

SLEEP HYGIENE ANALYSIS & EDUCATION MODULE FOR NURSING STUDENTS

A Dissertation  
Submitted to the Graduate Faculty  
of the  
North Dakota State University  
of Agriculture and Applied Science

By

Kayla Jean Sorenson

In Partial Fulfillment of the Requirements  
for the Degree of  
DOCTOR OF NURSING PRACTICE

Major Program:  
Nursing

February 2021

Fargo, North Dakota

North Dakota State University  
Graduate School

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**Title**

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Kayla Jean Sorenson

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The Supervisory Committee certifies that this *disquisition* complies with North Dakota State University's regulations and meets the accepted standards for the degree of

**DOCTOR OF NURSING PRACTICE**

SUPERVISORY COMMITTEE:

Dr. Heidi Saarinen, DNP, FNP-C

---

Chair

Dr. Mykell Barnacle, DNP, FNP-BC

---

Dr. Molly Secor-Turner, Ph.D., MS, RN

---

Dr. Leah Irish, Ph.D.

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Approved:

3/30/2021

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Date

Dr. Carla Gross

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Department Chair

## ABSTRACT

There is a research gap regarding college nursing student sleep habits and education compared to general college and medical students; nursing students are at high risk for poor sleep hygiene and impaired sleep quality due to coursework rigor, clinical hours, and balance between work (for majority) and college social life. There is a lack of sleep education and support in nursing students to allow for behavior change to occur amidst academic, employment, and social expectations. Nurse Practitioners (NPs) can play a vital role in health promotion to impact the nursing student population regarding sleep health. The practice improvement project (PIP) purpose was to evaluate, educate, and increase perceived sleep knowledge and habits of undergraduate nursing students at a Midwestern university. The PIP used descriptive statistics and open-ended questions for evaluation of sleep behaviors with nightly sleep logs pre- and post-education, Pittsburg Sleep Quality Index (PSQI) and Sleep Hygiene Practices Scale (SHPS) tools, and evaluation of an online sleep education module (SEM) to evaluate nursing student outcomes. Inclusion criteria included being a nursing student with admittance to the pre-licensure bachelor of science program. Of the 566 possible participants, 48 students completed the pre-survey and 21 students completed all evaluative measures. Collectively, results supported that nursing students had decreased sleep quality reflecting a mean pre-survey score of PSQI of 7.1 (a score greater than 5 indicates sleep difficulty) with a post-survey score improvement of 5.6. Pre-survey SHPS scores supported poorer sleep hygiene practices and sleep quality at 76.8, with improvement to scores of 75.2 post-survey. Due to the small sample size, sample bias, and a 56% attrition rate, no significant conclusions were able to be correlated. Eighty-six percent of participants indicated an increase in perceived knowledge after the SEM. Learning more about the patterns and barriers of sleep was important to make recommendations to support nursing

student sleep health. The results of this study reflect other findings from college student populations, but more research should focus on nursing students to determine if needs are closer to medical students and how academic institutions and NPs could provide better support to promote sleep wellness.

## ACKNOWLEDGEMENTS

A huge thank you goes out to all the faculty and staff at North Dakota State University Doctor of Nursing Practice program. The support, encouragement, and motivation provided by the faculty and staff at NDSU was dynamic to my success and completion of this project. I would like to thank my chair, Dr. Heidi Saarinen, for her endless patience, encouragement, and investment in my project. Your time, feedback, and knowledge in Sleep Medicine did not go unnoticed and was key to the success of my project. Thank you to all my committee members: Dr. Mykell Barnacle, Dr. Molly Secor-Turner and Dr. Leah Irish for your interest and feedback on my project that was pivotal in improving my project.

Lastly, I would like to acknowledge the important people in my life that have made this dissertation possible through endless support and encouragement. Thank you to my parents, Curt and Joyce, for believing in me when at times I didn't believe in myself and for your endless support and managing the countless breakdowns. Thank you to my sister, Alyssa, for always supporting me and providing me the best and needed distraction with two cute little boys, Kyler and Conner, during the stress of this project. To my fiancé, Zach, thank you for the endless support, making me laugh through the stress, and supporting my dreams and ambitions even when it was challenging. I could not have completed this without all of you and I am forever grateful for all of you in my life.

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## LIST OF ABBREVIATIONS

SEM .....	Sleep Education Module
NDSU.....	North Dakota State University
BSN.....	Bachelor of Science in Nursing
RN .....	Registered Nurse
HPM.....	Health Promotion Model
PIP.....	Practice Improvement Project
ISS.....	Insufficient Sleep Syndrome
PSQI.....	Pittsburg Sleep Quality Index
SHPS .....	Sleep Hygiene Practice Scale
CDC .....	Center for Disease Control
NP .....	Nurse Practitioner
DNP.....	Doctor of Nursing Practice
EEG.....	Electroencephalogram
EMG.....	Electromyography
NES.....	Night Eating Syndrome
ASA.....	American Sleep Association
REM.....	Rapid Eye Movement
NREM.....	Non-Rapid Eye Movement
GPA.....	Grade Point Average

## **CHAPTER ONE. INTRODUCTION**

### **Background and Significance**

About 72.6% of students in college indicate getting less than the recommended minimum seven hours of sleep each night reported by Hershner and O'Brien (Watson et al., 2015). Less than seven hours of sleep is consistently associated with adverse health outcomes, such as weight gain, obesity, diabetes, hypertension, heart disease, stroke, depression, decreased immune function, and increased risk of error. A minimum of eight hours of sleep per night for college students is a more important recommendation due to the neurological development still occurring for the usual age range of the traditional college student (Owens et al., 2017). Although sleep quantity is essential, sleep quality is also an important indicator of good sleep hygiene. Sleep quality is crucial to restorative sleep as individuals can sleep for seven hours with fragmented or interrupted sleep, thus not actually getting the amount of sleep perceived (Medic et al., 2017).

According to the Office of Disease Prevention and Health Promotion initiative in Healthy People 2020, "Sleep Health" was added as a fundamental topic for improvement of overall health in the United States by 2020 (Sleep Health, 2019). The goal outlined in HealthyPeople 2020 was to increase the public knowledge regarding adequate sleep and the benefits adequate sleep quantity and quality has to wellness, productivity, and quality of life. Additionally, in HealthyPeople 2030, sleep continues to be a key objective looking to help people get enough sleep, treating sleep disorders, and decreasing drowsy driving (Office of Disease Prevention and Health Promotion, 2020).

The concern of insufficient sleep has a significant public health burden related to physical, mental, and emotional health (Sleep Health, 2019). According to Chattu et al. (2018), insufficient sleep syndrome (ISS) has been established as an ICD-10 code due to the prevalence

that affects all age groups globally. Poor sleep hygiene and the decreased focus on sleep importance has raised the concern of ISS becoming a public health epidemic and the discussion of ISS being classified as a non-communicable disease due to the public's disease burden (Chattu et al., 2018).

### **Problem Statement**

With the increasing pressure of social media, constant screen time availability, and the newfound independence of being away from parental guidance, college students often neglect getting adequate sleep. Sleep habits are commonly the first personal wellness aspect sacrificed to enhance traditional college students' social life (Menon et al., 2015). Most college students are unaware of how important quality sleep is for optimum health. Sleep hygiene practices and sleep quality can directly impact mental, emotional, and physical health. The Center for Disease Control (CDC) reports that about 35% of adults are not getting enough sleep, which accounts for 84 million people. College students often view sleep as a luxury due to being overworked with challenging course work, part-time jobs, and a social life (Cunningham, 2019). College students typically abandon sleep when faced with periods of stress without understanding they are contributing to increased negative impacts on their physical and mental health.

### **Gaps in the Literature**

There are still a multitude of unknowns related to sleep hygiene in college students due to the many factors that influence college students' everyday routines. Although there has been an identified link to poor academic performance and sleep hygiene, further evidence is needed to fully validate this statement (Owens et al., 2017). Sleep quantity is a thoroughly researched indicator for healthy sleep patterns and behaviors but measuring quality of sleep requires further research to effectively quantify. The small body of research regarding quality of sleep indicators

in college students, and more specifically college nursing students, demonstrates a gap in the literature.

Although there is a variety of literature gathered to evaluate college students in general, there is limited gathered data to apply to nursing students specifically. Traditional-aged college students aged 18-24 years have been widely researched and there appears to be only a small body of evidence examining undergraduate nursing students' sleep hygiene habits. Some evidence supports that sleep difficulties are more concerning in the college nursing student population as compared to other college students (American Academy of Sleep Medicine [AASM], 2017).

This practice improvement project (PIP) helped contribute to the knowledge base on nursing student sleep hygiene habits and nursing student education on sleep. The PIP's education/intervention on sleep hygiene could possibly further impact the Nurse Practitioner (NP) role in health promotion, disease prevention, and patient education, as NPs often see college students in practice. The PIP sought to improve perceived knowledge on sleep hygiene in the nursing student population to improve awareness and promote healthy behavior change.

### **Purpose of the Project**

The purpose of this PIP was to evaluate, educate, and increase the perceived knowledge of North Dakota State University (NDSU) undergraduate Bachelor of Science (BSN), pre-licensure nursing students regarding sleep. An online sleep education module (SEM) was developed. The SEM included education regarding the physiology of sleep, importance of sleep, and health outcomes related to poor sleep hygiene, while also recommending specific behaviors that could be incorporated into improving sleep hygiene habits.

The co-investigator disseminated two self-report evaluations through an online platform, Qualtrics, to gain nursing student population sleep habit baseline data and perceptions in an

urban, Midwest nursing school. Post-module self-report evaluations further assessed changes from baseline to determine increased awareness and perceived knowledge of sleep and sleep hygiene. The goal of the sleep module was to improve awareness, perceived knowledge, and determine impact on behavior change and/or intended behavior change in the undergraduate nursing student population at NDSU. Further understanding sleep hygiene habits and possible patterns among cohorts contributed to recommendations and added to existing knowledge regarding the nursing student population.

### **Project Objectives**

The following were the project objectives:

1. Identify sleep habits and patterns of the NDSU undergraduate BSN, pre-licensure nursing student population over the course of the fall 2020 semester.
2. Increase perceived knowledge regarding sleep importance and ways to improve sleep quality and quantity in the nursing students after completion of the online SEM.
3. Improve self-reported sleep hygiene practices in nursing students upon completion of the online SEM.
4. Evaluate if an online education modality is an effective form of education in the nursing student population.



