior to sleep. The fourth and final domain is Sleep Environment including items such as sleep environment being too noisy or too quiet, too bright or too dark, too humid or too dry, and is sleep is interrupted by a bed partner (Yang et al., 2010). Individuals rate their scores on the 30 items under the four domains on how frequent they engage in the behaviour on a six point Likert Scale, 1 (Never) to 6 (Always). The scores are then added up to generate four subscale scores for each of the domains stated above. The four subscales are then added together to create a global sleep hygiene practice scale score. The higher the scores that are generated the worse sleep hygiene practice the individual exhibits. The SHPS Cronbach's $\alpha$ scores were as follows for each domain. Arousal-related behaviours had Cronbach $\alpha$ coefficients of .70 and .58, sleep environment had .67 and .65, eating/drinking habits had .70 and .72, and for sleep scheduling it had .82 and .74 (Yang et al., 2010). These coefficients were at reasonable ranges due to the broad aspects of sleep hygiene practices and behaviours. The Cronbach's alpha for the global SHPS factor with the current study was $\alpha$=.84.

**3.4 Data Analysis**

The data was analyzed by investigating the relationships between global scores of the three questionnaires; PSQI, K6, and SHPS. First, the direct effect was examined by looking at the relationship between the predictor (i.e., Sleep quality score) and the outcome (i.e., Psychological Distress score). Second, the indirect effect was investigated through the use of two different pathways. First, is the path or relationship between the

predictor and the mediator (i.e., Sleep Hygiene) using the global scores of both the PSQI

and the SHPS. Then the next pathway involved the relationship between the sleep

hygiene as the mediator and psychological distress as the outcome. Mediation was then

tested by exploring if the strength of the relationship between the predictor and the

outcome decreases once the mediator is involved. If it does not change then the mediator

does not significantly affect the relationship between the predictor and the outcome

(Field, 2018).

**Chapter 4: Results**

**4.1 Results**

Prior to testing the hypotheses, the data was checked to see if it upheld the assumptions for regression analyses, specifically, the assumptions of normality and homogeneity variance. The assumption of normality distribution was tested using skewness and kurtosis on each questionnaire for the sample to determine if the statistic divided by the standard error was >1.96. It was found that the data was normally distributed according to the ratios as see in Table 2 The homogeneity of variance assumption was tested by visually analyzing a scatterplot graph of each combination of variables. The data variances from the scatterplot graphs were equal across all variables. Pearson correlations were used to determine if the variables were correlated, refer to Table 3 for the correlations.

Table 2

*Descriptives and Assumption of Normality Among Variables*

| Questionnaire | Mean | Standard Deviation |
|---|---|---|
| K6 | 20.97 | 4.62 |
| PSQI | 4.78 | 2.53 |
| SHPS | 87.0 | 17.02 |

According to Kessler et al. (2002) the cut off point for predicting serious mental illness for the K6 questionnaire is ≥13. As shown in *table 2* the mean for the sample of student-athletes used in this study was 20.9, which is above the cut off point for predicting serious mental illness. The SHPS does not have a specific cut off point for the questionnaire, but it indicates that the lower the score the better sleep hygiene behaviours and lifestyle habits the individual exhibits. Peach et al. (2016) conducted a study using

the SHPS and had a comparable mean of 91.78 with the current study having a mean of 87.0 within the student-athlete population. The PSQI only used four of the seven components making it difficult to interpret the global score for poor sleep quality. The PSQI cut off point is 5 if the questionnaire has all components for a total global score of 21 (Buyesse et al., 1989). With three components missing from the current study the mean of the four components used was 4.78.

Table 3

*Pearson Correlations of Psychological Distress, Sleep Hygiene, and Sleep Quality*

|  | K6 | SHPS | PSQI |
|---|---|---|---|
| K6 | 1 | -.451* | -.417* |
| SHPS | - | 1 | .504* |
| PSQI | - | - | 1 |

The three variables were then analyzed using a mediation model to assess direct and indirect effects. Table 3 gives the Pearson correlation coefficients among these variables. As hypothesized, the predictor had a direct effect on the outcome. The PSQI and the K6 had an inverse effect on one another. This means that as the global score of the PSQI increased, showing bad sleep quality, the K6 decreased showing increased levels of psychological distress in the student-athletes. The Beta score for this pathway (p < .001; Table 4). The second regression analysis was between the predictor and the mediator. As hypothesized, there was a direct effect in the pathway between the PSQI and the SHPS. This shows that an increased score on the PSQI meaning poor sleep quality is related to an increased score on the SHPS implicating poor sleep hygiene. The Beta score for the pathway between the predictor and the mediator was .504 (p < .001).