## **CHAPTER TWO. LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

### **Introduction**

Sleep is a simple concept, though complex activity, that every individual does as part of his or her everyday routine. Many individuals are willing to sacrifice sleep, a crucial component of health, for a social gathering, screen time, and/or work obligations when under time constraints. Most people acknowledge that sleep is important but are not willing to make sleep a priority regardless of the countless benefits (Chiang, & Arendt, 2017). Owens et al. (2017) state that 70% of college-aged students report getting less than seven hours of sleep nightly due to the challenges that come with balancing school, social life, and possible work obligations. Up until the 1950's, sleep was recognized as a passive process in which the brain would rest in correlation to the body (Peever & Fuller, 2017). In 1953, Eugene Aserinsky and Nathan Kleitman identified the active process of sleep patterns during a study on infant sleeping patterns. Following this study, further sleep studies by Kleitman and Dement were performed that identified brain activity and electroencephalogram (EEG) changes correlating to the rapid eye movements (Dement & Kleitman, 1957; Peever & Fuller, 2017).

College students are at an increased risk for developing poor sleep hygiene due to a multitude of barriers to good sleep hygiene. The harmful outcomes of inadequate sleep hygiene are discussed below. For the purpose of this project, sleep hygiene will be defined as the behaviors and habits that contribute to quality and quantity of sleep and daily alertness (National Sleep Foundation [NSF], 2019).

### **Sleep Physiology**

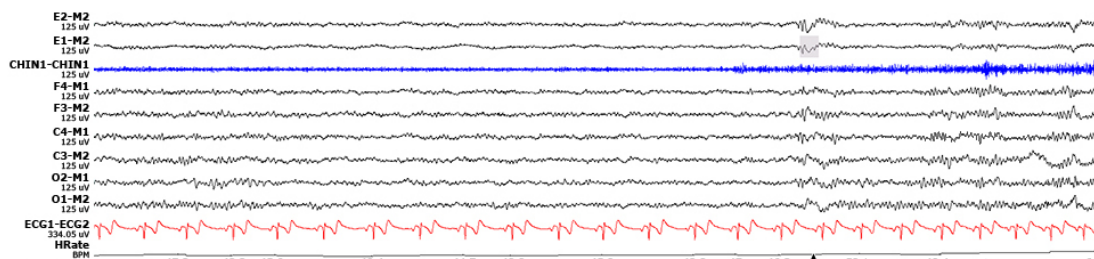
Although sleep is a natural and needed phenomenon, sleep is a complex process that requires a significant amount of activity from the brain and neurons in coordination with the

parasympathetic nervous system (American Sleep Association [ASA], 2019). Neurotransmitter communication within the brainstem neurons is a key component to switching the neurons off that keep us awake and signal the brain to go to sleep. According to the American Sleep Association (ASA) (2019), there are four phases of sleep. The four phases of sleep include phase N1, N2, N3 and Rapid Eye Movement (REM). The adult body normally spends over 50% of sleep time in phase 2 (N2) and about 20% of sleep in REM.

Phase one of sleep (N1) is considered “light sleep”, during which individuals can be awakened easily (ASA, 2019). Phase one is characterized with very slow eye movement, a decrease in muscle activity and normal EEG waves as indicated in Figure 1. A variety of individuals in N1 sleep experience a sensation recognized as hypnic myoclonia. Hypnic myoclonia is the sensation of muscle jerking and falling which can cause individuals to startle awake.

**Figure 1**

*Diagram 1: N1 (2019)*

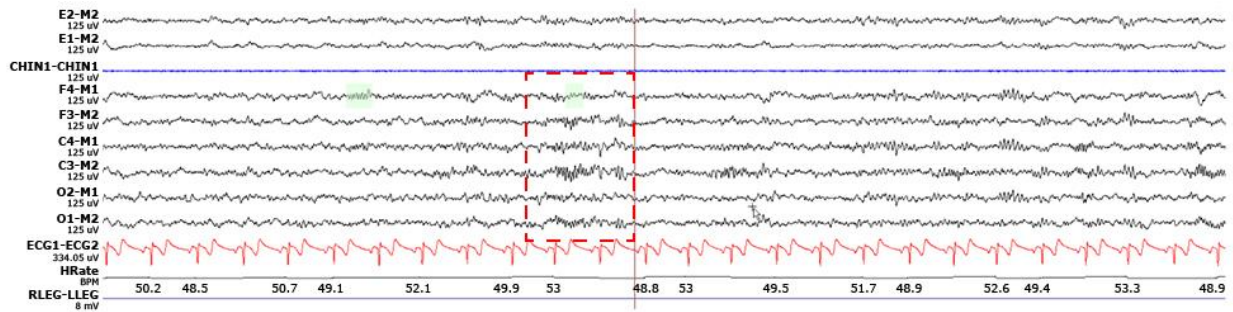


Phase two (N2) of sleep is characterized by no eye movements and slowing of the EEG brain waves as indicated in Figure 2 (ASA, 2019). Although the eyes and EEG waves slow, there has been evidence of short bursts of brain activity known as sleep spindles usually lasting 0.5 seconds. Certain medications such as benzodiazepines can increase activity and frequency of sleep spindles in N2 sleep. A secondary characteristic related to N2 sleep is the presence of K-

complexes, which include an increase in eye activity and brain activity lasting about 0.5 seconds (Kirsch, 2019).

## Figure 2

Diagram 2: N2 (2019)



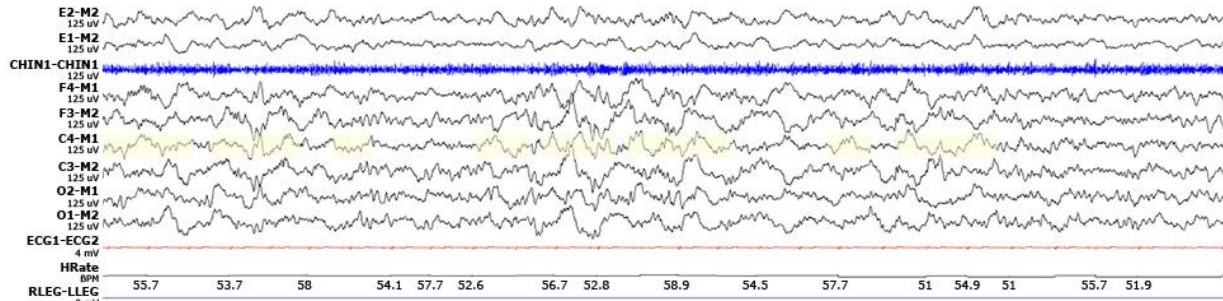
The third phase of sleep (N3) is considered deep sleep and comprises 10-20% of total sleeping time of adults; stage N3 sleep slowly decreases in length as individuals age (ASA, 2019). N3 is characterized by slow delta EEG waves, that occur almost exclusively in N3. Kirsch (2019) describes the stages of normal sleep as the following:

Stage N3 tends to occur more in the first half of the night and particularly at the beginning of the night, since slow wave activity during sleep represents the homeostatic drive to sleep, which is maximal after the waking period. It is often more difficult to arouse sleepers during stage N3 sleep compared with stages N1 and N2. (para. 15).

N3 Sleep is often referred to the “deepest” stage of sleep, allowing individuals to feel refreshed and well rested due to the slow delta waves seen on EEG (Cleveland Clinic, 2012).

**Figure 3**

*Diagram 3: N3 (2019)*

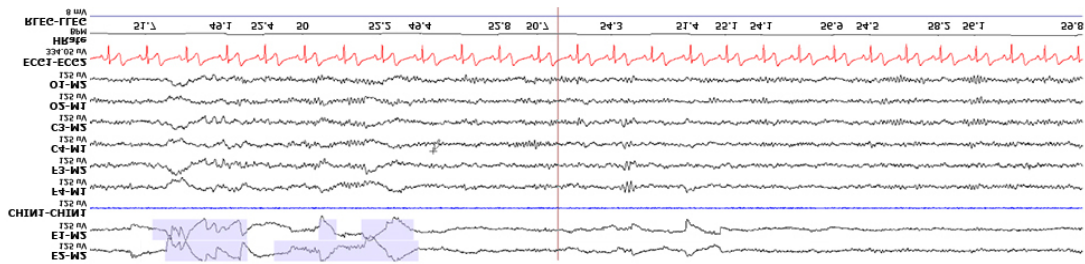


The final phase of sleep, known as rapid eye movement (REM), is characterized by three defining features: a low voltage but mixed EEG waves, rapid eye movements, and atonia (Kirsch, 2019). Scientists usually refer to this as paradoxical sleep due to the active process, benefits to health, and, more specifically, memory consolidation (Peever & Fuller, 2017). Within the REM sleep phase, there are two phases: phasic and tonic. The phasic portion of REM sleep is characterized by bursts of classic rapid eye movement, respiratory changes, and electromyography (EMG) variability which present as muscle twitches and is a result of activation of sympathetic activity (Kirsch, 2019). The tonic phase of REM sleep causes low muscle tone and activation of the parasympathetic nervous system.

The widely unknown phenomenon of REM sleep is highly researched due to perceived benefits to health yet is still not completely understood (Peever & Fuller, 2017). REM sleep is recognized as responsible for facilitation and formation of memory through activation of many areas of the brain including the brainstem, midbrain, hypothalamus, hippocampus, cerebellar cortex, and red nucleus. REM allows the body to enable learning and cementing memories through selectively eliminating and maintaining new synapses by calcium spike-dependent mechanisms. REM sleep is also responsible for the complex dreams that individuals have (Kirsch, 2019).

**Figure 4**

*Diagram 4: REM Sleep (2019)*



Sleep hygiene can affect all aspects of sleep phases, which impacts sleep quality.

Understanding how the sleep phases are impacted by sleep hygiene can help to better understand the indirect impact on sleep quality. Upon initially falling asleep, individuals are in N1, N2, and N3 for about 70-90 minutes when the body cycles to REM sleep (ASA, 2019). Each cycle contains all phases of sleep with REM marking the end of the sleep cycle before starting a new cycle. On average, most sleep cycles last about 90-110 minutes. The REM phase of sleep is shorter earlier in the night, and as the sleep cycle progresses, the REM phases increase in length, which increases the ability of each individual to improve memory and learning (Pacheco, 2021). A normal adult typically experiences four cycles of REM per night, which results in four sleep cycles per night (ASA, 2019).

Non-rapid eye movement (NREM) and REM are separated aspects of the sleep cycle characterized by EEG changes and physiological differences (ASA, 2019). NREM sleep occurs prior to REM sleep and is responsible for aiding in building the immune system and building bones and muscle tissue. REM sleep is responsible for assisting the development of memory and facilitation of learning through physiological components such as muscular changes. These changes range from muscle contraction to relaxation, eye movement variability, mixed low voltage EEG waves and variable respiratory rate.

Both NREM and REM sleep have shortened sleep phases as people age. REM sleep declines in adolescence but can enter REM sleep sooner in the sleep cycle and stay in the stage longer although the overall sleep percentage is decreased. In contrast, NREM sleep in young adulthood encompasses about two hours of restorative sleep nightly, whereas, after the age of 30 years, NREM sleep can be less than 30 minutes by age 65 years (Cleveland Clinic, 2012). The changes in sleep stages across the lifespan indicate the important needs required of each individual age group at the time in their life, which is crucial to understanding sleep habits.

### **Circadian Rhythm**

Beyond the four phases of sleep, the sleep-wake cycle is modulated by the circadian system to maintain a consistent sleep cycle based on the time of the day. The circadian system is an intrinsic timeclock which monitors many physiological systems, including core body temperature, cortisol levels, and eating habits (Wyatt, 2019). The circadian rhythm is responsible for increasing the need and drive for sleep at nighttime and drive for wakefulness in the morning. Circadian rhythm is at its peak half-way through the night to maintain sleep consolidation until wake time. The circadian rhythm is strongly associated with sleep-homeostatic drive, which “actively drives wakefulness during the habitual waking day, helping to offset the progressive increase in sleepiness which accumulates sleep pressure across extended wakefulness”.

The circadian system is slightly longer than 24 hours and is on average a 24.2-hour cycle in adults. The body adjusts to this change daily through time cues which are also called zeitgebers (Wyatt, 2019). The most prominent zeitgeber is the light-dark cycle of the environment. For example, light during the last few hours of the typical sleep period and during the early morning moves the circadian rhythm earlier, which is known as phase advancement.

Oppositely of phase advancement, phase delay is a result of light in the evening and first half of the usual sleep period which moves the circadian rhythm later.

The circadian rhythm is responsible for many of the sleep concerns seen in much of the population due to a decrease in total sleep time as a result of working nights, jet lag, and/or lifestyle changes such as college or a new job (Cirelli, 2019). Both environmental and artificial light can be responsible for altering circadian rhythm. Environmental light is the driving factor to keep the circadian rhythm in alignment. Circadian rhythm alignment can be challenging for individuals who are blind or live in areas with limited sunlight depending on the season. The dark-light cycle is the greatest influence on the hypothalamic pacemaker, known as the suprachiasmatic nucleus, that helps regulate circadian rhythm (ASA, 2019; Cirelli, 2019).

As a result of the need to be constantly connected on cell phones, computers, and tablets, the blue light emitted from these devices can significantly influence circadian rhythm (Wyatt, 2019). Retinal circadian receptors are exceptionally sensitive to the blue light of devices, which can inhibit the action of melatonin and result in a phase delay and inability to fall asleep. As a result of the blue light's influence on circadian rhythm, recommendations include to avoid electronics at least 1-2 hours prior to bedtime.

### **Best Sleep Hygiene Practices**

Sleep hygiene has been evolving within the field of sleep medicine and was first described for the treatment of insomnia starting in the 1950's (Shulz, & Salzarulo, 2016). Initially, insomnia was treated with pharmacological therapy such as benzodiazepines. Sleep hygiene was developed after medication treatment failure, and unwanted side effects of medication. Sleep hygiene has since evolved for standard sleep health for all individuals to promote quality sleep (Shulz & Salzarulo, 2016). Best practices for sleep hygiene for adults have

been widely researched, but limited research is present regarding tips specifically the college population. With the ever-changing learning strategies and entertainment sources, more information is warranted regarding college students. The current recommendations for good sleep hygiene for adults, according to the American Sleep Association (ASA) (2019) are listed below:

- 1) Maintain a consistent sleep schedule. Go to bed at the same time and wake up at the same time daily (+/- 20 minutes).
- 2) Avoid napping to prevent difficulty initiating and maintaining sleep. Naps decrease sleep pressure and sleep debt which help initiate sleep.
- 3) Reserve your bed for sleeping only. Do not watch television, read, or lay in bed for more than 10 minutes if unable to fall asleep. Doing activities in bed causes your brain to associate being in bed with wakefulness.
- 4) Avoid caffeinated beverages at least 8 hours prior to bedtime due to the long lasting effects. If at all possible, try to only drink caffeine before noon.
- 5) Exercise every day if possible to promote continuous sleep. Try to complete exercise before 2 pm daily, as exercising later in the day can cause difficulty in initiating sleep.
- 6) Control the sleep environment. Sleep in a cool and dark room with no TV, outside noise, or distractions such as roommates, bed partners, or pets. White noise can be effective for promoting sleep.
- 7) Create a regular pre-bedtime routine with activities such as a warm shower, meditation, quiet time, and avoiding television or cell phones.
- 8) Avoid television, cell phone, or tablet use 30 minutes-1 hour prior to sleep due to the blue light activating the brain and stimulating wakefulness.



## **Barriers to Good Sleep Hygiene**

College students and nursing students have significant barriers to achieving adequate sleep hygiene behaviors, such as stressors, time management between academics and social life, schoolwork, work obligations, technology, and the variable schedule of college students.

### **Stress**

Stress is one of the key barriers to adequate sleep hygiene due to the overarching effects that stress can have on every aspect of health. Nursing students are at a higher risk of experiencing stress that negatively affects sleep hygiene due to the rigor of nursing programs and the extra commitment that is needed for practical clinical hours (Owens et al., 2017, Polivka, et al., 2019). College students are at a unique stage of their lives where stressors can be variable with academics at the core of their responsibilities. Other stressors that highly impact this unique population include financial stress of paying for college and living away from home (Wallace et al., 2017; Tarsitano, 2019). In addition, developing friendships impact stress, as both romantic and family relationships can be challenging as well as difficulties in maintaining the work-school balance. Furthermore, stressors can have a cumulative effect on college students which can result in poor sleep quantity and quality while also negatively affects mental health (Zhang et al., 2017). Stress and poor sleep hygiene are also associated with risk-taking behaviors, such as drinking alcohol, for which college students may use at a higher rate to cope with stress.

According to a qualitative focus-group of adolescent college students, key themes were identified including stress and the inability to turn their brain “off” at night (Paterson et al., 2017). The pressure for students to succeed in school, balance a social life, and work commitments significantly influence stress, along with quality and quantity of sleep. In today’s society, most individuals are programmed to always be doing something to get ahead, which can

drastically influence sleep habits. Due to the drastic increase in autonomy during the transition to college, this can greatly influence sleep and stress. Sleep quality and stressors have a strong correlation and can predispose individuals to depressive symptoms and anxiety. In a study from Lund et al. (2010), over 64% of students reported their sleep was negatively impacted by either emotional or academic stressors (Wallace et al., 2016; Lund et al., 2010). More specifically, nursing students have a significant amount of stress related to work commitments, but also clinical requirements which can result in disturbed sleep patterns. This was thought to be a result of nursing students having more work commitments of 16.3 hours per week compared to medical students work commitments of only 3.4 hours per week (Bunjo et al., 2019).

## **Time**

Changes in time allocation during college years is significantly different than the highly structured schedule of high school (Appleby, 2014). Time constraints related to extracurricular involvement, succeeding at school, developing strong friendships and relationships, and work commitments can leave minimal time for sleep. When college students are adjusting to the difference in time allocation in college, students are often unaware of the importance that sleep has on academic success and overall health (Ducharme, 2019).

Nursing students are a unique subpopulation of college students who can feel like there are not enough hours in the day to get everything done due to clinical commitments, working, and rigor of coursework. The results of a descriptive, cross-sectional study at a university with 204 participants demonstrated that working and going to school has a negative impact on sleep hygiene (Moraes dos Santos et al., 2016). Referred to the “double-journey,” in which nursing students go to class during the day and work either an evening or night shift greatly impacts health and sleep of students. In most nursing students, work is prioritized so academic

performance suffers. The results of working and attending classes have been shown to increase daytime fatigue, sleepiness, and difficulty concentrating.

Sleep is not seen as a priority in most college students due to the believed notion that allocating more time to sleep would result in missed social events and minimal perceived benefits to getting more sleep (Paterson et al., 2018). College students prioritize sleep last behind studying, social activities, and work. Individual students who perform shift work in combination with school may not see the importance of sleep on their everyday life, thus, neglecting sleep to work or finish school work which results in heavy reliance on coffee and energy drinks to replace sleep (Chiang & Arendt, 2017; Peach et al., 2017).

### **Technology**

The constant pressure to be connected to technology with endless smart phone usage through text messaging and social media is significantly affecting the sleep quantity of college students. Electronic use at bedtime can result in a multitude of concerns related to sleep hygiene including delayed sleep cycle, decrease in sleep duration, daytime sleepiness, and greater nocturnal alertness (Hershner et al., 2018). A randomized sleep intervention was performed at the University of Michigan using an online survey to undergraduate students that included a multitude of self-report tools including: the Epworth Sleepiness Scale (ESS), the Morning-Eveningness Questionnaire, and Pittsburg Sleep Quality Index (PSQI). Participants who received the sleep intervention showed an improvement in turning off their electronics earlier before bed which correlated to improved sleep quality, knowledge, and even improved depression scores after the eight-week evaluation period.

A research survey investigated sleep patterns in fifth-year medical students and third-year nursing students that identified sleep hygiene and risk factors for poor sleep. Bunjo et al. (2019)

found that 90% of the nursing and medical students used electronics every night before bed and 80% used social media right before going to bed. With most universities turning to some form of online education, whether online modules or online classes, students spend a large amount of time on the computer (Lederman, 2019).

Students are engaging with online education due to the flexibility online modalities allow in their schedule but is not necessarily shown to be their preferred way to learn in class. Students report spending late nights doing homework on their computers which can also activates nocturnal alertness and impacts sleep quality without the students even realizing the effects until the next day when experiencing increased daytime sleepiness (Bunjo et al., 2019)

Exposure to blue-light from electronics can delay normal circadian rhythm through suppressing the melatonin release to result in the body taking longer to wind-down and be able to advance through the sleep stages to enable better quality sleep (Wyatt, 2019). The activation of the reticular activating system causes the cerebral cortex stimulation preventing the bulbar synchronizing region from inducing sleep (Owens et al., 2017). Inhibition of the bulbar synchronizing region with the blue light results in sleep latency, which can further impact the many physiological changes that accompany college students. Traditional-age college students ages 18-24 years are still experiencing brain growth and development as the brain is not fully developed until age 26, which is why adequate sleep (at least eight hours) is so crucial for this age group.

### **Variable Schedule**

Research suggests the importance of maintaining a consistent sleep-wake cycle for optimal circadian rhythm functioning and maintaining appropriate physiological sleep drive (Irish et al., 2014). Significant variations in sleep schedules result in greater waking throughout

the night and inability to sleep through the night without waking. Although all the evidence reports the importance of consistent sleep-wake cycle, some variability in sleep times is tolerated by adjustments of the human body. Some variability in individual sleep schedules is important due to the importance of not going to bed until feeling sleepy to prevent insomnia symptoms.

College students are a unique population due to such variation in their daily schedules, depending on the day of the week and their class schedules (Paterson et al., 2018). Most college students do not have class every day at the same time, which usually results in different wake times and different sleep times, depending on the day of the week and individual student's social and school organizational obligations. College students have a difficult time initiating a daily routine due to variations in not only their schoolwork, but also work obligations and personal schedule. Course deadlines and exams also contribute to variable schedules and delayed sleep due to late night studying and eating.