Lastly, the third hypothesis was that when adding the mediator there would be a decrease in strength of the relationship between the PSQI and K6. This was analyzed using Hayes (2018) protocol. Bootstrapping was conducted on the data for the mediated analysis in the current study. The number of bootstrap samples ran with the data was 5000. The mediated model had a $R^2$ of .25, accounting for 25% of the variation within the K6 of the mediated model. The beta weights and standard errors for the pathways are given in Table 4. The indirect effect of the predictor on the outcome when including the mediator had an effect size of -.20. Confidence intervals (CI) were conducted with a 95% level of confidence for all CI's. The lower level CI was -.5458 and the upper level CI was -.0791. Since the CI does not include zero it indicates that the indirect effect is significant. In this mediated model, sleep hygiene mediates the relationship between psychological distress and sleep quality within the present study.

Table 4

*Regression Analyses of Mediated Model*

| Model | DV | IV | B | t | p | $R^2$ |
|---|---|---|---|---|---|---|
| 1 | K6 | PSQI | -0.76 | -4.40 | .000* | 0.17 |
| 2 | SHPS | PSQI | 3.39 | 5.60 | .000* | 0.25 |
| 3 | K6 | PSQI | -0.46 | -2.42 | .018* | 0.25 |
|  |  | SHPS | -.009 | -3.08 | .003* |  |

## Chapter 5: Discussion

### 5.1 Discussion

This study had the initial primary focus on examining whether sleep hygiene mediated the relationship between sleep quality and psychological distress within a university student-athlete population. A mediation model was used to investigate these relationships through different pathways to determine the strength of the relationships between the variables. When testing the relationship between sleep quality and psychological distress, it was found that there was a correlation between the two with an inverse effect. This means that as the sleep quality global scores increased, showing poor sleep quality, the individuals' psychological distress scores decreased, implying poorer psychological distress and contrariwise. This study also investigated the relationship between sleep quality and sleep hygiene. The regression analysis revealed that there was a direct relationship between the variables of sleep quality and sleep hygiene. As the sleep quality scores increases suggesting poorer sleep quality the sleep hygiene scores also rose showing poorer sleep hygiene. Lastly, the relationship between sleep quality and psychological distress was analyzed when including sleep hygiene to determine if the strength of the relationship would decrease between sleep quality and psychological distress when adding sleep hygiene. The regression showed that the strength of the pathway between sleep quality and mental health was reduced to non-significant after adding sleep hygiene. With regards to the findings of the present study mediation analysis researchers need to aid student-athletes in their sleep hygiene knowledge in order to increase both sleep quality and psychological distress.

The present study found a direct effect between the relationship of sleep quality and psychological distress using the global scores between the PSQI and the K6 within the mediation model. The two global scores had inverse significant effects on each other showing that as one global score increased the other decreased. This is similar to a study done by Litwic-Kaminska and Kotysko (2017); who compared the differences in levels of perceived stress, type of stress appraisal and life satisfaction between university student-athletes while looking at their sleep. They determined that student-athletes who indicate being poor sleepers or low sleep quality most often are stressed throughout their everyday life and affirm having low life satisfaction levels. They also found that when one of the previously stated variables are present usually the other one is as well, showing elevated levels of the other variables as stated above (Litwic-Kaminska & compared the differences in levels of perceived stress, type of stress appraisal and life satisfaction between university student-athletes while looking at their sleep compared the differences in levels of perceived stress, type of stress appraisal and life satisfaction between university student-athletes while looking at their sleep Kotysko, 2017). This is similar to the findings of the present study that also indicated that sleep quality and psychological distress affect one another because when one global score is poor the other is poor as well.