According to Chiang & Arendt (2017), 36% of college students for a weekly average went to sleep between midnight and 2:00 A.M., whereas 36.6% went to sleep between 2:00 A.M. and 5:00 A.M on the weekends. In comparison, 82% of students awoke between 6 A.M. and 9 A.M. during the week, whereas on the weekends 72.9% of students awoke between 9 A.M and 2 P.M. This demonstrates that college students are compensating for the lack of sleep during the week and the time they went to bed during the weekends (Chiang & Arendt, 2017).

College students are experiencing sleep debt due to variability of sleep quantity and quality each night (Chiang & Arendt, 2017). Further supporting, Hershner & O' Brien (2018), report 72.6% of students do not get sufficient sleep on weeknights, which results in "catch-up" sleep on the weekends. Sleep quantity on the weekends is improved compared to the weekdays, as students report only 19.5% get insufficient sleep on the weekends. Lack of adequate sleep

results in increased daytime sleepiness; as a result, 78.2% of college students report poor sleep negatively impacting academic performance (Hershner & O'Brien, 2018). Late-night eating has also been reported to affect sleeping patterns with increased consumption of carbohydrates and sugar later in the evening which made it difficult to fall asleep (Patterson et al., 2018). Also, caffeine intake has been noted to be a barrier to good sleep hygiene when consumed later in the afternoon and evening.

Variability in college students' schedule is significantly affecting both sleep quality and quantity as outlined above. Improving sleep hygiene knowledge can impact students' efforts to create a relative daily sleep-wake cycle routine and improve sleep hygiene behaviors. A consistent sleep-wake cycle, also known as circadian rhythm is important to sleep quality to prevent cycle delays or advancements. College students have significant barriers to achieving routines and some of the barriers are not completely within their control. Ducharme (2019), states regardless of bedtime, consistent sleep-wake cycles are even more important than sleep quantity.

### **Poor Sleep Hygiene Outcomes**

Poor sleep hygiene behaviors can have serious side effects on daily functioning, mental health, physical health, and cognitive functioning. The effects of poor sleep hygiene can impact college students significantly in their day-to-day life, including increased daytime sleepiness, poor academic performance, negative effects on mental health, and poor nutrition.

### **Daytime Sleepiness**

Insufficient sleep quality and quantity can impact everyday activities due to fatigue and feeling tired all the time. A systematic review of sleep behaviors in college students completed by Owens et al. (2017) described safety concerns related to daytime sleepiness as one of the

main outcomes of poor sleep. According to Davis (2018), the cardinal sign of chronic poor sleep hygiene is daytime sleepiness and feeling “groggy.” A survey of nursing students resulted in over two-thirds of nursing students reporting poor sleep quality, and, furthermore, one-third of these students experienced excessive daytime sleepiness with utilization of the PSQI report tool (Zhang et al., 2017).

The variability in college student schedules have been shown to greatly attribute to daytime sleepiness all circling back to the importance of a consistent sleep schedule. The variation of students’ daily schedule is one of the most notable inferences to poor sleep quality and daytime sleepiness (Irish et al., 2014). College students’ variable schedules do not allow for sleep consistency which has been shown to be more conducive to academic performance (Ducharme, 2019).

One of the most noteworthy consequences of daytime sleepiness and sleep insufficiency is decreased alertness and has resulted in significant motor vehicle injuries. The increased motor vehicle accidents statistics raises significant safety concerns for the college student population (Owens et al., 2017). Young adults that have slept less than six hours were at a 21% more risk of causing an accident, while on the weekends that percentage rose to 55% of causing an accident due to sleep insufficiency (Fox, 2013).

Drowsy driving from sleep insufficiency claimed 795 deaths in 2017 in the United States (National Highway Traffic Safety Administration, 2017). According to Bunjo et al. (2019) poor sleep hygiene in nursing and medical students predisposes them to hazardous driving behaviors. Reports of this survey demonstrated that 16% of nursing students and 9% of medical students reported falling asleep while driving to or from clinical in the last month. Additionally, 34% of nursing students and 32% of medical students reported a near miss accident in relation to driving

to clinical (Bunjo et. al., 2019). These statistics are concerning regarding the amount of stress and lack of sleep the students get, which are both significantly affecting public and individual safety.

### **Academic Performance**

Sleep hygiene is positively linked to academic performance, whereas the better the college students' sleep hygiene, the better their grade point average (GPA). The link between poor sleep hygiene and traditional college students' academic performance indicates that a lack of quality and quantity of sleep can lead to decreased concentration, fatigue, and poorer grades (Owens et al., 2017). Sleep insufficiency can interfere with consolidation of information learned and decrease in memory capabilities resulting in poor academic performance (Mattos et al., 2016).

Although the link of poorer GPA and sleep has been inconsistent, a study by Kelly et al. (2001) demonstrated a link with a study of 147 undergraduate students. Students who reported sleeping less than six hours in a day had a 0.5 lower GPA compared to students who sleep nine plus hours a night (Chiang & Arendt, 2017). The surveys administered to college students at a university in the Midwest focused on actual sleep quantity compared to perceived sleep needs. Individuals who slept less than their perceived needs had a GPA of 2.9 +/- 0.7 and students who slept the amount of the perceived needs had a GPA of 3.2 +/- 0.6. Another significant finding showed that delayed and irregular sleep shows a GPA of 3.1 +/- 0.7, whereas a regular sleep cycle maintained a higher GPA of 3.6 +/- 0.5. Researchers were able to correlate that every individual has unique sleep needs and students who achieve their perceived needs are more academically successful, as reflected by their GPA (Chiang & Arendt, 2017). Connecting poor



sleep hygiene to underperformance on exams and assignments has also been linked to mental health concerns, such as anxiety and depression (Gurera, 2017).

## **Mental Health**

The traditional college aged student is at a pivotal point in his or her life in which he or she is faced with noteworthy life transitions and new independence and responsibility. During these years, the student experiences significant changes with emotional growth and brain development up until the age of 25-26 years; the same years for which has been shown to influence sleep quality. Adequate sleep, with a goal of 8-9 hours is optimal for further brain development in the college student population (Owens et al., 2017).

Poor sleep hygiene puts especially vulnerable college students at risk for depression due to many life transitions and the perceived and researched relationship between sleep and depression. The strong correlation is that depressed students have sleep concerns and individuals having sleep difficulties experience depression symptoms more frequently than non-clinically diagnosed students. Individuals who experience high levels of ongoing stress are at a high risk for depression and sleep difficulties (Wallace et al., 2017). In a pre-post design study, 51.9% of students met criteria for diagnosis of insomnia based on DSM-5 standards (Schlarb et al., 2017). These same students also had mental health concerns including depression, anxiety, obsessive-compulsive disorder, and chronic fatigue.

Mental health concerns such as depression and anxiety are prevalent in college students due to stress and the many life changes that happen rapidly (Owens et al., 2017). Anxiety has been linked to poor sleep quantity and quality due to low self-efficacy and translates to poor academic performance (Gurera, 2018). Most high trait anxiety manifests itself in restlessness when trying to initiate sleep due to worrying. Relating high anxiety to poor sleep quality suggests

that sleep hygiene education would be beneficial to alleviate some anxiety when initiating sleep, but also proper treatment of anxiety can improve sleep initiation.

Some mental health concerns will be manifested by poor behavioral responses, such as drinking alcohol, smoking, drug use, and risky sexual activity, all of which are not appropriate coping mechanisms (Owens et al., 2017). A multivariate analysis from the American College Health Association-National College Health Assessment II Database was utilized to obtain information on college students regarding mental health and addictive behaviors such as smoking and binge drinking (Boehm et al., 2016). The database supported that 15.8% of students have been diagnosed with anxiety, 13.1% with depression, and 20% report that their academics are adversely affected by poor sleep. Results of the analysis completed by Boehm et al. (2016), validated that individuals with anxiety or depression are more likely to use tobacco daily, which contributes to poor sleep hygiene.

An eight-week sleep intervention program examined sleeping patterns and effectiveness of a targeted sleep intervention with use of self-report tools and increased validity by using an intervention group and control group (Hershner & O'Brien, 2018). Results indicated improvement in sleep quality through the PSQI, depression with use of the PHQ-9 and improvement of sleep hygiene with the use of the Sleep Health Index (SHI). The SHI, created by the National Sleep Association (NSA), can be used to define population sleep health. The participants who received the intervention showed overall improvement related to depression, sleep quality and knowledge following the eight-week personalized online intervention created by the University of Michigan through a website, [SleepToStayAwake.org](http://SleepToStayAwake.org). These results demonstrate the relationship of quality sleep to overall mental health. The success of this online education module demonstrates the utility of online education in the college student population.

## **Poor Nutrition**

Poor nutrition and obesity have been suggested to be related to poor sleep quality. Many college students are unaware of the importance of sleep and the biological and physiological processes that occur with sleep to help regulate the body (Wallace et al., 2017). Students are unaware of the risk that poor sleep hygiene habits have and can lead to nutritional concerns, such as overeating. There has been a determined relationship that individuals who get less than the recommended 7-9 hours of sleep, are more likely to be overweight or obese. Sleep quality and quantity affects hormonal levels such as ghrelin and leptin levels that impact satiety and overall nutrition. Although there is a correlation, the lack of sleep directly affecting obesity risk is not clearly defined due to other factors in college students' lives (Wallace et al., 2017).

College students are replacing sleep with sugary caffeinated beverages and high carbohydrate foods to stay awake (Owens et al., 2019; Peach & Gaultney, 2016). College students who ate a majority of their meals away from home on average did not meet the CDC's recommendation of appropriate fruit and vegetable intake resulting in unhealthy options. Students who were employed, were a member of a fraternity or sorority, and ate most of their meals away from their home consumed more fast food and sugar-sweetened beverages (Peach & Gaultney, 2016). Lack of understanding of healthy food choices and importance of making food at home is not well understood by most college students which can lead to weight gain with no parental guidance on food intake.

Sleep difficulties and stress can attribute to weight concerns and possible overeating, especially late at night. The American Psychiatric Association identified night eating syndrome (NES) as a disordered eating pattern which is characterized as "recurrent episodes of night eating as manifested by eating after awakening from sleep or by excessive food consumption after the

evening meal” (Allison et al., 2010; Yahia et al., 2017). NES is accepted in the medical field in the DSM-5. College students are especially at risk for NES due to stress, poor sleep hygiene, and links to depression. Some studies reveal a positive correlation between NES and higher body mass index (BMI), but not all studies represent this due to other factors including sleep patterns. Disordered sleep patterns are also linked to higher BMI and excessive caloric intake.

After review of a cross-sectional survey at Central Michigan University, anthropometric measurements were obtained as well as self-report surveys including the PSQI and Night Eating Diagnostic Questionnaire (NEDQ) (Yahia et. al., 2017). A PSQI score of greater than six indicates some aspect of sleep dysfunction and poor sleep quality. Results demonstrated students who presented with any symptoms of NES self-reported a PSQI score of 6.7 +/- .41 in comparison to remaining students 5.6 +/- 2.6. Students with NES symptoms reported less hours of sleep per night (7.03 +/- 1.12 hours) compared to other students (7.28 +/- 1.02 hours). The results of this survey showed no relationship between BMI and NES symptoms but was also noted that the symptoms of night eating syndrome take a prolonged amount of time to cause weight gain(Yahia et. al., 2017). Although there is no relationship with BMI and NES symptoms, there was a positive correlation between NES symptoms and poor sleep quantity and quality.

Although sleep hygiene and nutritional intake/obesity does not have a well-established relationship due to the difficulty of correlating poor sleep in college students to poor nutrition due to all the other variables that come with college students. Through a descriptive, cross-sectional study, further evidence has demonstrated that individual variations in every student’s bioecological makeup is an important factor related to weight behaviors and nutrition (Owens et. al., 2019).

## **Tools/Interventions**

This PIP used two tools to evaluate nursing student's sleep hygiene habits. The Pittsburgh Sleep Quality Index (PSQI) and Sleep Hygiene Practice Scale (SHPS) were selected due to the widespread use of these tools in the literature reviewed, as well as the utility in the traditional-aged college student population. Current literature focused on sleep education has been targeted to the high school population with in-classroom interventions. The sleep education was focused on increasing knowledge, but very limited research was available using validated tools on sleep hygiene behaviors (Hershner & O'Brien, 2018). After review of previous studies, only two of 12 sleep education programs focused on college students. College students and high school students have very different lifestyles and needs, thus, programs effective for high school students will not necessarily be effective in the college student population.

Following pre-surveys, sleep logs were utilized to monitor nightly sleep hours, amount of times waking, and stress during the day for four weeks. If students honestly record sleeping habits, self-reported sleep hours can be a very accurate method to monitor sleep trends. When focusing on test-retest validity and reliability of the PSQI related to primary insomnia, the PSQI demonstrates validity of 0.87 with high correlation to sleep log results. The specificity of 84.4 and sensitivity of 98.7 of PSQI demonstrates a good indicator for sleep quality and related factors (Backhaus, et al., 2002). The PSQI was chosen due to the wide range of repeated use and psychometric properties. After examining the psychometrics of the PSQI on two separate studies:

“The PSQI demonstrated moderate convergent validity compared to measures of insomnia and fatigue and good divergent validity with measures of daytime sleepiness, circadian phase preference, and alcohol and marijuana use. The PSQI demonstrated

considerable overlap with depression, anxiety, and perceived stress. Therefore, caution should be used with interpretation (Dietch, et al., 2016).”

The Sleep Hygiene Practices Scale (SHPS) was utilized to analyze the possible negative factors that can influence sleep. There are four domains the SHPS looks to examine including: arousal-related behaviors, sleep scheduling/timing, eating/drinking behavior and sleep environment. The SHPS looks to examine the behaviors that influence sleep and associated improvements possible. According to Yang et al., in 2010 overall scores that are indicative of difficulty with sleep hygiene are scores 75 and above; whereas adequate sleep hygiene is associated with scores 69 and below.

The intervention proposed to generate behavioral change included an online Sleep Education Module (SEM) on sleep hygiene specifically for college nursing students. The SEM discussed the importance of sleep, the poor outcomes that can result from poor sleep quality, and applicable behavioral modifications that each individual can do to improve sleep. Heidi Saarinen, a NDSU DNP faculty and a practicing provider in Sleep Medicine for the last 10 years, guided and presented the SEM for this PIP based on the literature review aimed for college students.

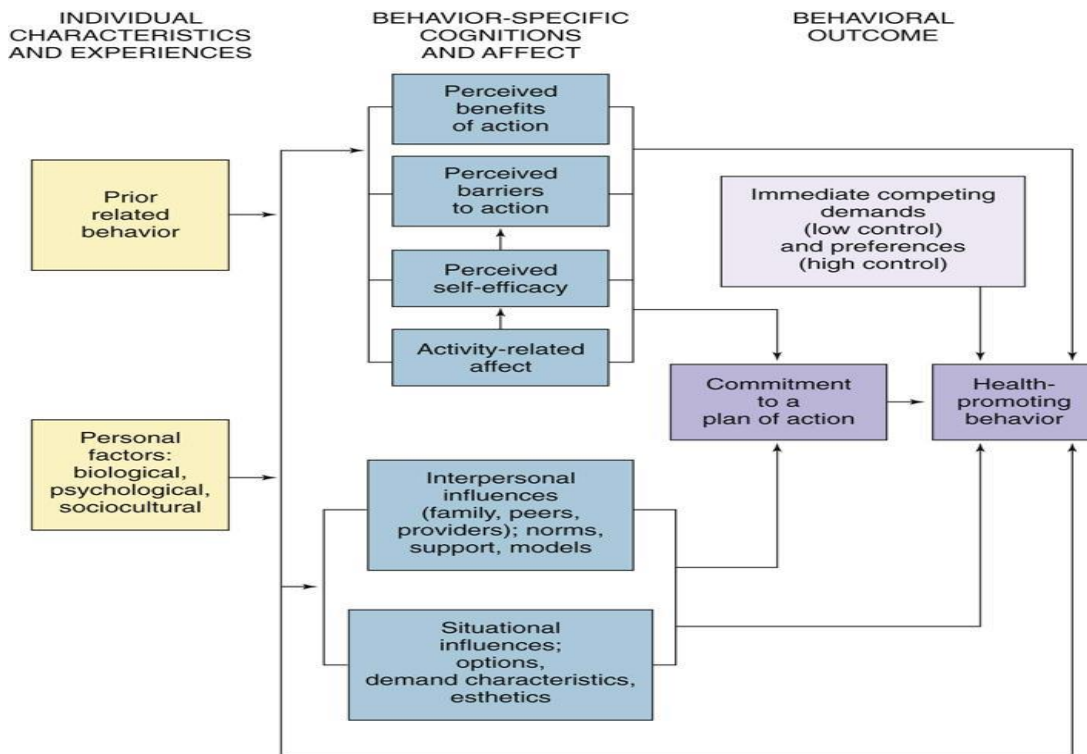
## **Theoretical Framework**

### **Health Promotion Model**

The Health Promotion Model (HPM) developed by Nola J. Pender in 1982 and further revised in 1996 was selected to guide this PIP. Due to the wide variety of the nursing student population, the HPM identifies individual experiences and factors these into behaviors and thought processes to impact proposed outcomes. The HPM foundation focuses on the dynamic and constantly changing state of individual health.

**Figure 5**

*Health Promotion Model*



Pender's model also focuses on the premises of every aspect of an individual's environment significantly impacting health and wellness which can, in this project, significantly influence sleep hygiene. The HPM identifies three major areas including 1) individual biological, psychological, and sociocultural characteristics; 2) behavioral attitudes and 3) behavioral outcomes. One important aspect of the HPM to consider when utilizing this model for the PIP is the seven assumptions that come with using this model. The seven assumptions are as listed below and how they relate to the PIP:

1. Persons seek to create conditions of living through which they can express their unique human health potential (Pender, pg. 5, 2011). An example pertaining to sleep, is that each nursing student can create individualized sleep conditions to express desires for personal commitments, school, and/or work schedules to reflect his or her own values.

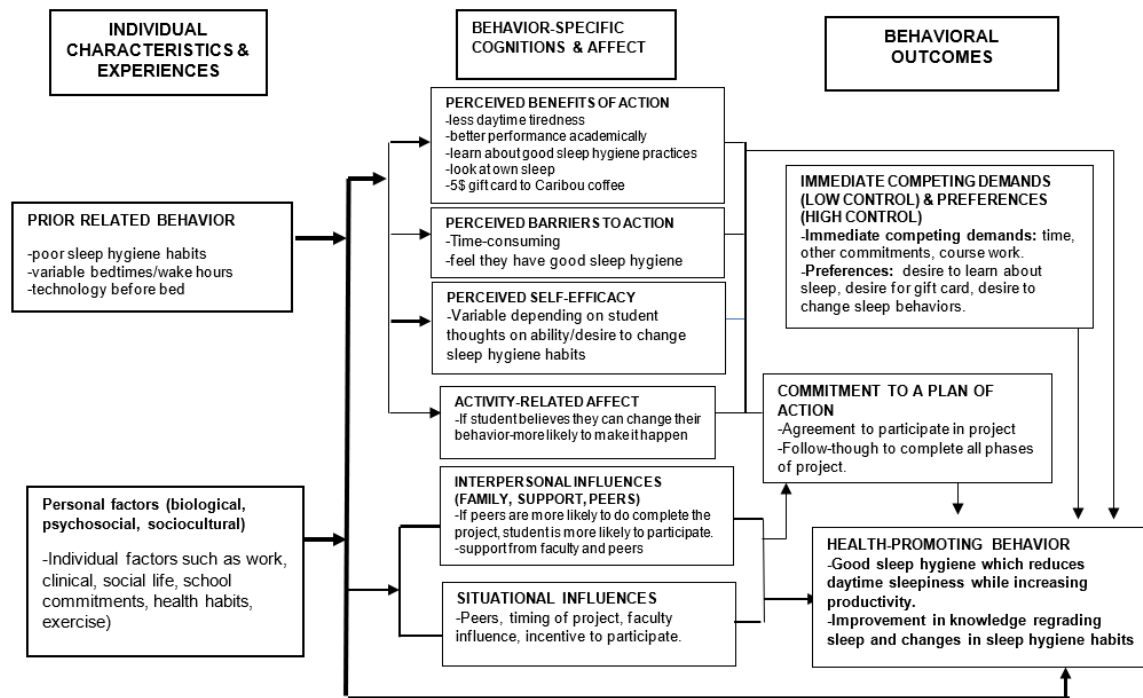
2. Persons have the capacity for reflective self-awareness, including assessment of their own competencies (Pender, pg. 5, 2011). An example is that each individual can self-reflect on the ability/need to change sleep behaviors by recognizing their own sleep patterns and needs.
3. Persons value growth in directions viewed as positive and attempt to achieve a personally acceptable balance between change and stability (Pender, pg. 5, 2011). Interventions of this project targeted why sleep hygiene and sleep routines are important and to ideally impact a positive change in behavior.
4. Individuals seek to actively regulate their own behavior (Pender, pg. 5, 2011). Nursing students were able to voluntarily join the study and be self-motivated to complete all phases and view the online SEM.
5. Individuals in all their biopsychosocial complexity interact with the environment, progressively transforming the environment and being transformed over time (Pender, pg. 5, 2011). Nursing students are learning about important aspects to health and wellness while making their own sleep decisions.
6. Health professionals constitute a part of the interpersonal environment, which exerts influence on persons throughout their lifespan (Pender, pg. 5, 2011). Using the NP role to provide education and health promotion can positively impact student behavior with the online SEM on sleep hygiene.
7. Self-initiated reconfiguration of person-environment interactive patterns is essential to behavior change (Pender, pg. 5, 2011). While providing education is a crucial part of success, the individual must internalize the information, apply the information to



himself/herself and want to make a behavioral change. Incentive helped the participant determine the education was worth his/her time and be motivated to make a change.