The relationship between sleep quality and psychological distress in the present study showing the predictor and the outcome variable had a direct significant relationship on one another was consistent with the literature from Alvaro et al. (2013), who conducted a systematic review of the field. The focal point of the systematic review was to assess the directional relationship between sleep disturbances, anxiety and depression

(Alvaro et al., 2013). The findings from the current study added to the literature in a similar manner showing the associations between the three and how they affect one another in a directional manner.

In addition to the present study's finding, Sheehan et al. (2018), determined that depressive symptoms and poor sleep quality affect student-athletes in Ireland. Even though this study was conducted within a different country, one can speculate there would be similar stressors among post-secondary student-athletes globally. The study indicated that once again poor sleep quality and depressive symptoms affect student-athlete populations with elevated prevalence rates for both (Sheehan et al., 2018). This finding was similar to the findings of the first hypothesis identifying a direct effect between the relationship between sleep quality and psychological distress.

The present study in addition found that there was a direct relationship between sleep quality and sleep hygiene. When there was an increased score on the PSQI implicating poor sleep quality there was a relation to an elevated score on the SHPS suggesting poor sleep hygiene. Suen et al. (2010) discovered that university students who had improper sleep hygiene practices were significantly associated with poor sleep quality. It was also suggested that practicing proper habits relating to sleep hygiene was strongly related to the overall outcome of increased sleep quality (Suen et al., 2010). Even though Suen et al. (2010) was solely looking at university students with less stressors than the typical student-athlete, the findings of the present study were very similar. It is evident that students in university in general suffer from poor sleep due to poor sleep hygiene.

Juliff et al. (2015) found that athletes obtained well below the general target for sufficient hours of sleep per night as opposed to the healthy amount of hours an average adult should obtain a night. In the present study student-athletes reported obtaining an average of 6.9 hours of sleep a night found within the PSQI. Athletes sleep suffered due to having poor sleep hygiene such as issues due to sleep scheduling and timing, which is one of the four domains pertaining to sleep hygiene. Issues with implementing strategies to aid in proper sleep hygiene practice were lacking (Juliff et al., 2015). This could be a potential reason explaining the finding from the current study showing that poor sleep quality was significantly related to poor sleep hygiene. By increasing sleep hygiene knowledge and proper behaviours it may in turn aid in the sleep quality.

With a student-athlete sample similar to the present study, Monma et al. (2018) found similar findings to the present study, suggesting that poor sleep quality among a student-athlete population is related to poor sleep hygiene behaviours and lifestyle habits. Student-athletes struggled in three of the four domains of sleep hygiene, arousal-related behaviours, sleep scheduling and timing, eating and drinking behaviours; the fourth domain of environmental factors was not tested (Monma et al., 2018). These results are comparable to the current study because student-athletes reported having issues with sleep hygiene behaviours and lifestyle habits from the SHPS. This can be related to the direct effect showed in the mediation analysis on the a pathway between sleep quality and sleep hygiene. The benefits of correcting sleep hygiene habits were seen in a study by O'Donnell and Driller (2017), where athletes experienced poor sleep quality due to improper sleep hygiene behaviours. After participating in sleep hygiene education sessions, sleep quality drastically increased due to the implementation of the knowledge

that was gained. Further linking and solidifying the results of the present study of how there is a direct effect between the two.

Sleep hygiene was shown to mediate the relationship between sleep quality and psychological distress in the present study. There was a decrease in the strength of the relationship between the sleep quality and psychological distress when including sleep hygiene. There is no literature that examines these three variables together within a post secondary student-athlete sample. This finding added to the literature by examining a specific and very vulnerable population that needs attention as mentioned above the sample within the study falls within the age group that is particularly at risk for mental health concerns. Within the scarce research done on all three variables being tested together there were very similar results.

Barber et al. (2014), found that poorer sleep hygiene predicted lower wellbeing, less sleep duration and morningness. University students that experience poor sleep hygiene will have other aspects of their mental health and sleep dwindle as suggested from both the Barber et al. (2014) and Peach et al. (2016) studies. Barber et al.'s (2014) study was different in the sense that it analyzed sleep duration instead of sleep quality, but also suggested that sleep hygiene should be focused on to increase mental well-being and aspects of sleep outcomes such as duration and quality (Barber et al., 2014). Due to sleep quality and quantity being outcomes, sleep hygiene are the lifestyle habits and behaviours that can be modified to increase better sleep outcomes. Peach et al. (2016) was the second article that took Barber et al.'s (2014) suggestion on analyzing sleep quality instead of sleep quantity. Both full and partial mediation models were used to examine the variables or sleep hygiene, mental health, and sleep quality in the study