**Figure 6**

*Health Promotion Model Regarding Sleep Hygiene*



The HPM model focuses on preventing a negative impact on the health of individuals by focusing on their behavior and choices that influence their everyday life. The model is a respectable choice to guiding the PIP to modify nursing students' sleep habits, as the intervention focused on actions and barriers to promote adequate sleep hygiene behaviors. The online module enabled students to view the education at a time when each student is willing and has the time to focus on the content, sought out learning strategies to possibly regulate his or her own behaviors, and potentially influence his or her health throughout nursing school and the lifespan. The sleep logs and surveys also helped students become more self-aware of their own sleep habits in order to make decisions to impact their sleep behaviors in the future.

The health promotion model focuses on the reciprocal relationship between the individual and their environment and the premise that health and illness occurs on a continuum (Petiprin, 2016). The goal of using the HPM for this PIP was to positively alter NDSU nursing students' sleep hygiene behaviors to move them closer to health through even a minor behavioral modification related to sleep. Improvements in sleep hygiene can further benefit sleep overall during nursing school and overall health outcomes over the life continuum.

## **CHAPTER THREE. METHODS**

### **Evidence-Based Practice Model**

#### **Iowa Model of Evidence-Based Practice**

The Iowa Model of evidence-based practice was selected as the framework for guiding the PIP due to the step by step approach to creating a high-quality improvement to a population using evidence-based research. Utilizing the Iowa model in combination with the health promotion theory, a PIP was created to increase the body of evidence in nursing students' sleep hygiene.

#### ***Step 1: Topic Selection***

Selecting a topic for this PIP was completed after consultation with multiple advanced practice providers, nursing faculty, and self-evaluation of interests and a clinically identified concern which can be improved through research and interventions. A systematic review of literature indicated a significant need for improvement of quality sleep in the college student population due to a knowledge gap related to the vital functions of sleep, importance of prioritizing sleep, and the time constraints that come with being a student while still maintaining a social life.

#### ***Step 2: Forming a Team***

The co-investigator developed a committee team consisting of a Doctor of Nursing Practice (DNP) faculty chair, two DNP faculty, and a graduate appointee specializing in sleep research. The committee was an important aspect of the PIP during the planning, implementation, and evaluation phases. The faculty chair was a DNP faculty member at NDSU, practicing as a provider with ten years of experience in Sleep Medicine and seven years in academia at NDSU. One of the DNP faculty on the committee was a practicing NP with a

specific interest in health promotion and the college student population. The third member of the committee was a faculty member with a Ph.D. in Public Health and a focus on adolescent health. The graduate appointee member had her Ph.D. in Psychology and specializes in the Psychology of Sleep with multiple publications.

### ***Step 3 and 4: Retrieval and Grading of the Evidence***

Collection, systematic review, and thorough evaluation of the literature related to sleep physiology, factors influencing sleep, and the unique sub-group of college students' sleep patterns was completed through utilization of academic databases and utilization of UpToDate. All articles and resources were chosen based on credibility and applying evidence with a preference for literature within the last 5 year of publication.

The literature guided selection of evaluation tools and interventions to best suit the nursing student population. Pre-survey, post-survey, and sleep logs were the selected evaluation tools to gather information regarding sleep habits through the use of online Qualtrics surveys for efficiency of data collection and ease of completion for participants. The time frame of four weeks was selected for data collection to be completed over a six week period to be feasible for students during the COVID-19 pandemic. After the first two weeks, the SEM was sent to the participants to increase their awareness and knowledge regarding sleep hygiene in order to positively influence sleep health behaviors. Sleep log tracking continued the following two weeks after the SEM to assess if sleep hygiene habits improved. The incentive for nursing students included a chance to win one of thirty \$5 gift cards to Caribou Coffee.

### ***Step 5 and 6: Developing and Implementing Evidence-Based Education***

Development and implementation of an evidence-based education module focusing on improving nursing students' sleep hygiene can be best received and utilized when the education

is flexible due to students' busy schedules. Providing incentive for students to participate in this project helped to motivate completion of all phases by students. The nursing students had to participate in the entirety of the study to be eligible to be picked as a winner of the random drawings. After reviewing the literature, utilizing an online education module in addition to studying sleep habits with technology and surveys were recommended to improve sleep hygiene amongst the nursing student population.

The PIP entailed a pre- and post-survey of sleep hygiene perceived knowledge, awareness, demographic information, and sleep hygiene practices before and after implementation of a developed online educational PowerPoint including sleep education and sleep hygiene interventions. Initial evaluation through an online survey of demographic data, utilized the PSQI and the SHPS, was completed by NDSU undergraduate BSN pre-licensure nursing students. For purposes of this PIP, the NDSU undergraduate pre-licensure nursing students will be referred to as "nursing students" throughout from this point on. There were six phases to the completion of this PIP which occurred over 28 days in the month of September-October 2020. This time frame was selected due to the beginning of the school year with the goal to encourage participation when school stress and burnout was possibly lower.

Phase 1: Recruitment of participants was through email communication and nursing faculty communication to students. The co-investigator initially planned to go to nursing students' classrooms to discuss the project if faculty would be receptive to this recruitment strategy but due to COVID-19 and virtual learning was not completed. There was an incentive offered for participants who completed all phases of the project including a chance to win one of thirty \$5 Caribou Coffee gift cards for students who participated in this PIP to help motivate

students. The nursing students were required to participate in the entirety of the study to be selected as a potential winner of the random drawings.

Phase 2: The second phase involved obtaining electronic informed consent prior to the entrance survey. The pre-survey includes the PSQI, SHPS, and demographic data administered online with the use of Qualtrics, completion took about 10 minutes, and participants had about 5 days to complete. Each participant used the last 4 digits of their student ID when entering information to maintain confidentiality. Students were also asked to fill out 14 days of online sleep logs through Qualtrics as described above. A follow-up evaluation regarding sleep habits, hygiene, and knowledge was administered online to the same population. The post-survey was used to evaluate effectiveness of the online module and any self-reported positive changes to nursing student sleep habits.

Phase 3: The third phase included the online SEM which did not take longer than 15 minutes and must have been completed/reviewed to be eligible for the incentive. The online SEM was embedded within Qualtrics to verify participant completion. Nursing students completed an online SEM regarding physiology of sleep, importance of sleep, and interventions to improve sleep hygiene.

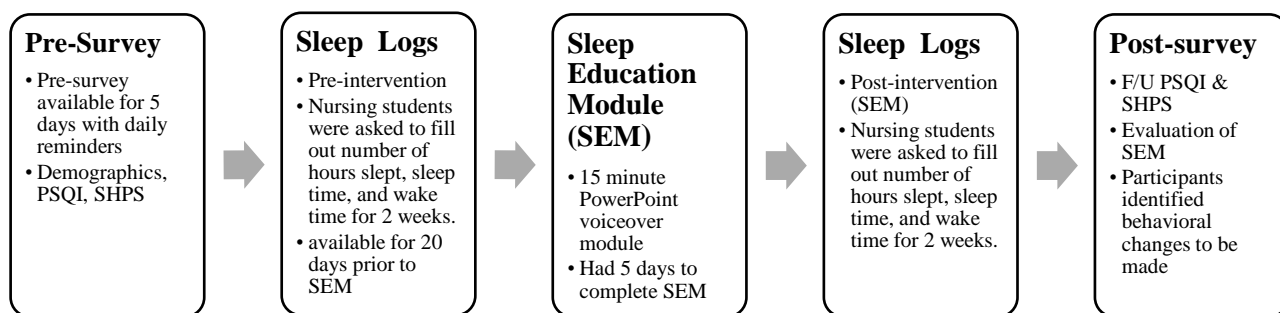
Phase 4: After completion of the online SEM, participants completed post-surveys, including a repeat PSQI, SHPS, sleep habits, hygiene, and a survey regarding the effectiveness of the online SEM. In addition, participants completed post-intervention sleep logs through Qualtrics over roughly five days. Nursing students were required to track 28 days of sleep logs had a total of 6 weeks to complete all components.

Phase 5: After all surveys were completed, the gift cards were awarded to participants who completed all phases, as there were only 21 students who completed all phases. Random

selection of participants through Qualtrics was not needed since only 21 of the 30 anticipated number of students. Following the final phase of the PIP, all students and faculty were to have access through the NDSU library upon completion of project and following graduation. The results were also made available by request prior to that time to anyone requesting.

**Figure 7**

*Project Design*



**Step 7: Evaluation**

Each PIP objective was evaluated with a variety of measures. One evaluation technique included pre- and post-intervention surveys using the PSQI and SHPS as a guide as well as collection of demographic data. The goal of the systematic review of collected data was to determine the barriers to sleep hygiene and if an online education module would effectively lead to sleep practice improvements in college nursing students.

Listed below are the practice improvement objectives and how each objective was measured with the PSQI and SHPS:

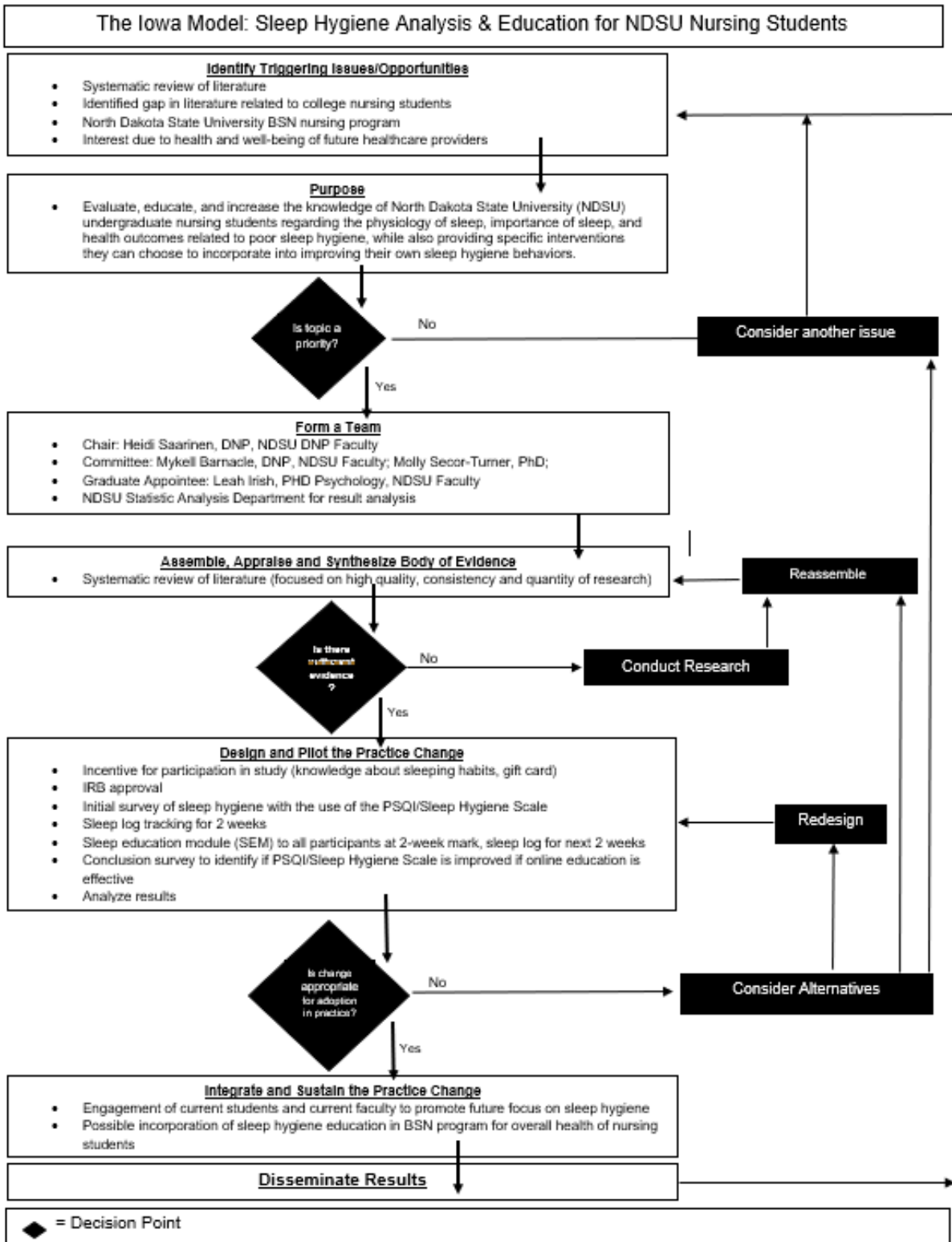
1. Identify sleep habits and patterns of the NDSU undergraduate BSN, pre-licensure nursing student population over the course of the fall 2020 semester.
  - a. Sleep habits and patterns were identified from the daily sleep logs, PSQI, and SHPS self-reported surveys.

2. Increase perceived knowledge regarding sleep importance and ways to improve sleep quality and quantity in the nursing students after completion of the online SEM.
  - a. Post-survey question two inquired if students felt “Increased perceived knowledge of how to improve sleep hygiene habits?”
3. Nursing students will improve self-reported sleep hygiene practices upon completion of the online SEM.
  - a. The PSQI and SHPS would determine if scores demonstrated positive change.
  - b. Post-survey questions three, four, and seven indicated if nursing students felt their sleep hygiene habits improved.
  - c. Sleep logs indicated any possible changes in quality and quantity of sleep evident by sleep patterns and self-report of feelings of state upon awakening following the SEM educational module.
  - d. Determine possible changes in sleep hygiene practices prior to intervention compared to post-intervention through self-reported sleep logs and questions three and four regarding intent to change in post-survey.
4. Evaluate if an online education modality is an effective form of education in the college nursing student population.
  - a. Comparison of PSQI and SHPS of pre- and post-survey results to verify if there was a positive change.
  - b. Evaluate if the SEM module met the objectives of the project, was easy to understand, helpful to each participant, and was able to keep the attention of the participant.



**Figure 8**

*Sleep Hygiene implementation with use of Iowa Model*



## **Setting**

The setting for the self-reported surveys took place at NDSU, a land-grant university at both Fargo, ND and Bismarck, ND campuses. Between the two campus sites, there was a total enrollment of college students was 10,555 undergraduate students with 50.2% of students identifying as male and 49.8% of the student population identifying as female for the fall of 2020. As of fall 2020, 7,880 students applied for attendance with 7,415 students accepted and 2,307 students ultimately enroll at NDSU. Of note, over 42.4% of the undergraduate students are North Dakota State residents while 40.8% of students from Minnesota with reciprocity. Within the college of health professions, there are 1,461 undergraduate students with 566 undergraduate, pre-licensure, Bachelor of Science Nursing students in the 2020-2021 academic year (NDSU, 2020).

Students were asked to complete the surveys online, which could have occurred in any potential location; online access and use could have included the NDSU campus computer areas but most likely occurred from the nursing students' home settings ranging from dorms to apartments to houses. One advantage to the online modality was the flexibility for participants to complete the surveys and module wherever worked best for each individual; deadlines were set within a range and all project steps could be completed online through Qualtrics for the surveys, education module, and email communication.

## **Sample/Recruitment of Participants**

The goal sample participants included NDSU nursing students enrolled in the BSN, pre-licensure nursing program. All 566 possible student participants across the three cohorts (Sophomores, Juniors, and Seniors) between Fargo and Bismarck, were asked to voluntarily participate during a 2-month window during the fall 2020 semester. The goal was to target

Sophomore, Junior, and Senior students to compare the different sleep hygiene habits and patterns of each class and the nursing population as a whole. Recruitment of the sample included email communication with explanation of the expectations, time commitments, as well as how time will be compensated through the BSN nursing department listserv. Further recruitment occurred through nursing faculty willing to promote the project and encouraged students to participate. Reminder e-mails were sent to the students periodically to encourage maximum participation for those indicating willingness to participate.

Inclusion criteria for selecting participants included: NDSU nursing student, enrolled in the BSN pre-licensure program, a Sophomore, Junior, or Senior level standing in the nursing program, regular computer access, and any identified gender was applicable. Exclusion criteria included: RN to BSN students, Licensed Practical Nurse (LPN) to BSN students, students not currently enrolled in the nursing program, pre-nursing students, anyone under the age of 18 and non-NDSU nursing students.

### **Protection of Human Subjects**

The participants of the proposed project were informed of the benefits and minimal risks, and all individuals participating in the project were voluntarily consenting and could withdraw from the study at any time without need for explanation or penalty. All participants were fluent in English, as the program teaches in English, and no minority populations, such as pregnant women were purposefully recruited. All participants were adults over 18 years of age. Participants indicated online consent after being sent the link to the surveys via Qualtrics through his/her e-mail. By clicking to “proceed to the survey” he or she gave consent. The consent disclosed the purpose, risks/benefits, and required time commitment, and primary and co-investigator information. All collected data was stored on a locked computer with single access

by the co-investigator. All personal identifying information was removed from the data by the co-investigator prior to recruiting statistical counseling from NDSU through use of the last four digits of their phone number for identification purposes.

Demographic information was collected such as age, year in the nursing program, potential stressors, exercise, and time commitments via online surveys with Qualtrics. There was a potential for loss of anonymity within the class cohorts from their own discussions but was viewed as minor risk and would have been volunteered by the participant.

Benefits to participation were discussed with all potential participants including:

1. Improved perceived knowledge.
2. Increased awareness of own habits.
3. Interventions to improve sleep behaviors that could improve nursing GPA/learning in general, coping skills, and overall health in nursing school and potentially lifelong.
4. Potential incentive by being entered into a random drawing for one of thirty \$5 gift cards to Caribou Coffee on campus.

Discussion of the risks of this study were also discussed with all participants, which could have included:

1. Possible anxiety due to time commitments from participating in the study.
2. Possible stress due to learning about the consequences of poor or decreased amounts of sleep.

### **Institutional Review Board Approval**

An application was submitted to the NDSU university institutional review board (IRB) for approval of primary research, exempt category three. Although this PIP's goal was to see a change in population behavior, the extensive literature review that was performed indicated the

need for further validation of evidence. The PIP was focused on improving health outcomes through practice improvement and specifically the impact the Nurse Practitioner role can have on promoting health and preventing disease in the NDSU nursing student population. This project qualified for category three exemption, as stated,

“benign behavioral interventions: in conjunction with the collection of information from an adult subject through verbal or written responses (including data entry) or audiovisual recording if the subject prospectively agrees to the intervention and information collection and at least one of the following criteria is met:

A) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;

(B) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or

(C) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects (North Dakota State University [NDSU] Institutional Review Board [IRB] protocol, 2019).”

The proposed benign behavioral intervention included the participants completing corresponding sleep logs and surveys before and after the intervention of the online SEM. The project was implemented following IRB approval.

## Interventions

Nursing students completed the PSQI and SHPS scales to determine baseline sleep hygiene habits. The two instruments and entry data were proposed to take no longer than 10 minutes. After the first two weeks, participants were asked to complete the online module that was anticipated to take no longer than 15-20 minutes. Following completion of the online module, participants completed sleep logs for an additional two weeks before taking the post-survey that was anticipated to take three to five minutes.

The participants completed the pre-survey, filled out sleep logs for two weeks, completed the online SEM, completed sleep logs for an additional two weeks, and finally completed post-surveys. Although some nursing students might have already had adequate sleep hygiene habits, the online SEM could still possibly have provided further benefit to all nursing students.

## Project Timeline

**Table 1**

*Project Implementation Plan*

Completion Date	Pre-implementation	Implementation	Evaluation
April 2019	Met with key stakeholders and project chair		
October-November 2019	Systematic review of literature and completion of literature review		
February 2020	Develop Dissertation proposal plan		
March 2020	NDSU proposal meeting with committee		
August 2020	Obtain IRB approval from NDSU		
September 2020		Send out emails to goal population & faculty to determine participation	
September 2020		Start implementation: Administer Pre-intervention survey & sleep logs	
September 2020-October 2020		Initiate four-week sleep diary intervention, with sleep education module at 2 weeks	
October 2020		Administer Post-intervention survey	
November 2020-January 2021			Statistical & Survey analysis
February 2021			Final defense & Disseminate Results

## Project Resources

For this PIP to be successful, there were five key resources needed. The need and feasibility of obtaining these resources was discussed with the chair and committee prior to the project design and literature review to ensure project could be successfully accomplished from a resource standpoint.

**Table 2**

### *Resources*

Resource Needed	Resource Provider	Rationale
Incentive for participation	Co-investigator	Incentive needed for a significant sample size of NDSU nursing students due to the time commitment.  Incentive of a chance to win one of thirty \$5 Caribou Coffee gift cards.
Qualtrics Survey Service	NDSU; no cost.	Able to email the Qualtrics survey out to students and it is an efficient way to reach a large population and user friendly making it easy to fill out.
Education Module	Heidi Saarinen, DNP in Sleep Medicine , NDSU faculty (no cost)	Provide a PowerPoint presentation that will be sent via email to NDSU nursing students for review and to improve knowledge regarding good sleep hygiene after pre-survey.
Statistical counseling for analysis of data	NDSU IT department & college of Statistics (no cost)	Analyze collected data and allow accurate dissemination of results of practice improvement project.