(Peach et al., 2016). Full mediation occurred where sleep hygiene indirectly predicted mental health through sleep quality and partial mediation where sleep hygiene directly affected mental health and had indirect effects through sleep quality. Even with the small differing samples from the current study we found identical results with regards to the mediation analysis used in the present study. Peach et al. (2016) used both a full mediation model and a partial mediation model within their study. This is different from the present study where only a partial mediation analysis was used to understand the known relationship of how one variable influences another through a mediator variable. Peach et al. (2016) used three domains underneath well-being such as psychological, physical, and relationship well-being in their analysis and had depression as another separate variable. The present study used on three variables that were sleep hygiene, sleep quality and psychological distress with no domains separated underneath using global scores instead.

After comparing previous literature and the results from the present study it was evident that the findings were very consistent with what was found previously. Sleep hygiene plays a big role in aiding in student-athlete's sleep quality and psychological distress. By increasing individuals sleep hygiene it will in turn increase sleep quality and improve psychological distress within the student-athlete's life.

This was the first study within this field to examine a Canadian sample of student-athletes regarding sleep quality, sleep hygiene, and psychological distress. This is important because different samples from different locations over the world have different perspectives of what sleep is to them contextually. This means that the results

and implications from the current study can be applied to inform future research within a Canadian context, as well as be applied to current student-athletes.

## 5.2 Implications

The current study can add to the literature by suggesting that post secondary student-athletes are similar to their non-athlete counterparts requiring more of a focus on sleep hygiene practice behaviours to increase sleep quality and psychological distress in the individual. Sleep hygiene can be at the forefront and act as a protective factor for student-athletes during the most vulnerable stage of their life.

The present findings from the mediated model indicated sleep hygiene mediated the relationship between sleep quality and psychological distress. In addition, on a broad empirical research trend there are a multitude of studies that indicated correlations between sleep quality and psychological distress. This study can add to the current literature by implicating sleep hygiene interventions within the student-athlete population due to the mediator reducing the strength of the relationship between the predictor and the outcome when added. This can aid the student-athlete population by modifying sleep hygiene behaviours and life style habits that can in turn increase sleep quality, which will decrease psychological distress levels. This can be done by focusing on the modifications of sleep hygiene behaviours and lifestyle habits such as sleep scheduling/timing, eating and drinking behaviours, arousal-related behaviours and environmental factors, rather than sleep outcomes such as sleep quality. O'Donnell and Driller (2017), investigated the effects of sleep hygiene education, it has proven to aid student-athletes increasing sleep quality and quantity, which would allow the athletes to recover both physiologically and psychologically. Sleep hygiene education allows individuals to excel not only on the

field, but in their academics as well by providing them with knowledge to replenish themselves physiologically and psychologically (O'Donnell & Driller, 2017). Ultimately, sleep hygiene is a modifiable factor that can increase sleep quality and decrease psychological distress levels in athletes.

**5.3 Future Directions**

This was the first study to investigate if sleep hygiene mediates the relationship between sleep quality and psychological distress within a student-athlete post-secondary population. This study was able to show that sleep hygiene does in fact mediate this relationship. A future direction for this topic of research could be to use a multiple mediation analysis using the different components of sleep quality and the four domains of sleep hygiene. This study used global scores of each variable to investigate the relationships between the variables, but by using a multiple mediation analysis with the different components and domains of the given variables it could further breakdown what the exact issue is showing researchers the specific components and domains where the student-athlete population is struggling. Another future direction would be to take base scores of each variable within the student-athlete population, then implement an intervention to determine if the intervention increases scores among all of the variables of sleep quality, psychological distress and sleep hygiene. O'Donnell and Driller (2017), provided elite female athletes with a sleep hygiene intervention class. Their study showed improvements among the study sample by improving scores of sleep quantity and quality.

**5.4 Limitations**

The current study has several limitations that need to be brought forth. First off, the sample size of the study was not as expected. Only 94 participants completed the study, by increasing the sample size it could have made the results from the study more accurate. Fritz and Mackinnon (2007) wrote an article determining required sample size to detect a mediated effect, they compiled and reviewed 187 studies. They determined that an approximate of 405 participants is required. Since this current study has a smaller sample size it can affect the results making results less significant than it would be with a higher sample size, which is the reason why bootstrapping was done with the sample. Lastly, an error was made in the dispensing of the PSQI only providing four of the seven components to analyze in this study. A modified version of the PSQI was used within the present study using only the second, third, fourth, and fifth component excluding the others for a total global score of 12 instead of 21. This makes it hard to generalize the sleep quality findings of the study. Out of the three components that are missing daytime dysfunction and use of sleep medications have been shown in previous literature to not correlate to symptoms of anxiety and depression (Hinz et al., 2017 : Otte et al., 2015). This may potentially mean that the exclusion of those two components might not have hindered validity of the findings. However, the subjective sleep quality component has been shown to correlate with anxiety and depression, which can influence the validity of the findings due to the PSQI being about sleep quality as a whole.

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# Appendix

## Sleep Hygiene Practices Scale (SHPS)

**Rate how frequently they engaged in the behavioral practices on a six-point**

| Domain 1: Arousal-Related Behaviours | 1= Never to 6 = Always | | | | | |
|---|---|---|---|---|---|---|
| Doing sleep-irrelevant activities in bed (ex. watching TV, reading). | 1 | 2 | 3 | 4 | 5 | 6 |
| Worry about not being able to fall asleep in bed. | 1 | 2 | 3 | 4 | 5 | 6 |
| Unpleasant conversation prior to sleep. | 1 | 2 | 3 | 4 | 5 | 6 |
| Not enough time to relax prior to sleep. | 1 | 2 | 3 | 4 | 5 | 6 |
| Falling asleep with TV or music on. | 1 | 2 | 3 | 4 | 5 | 6 |
| Pondering about unresolved matters while lying in bed. | 1 | 2 | 3 | 4 | 5 | 6 |
| Check the time in the middle of night. | 1 | 2 | 3 | 4 | 5 | 6 |
| Worry about night-time sleep during the day. | 1 | 2 | 3 | 4 | 5 | 6 |
| Vigorous exercise during the two hours prior to sleep. | 1 | 2 | 3 | 4 | 5 | 6 |

**Likert scale, from 1 = never to 6 = always.**

| Domain 2: Sleep Scheduling and Timing | 1= Never to 6 = Always | | | | | |
|---|---|---|---|---|---|---|
| Bedtime not consistent daily. | 1 | 2 | 3 | 4 | 5 | 6 |
| Get out of bed at inconsistent times. | 1 | 2 | 3 | 4 | 5 | 6 |
| Stay in bed after waking up in the morning. | 1 | 2 | 3 | 4 | 5 | 6 |
| Sleep in on weekends. | 1 | 2 | 3 | 4 | 5 | 6 |
| Napping or resting in bed for over one hour during the day. | 1 | 2 | 3 | 4 | 5 | 6 |
| Lack of exposure to outdoor light during the day. | 1 | 2 | 3 | 4 | 5 | 6 |
| Lack of regular exercise. | 1 | 2 | 3 | 4 | 5 | 6 |

| Domain 3: Eating/Drinking Behaviors | 1= Never to 6 = Always | | | | | |
|---|---|---|---|---|---|---|
| Going to bed hungry | 1 | 2 | 3 | 4 | 5 | 6 |
| Drinking caffeinated drinks (e.g., coffee, tea, coca-cola) within the four hours prior to bedtime. | 1 | 2 | 3 | 4 | 5 | 6 |
| Drinking alcohol within the two hours prior to bedtime. | 1 | 2 | 3 | 4 | 5 | 6 |
| Consuming stimulating substances (e.g., nicotine) during the two hours prior to bedtime. | 1 | 2 | 3 | 4 | 5 | 6 |
| Drinking a lot during the hour prior to sleep. | 1 | 2 | 3 | 4 | 5 | 6 |
| Eating too much food during the hour prior to sleep. | 1 | 2 | 3 | 4 | 5 | 6 |

| Domain 4: Sleep Environment | 1= Never to 6 = Always | | | | | |
|---|---|---|---|---|---|---|
| Sleep environment is either too noisy or too quiet. | 1 | 2 | 3 | 4 | 5 | 6 |
| Sleep environment is either too bright or too dark. | 1 | 2 | 3 | 4 | 5 | 6 |
| Sleep environment is either too humid or too dry. | 1 | 2 | 3 | 4 | 5 | 6 |
| Feeling too hot or too cold during sleep. | 1 | 2 | 3 | 4 | 5 | 6 |
| Poor ventilation of bedroom. | 1 | 2 | 3 | 4 | 5 | 6 |
| Uncomfortable bedding and/or pillow. | 1 | 2 | 3 | 4 | 5 | 6 |
| Too many sleep-unrelated items in bedroom. | 1 | 2 | 3 | 4 | 5 | 6 |
| Sleep is interrupted by bed partner. | 1 | 2 | 3 | 4 | 5 | 6 |

**Global Score:**_____

# The Pittsburgh Sleep Quality Index

Name_____        Date_____

**Instructions:**
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 the questions.

1.  During the past month, when have you usually gone to bed at night?

    **usual bed time**_____

2.  During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

    **number of minutes**_____

3.  During the past month, when have you usually got up in the morning?

    **usual getting up time**_____

4.  During the past month, how many hours of *actual* sleep did you get at night? (This may be different than the number of hours you spend in bed).

    **hours of sleep per night**_____

For each of the remaining questions, check the one best response. Please answer *all* questions.

5.  During the past month, how often have you had trouble sleeping because you……

(a) Cannot get to sleep within 30 minutes

    Not during the    Less than            Once or           three or more
    past month____once a week_____     twice a week_____    times a week_____

(b) Wake up in the middle of the night or early morning

    Not during the    Less than            Once or           Three or more
    past month____   once a week_____    twice a week_____    times a week_____

(c) Have to get up to use the bathroom

Not during the    Less than            Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(d) Cannot breathe comfortably

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(e) Cough or snore loudly

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(f) Feel too cold

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(g) Feel too hot

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(h) Had bad dreams

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(i) Have pain
Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

(j) Other reason(s), please describe_____

_____

How often during the past month have you had trouble sleeping because of this?

Not during the    Less than             Once or           three or more
past month____  once a week_____    twice a week_____   times a week____

6. During the past month, how would you rate your sleep quality overall?

Very good_____
Fairly good_____
Fairly bad_____

Very bad_____

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

    Not during the     Less than          Once or            three or more
    past month____     once a week_____    twice a week_____   times a week_____

8.  During the past month, how often have you had trouble staying awake while
    driving, eating meals, or engaging in social activity?
    Not during the     Less than          Once or            three or more
    past month____     once a week_____    twice a week_____   times a week_____

9.  During the past month, how much of a problem has it been for you to keep up
    enough enthusiasm to get things done?

                      No problem at all_____
                      Only a very slight problem__
                      Somewhat of a problem_____
                      A very big problem_____

10. Do you have a bed partner or roommate?

                      No bed partner or roommate              _____
                      Partner/roommate in other room    _____
                      Partner in same room, but not same bed__
                      Partner in same bed                     _____

11. How often do you feel tired during the following times during the day?

*Morning*:
        0                    1                    2                    3
     most days            often            occasionally            never

*Afternoon*:
        0                    1                    2                    3
     most days            often            occasionally            never

*Evening*:
        0                    1                    2                    3
     most days            often            occasionally            never

# K6+ Self-Report Measure

The following questions ask about how you have been feeling during the past 30 days. For each question, please circle the number that best describes how often you had this feeling.

| Q1. | During the past 30 days, about how often did you feel … | All of the time | Most of the time | Some of the time | A little of the time | None of the time |
|---|---|---|---|---|---|---|
| a. | …nervous? | 1 | 2 | 3 | 4 | 5 |
| b. | …hopeless? | 1 | 2 | 3 | 4 | 5 |
| c. | …restless or fidgerty? | 1 | 2 | 3 | 4 | 5 |
| d. | …so depressed that nothing could cheer you up? | 1 | 2 | 3 | 4 | 5 |
| e. | …that everything was an effort? | 1 | 2 | 3 | 4 | 5 |
| f. | …worthless? | 1 | 2 | 3 | 4 | 5 |