## Evaluation

### Objective One

Objective one was to identify sleep habits and patterns of the pre-licensure BSN nursing student population at NDSU over the course of the fall 2020 semester. To evaluate this objective, nursing student baseline scores from the PSQI, SHPS, and daily sleep logs were compiled using Qualtrics technology. Sleep log patterns were evaluated through trends of sleeping patterns of all nursing cohorts/students as a whole.

All PSQI and SHPS scores were compiled and evaluated utilizing central tendencies to observe for averages and distributions between cohorts and the nursing students as a whole using Qualtrics technology. The PSQI score interpretations were based off of a number value system with a score key to calculate seven separate sub scores ranging from “0-3”. Each sub-score was then added together to yield an overall score that ranged from “0-21”. An overall score of “5” or greater indicated poor sleep quality, with higher scores indicating even worse sleep quality. The SHPS score interpretation was based off a 28-question survey regarding sleep habits with a rating score of one through six. The rating score was as follows: “1-never; 2-rarely; 3-occasionally; 4: sometimes; 5: frequently; 6: always.” Each score from each question was added together, for a total possible score out of 168. The higher the score indicated worse sleep hygiene habits. The lower the score on the 30-question survey indicated more favorable sleep hygiene behaviors.

### **Objective Two**

Objective two was to have participants demonstrate a perceived increase in knowledge regarding sleep importance and ways to improve sleep quality and quantity in the pre-licensure bachelor of science in nursing students at NDSU after completion of the online SEM. Objective two was evaluated through the post-survey question “Did you feel an increase in perceived knowledge of how to improve sleep hygiene habits following the SEM?” Evaluation occurred by participants also noting examples of ways to improve their sleep hygiene behaviors which could further indicate improved perceived knowledge regarding sleep.

### **Objective Three**

The third objective was that “pre-licensure BSN NDSU nursing students will have a self-reported improvement in sleep hygiene practices with completion of the online SEM” to show



evidence of behavior modification/impact on personal sleep habits. The third objective focused on behavior modification of sleep habits with the comparison between pre- and post-surveys, sleep logs, and the post-survey of the SEM. A change in behavior was to be reflected by the PSQI & SHPS surveys having changed scores within the post-survey and tracking of sleep patterns. The post-survey included an additional question regarding self-report of sleep hygiene habits and perceptions regarding improved sleep.

Behavioral change could also be possibly evident comparison of sleep logs before and after the SEM for quality and quantity of sleep before and after the educational intervention. The sleep patterns and self-report of perceptions regarding sleep, along with post-scores of the PSQI and SHPS, were also utilized to further evaluate the objective.

#### **Objective Four**

The fourth objective was to “evaluate the online SEM for future use in the undergraduate BSN nursing student population.” The fourth objective was evaluated by comparison of pre- and post-PSQI and SHPS scores to determine if there was a positive change in behavior, sleep quality, and/or sleep quantity. Questions in the post-SEM survey included evaluation of the SEM regarding if the module was helpful with sleep hygiene habits and if the module was able to keep the participants’ attention. This objective was further evaluated regarding questioning if participants had suggestions to the online SEM. The post-survey allowed participants to identify suggestion to improve the online module.

#### **Data Collection and Analysis**

Data collection occurred with a few different methods including online surveys through Qualtrics, and online sleep log data of student sleep hours. Email communication was utilized to communicate with participants and ensure the completion of the online educational module and

surveys for accountability. Data collection also occurred in different phases throughout the project.

The participants initially consented to participate in the study through online informed consent and, upon accepting the potential risks and benefits, were directed to the online pre-survey on Qualtrics. The participants completed the sleep logs on Qualtrics for 14 days. Following the 14 days of sleep logs, nursing students were instructed to complete the online educational module and complete the sleep logs nightly for an additional 14 days with Qualtrics. After the 28 days of utilizing the sleep logs, the nursing students completed the post-intervention survey through Qualtrics.

Statistical analysis of the collected data occurred with the assistance of a statistician at NDSU. Analysis also occurred using percentages and identification in the main patterns and themes of sleep logs in NDSU nursing students. Average number of hours slept was identified as well as barriers to adequate sleep hygiene in the nursing student population.

**Table 3**

*Objective Measurements Using SAS Technology*

Objective	Description
Objective One	Mean, median, & standard deviation for PSQI & SHPS Mean number of hours of sleep/night Theme identification in post-survey regarding sleep hygiene
Objective Two	Chi-Square test
Objective Three	Paired t-test regarding sleep hours pre- & post- SEM P-value for statistical analysis Chi-Square test for intent to change sleep hygiene behaviors Identified intended sleep hygiene habits through participant direct write in. Chi-Square test of feeling well rested after project Identified barriers to good sleep from participant write-in
Objective Four	Direct survey of SEM attention and evaluation

**Data Confidentiality**

The data collected remained confidential with the use of the last four digits of their student ID number for identifying purposes to track of the project data. The data remained

confidential with a username and password protected Qualtrics service and only accessed on a single user, password protected computer by the co-investigator.

## **CHAPTER 4. RESULTS**

The primary goal of this PIP was to assess college nursing students' sleep hygiene and provide an educational module to increase students' perceived knowledge regarding sleep hygiene. Baseline pre-surveys were sent out to all nursing students in Fargo and Bismarck for a five-day timeframe and were asked to obtain two weeks of daily sleep logs. The SEM was then distributed on day 14 and was available for five days for completion. Then, another two weeks of daily sleep logs (all through Qualtrics online) and the post-survey was sent to participating students. The results of these surveys were analyzed by the NDSU statistics department.

### **Participants**

The total nursing student participant pool of 566, from both the Bismarck and Fargo locations, were eligible for participation in this PIP. Every class level of nursing students were invited to participate in the PIP. Overall, there were 48 responses to the pre-survey; 34 students who completed the SEM; and 21 students who completed all phases of the project with the sleep logs and post-survey. The initial participants identified as: 46 white participants, one African American participant, and one Hispanic participant.

The ages of participants in this project ranged from age 19-24 years, with a mean age of 20.3 and median age of 20 years. The participants that completed the pre-survey had a GPA of 3.0-4.0 with a mean of 3.71 and standard deviation of +/- 0.26 while the participants in the final survey had a GPA of 3.2-4.0 with a mean of 3.71 and a standard deviation of +/- 0.26.

**Table 4***Cohort Breakdown of Participation in Surveys*

Year in Program	Number of participants w/ PRE-survey	Number of participants w/ POST survey
Sophomore Semester 1	28	12
Sophomore Semester 2	10	4
Junior Semester 1	1	0
Junior Semester 2	2	2
Senior Semester 1	5	3
Senior Semester 2	2	0

All the participants declared “nursing” as their major and 37.5% ( $n=18$ ,  $N=48$ ) of the initial students also had a declared minor degree as listed in Table 4. Five out of 48 participants (10.4%) declared a double minor. Seven of the 21 (33.3%) participants that completed all phases of the project were also pursuing a minor.

**Table 5***Participants Striving for Minor with a Nursing Major*

Minor	# of participants w/ minor
Criminal Justice	1
Psychology	4
Human Development & Family Science	8
Spanish	1
History	1
Sociology	1
Neuroscience	1
Public Health	3
Business	1
Chemistry	1
Wellness	1

**Objective One**

Objective one was to identify sleep habits and patterns of the pre-licensure BSN student population at NDSU over the course of one semester in 2020. The pre-survey was analyzed to

determine mean and standard deviation regarding the PSQI and SHPS of all participants and further broken down by each nursing cohort (Sophomore, Junior, and Senior).

The PSQI pre-survey indicated mild difficulty with sleep amongst all cohorts as a score of “0” would indicate no sleep difficulty and a score of “21” would indicate severe difficulty with sleep. The Junior cohort had the most difficulty with sleep with a PSQI score of 8.3, followed by Seniors at 7.4 and Sophomores at 7.0. Table 5 relates the PSQI and SHPS pre-survey scores. Appendix F-G demonstrates the PSQI, SHPS, and sleep log surveys for reference.

The PSQI pre-survey mean of all participants was 7.1, with a median of 7.0. There were no identified outliers in the PSQI pre-survey data after examining the data with the interquartile range of 4.0. The PSQI post-survey mean of all students improved to 5.6 and a median improved to 5.0. One outlier was identified in the post-survey PSQI on the upper limit of the survey with an interquartile range of 2.0.

**Table 6**

*Statistics Regarding PSQI & SHPS in Pre-survey by Cohort*

YrProg	N	Variable	Mean	Std Dev	Minimum	Maximum
Sophomore	38	PSQI_pre	7.00	2.81	2.00	13.00
		SHPS_pre	77.42	15.48	53.00	118.00
Junior	3	PSQI_pre	8.33	2.52	6.00	11.00
		SHPS_pre	75.00	20.22	60.00	98.00
Senior	7	PSQI_pre	7.43	3.31	4.00	13.00
		SHPS_pre	73.86	17.94	51.00	98.00

The SHPS indicated more difficulty with sleep amongst all nursing students in the pre-survey with a mean of 76.7. A SHPS can have a maximum score possible of 168 which would indicate worse sleep hygiene habits and 28 indicating optimal sleep hygiene habits. The Sophomore class had a score of 77.42, the Junior cohort had a score of 75, and the Senior cohort a score of 73.8.

The post-survey was assessed to determine mean, and standard deviation regarding the PSQI and SHPS of all participants and further broken down by each nursing cohort as listed below (Sophomore, Junior, and Senior).

**Table 7**

*Results Regarding PSQI & SHPS in Post-survey by Cohort*

YrProg	N	Variable	Mean	Std Dev	Minimum	Maximum
Sophomore	16	PSQI_post	5.50	1.86	2.00	9.00
		SHPS_post	74.81	12.46	55.00	92.00
Junior	2	PSQI_post	9.00	5.66	5.00	13.00
		SHPS_post	86.50	30.41	65.00	108.00
Senior	3	PSQI_post	4.00	1.73	3.00	6.00
		SHPS_post	69.67	3.21	66.00	72.00

The sample size of the participants was significantly smaller for the post-survey at 21 participants compared to 48 participants initially. Due to attrition rates, the project was unable to make direct comparisons of pre- and post-surveys of participants to interpret results. The PSQI showed an improvement overall in participants sleep going from a 7.1 to a 5.6, indicating possible improvement in sleep quality overall. The Senior cohort improved their sleep quality from 7.4 to 4.0 but with a small sample size of two. The Sophomore cohort also showed improvement in their sleep quality from a 7.0 to a 5.5, but the Junior cohort showed a worsening of sleep quality going from an 8.3 to a 9.0.

The SHPS pre-survey mean of all participants was 76.7, with a median of 73.5. The pre-survey had two identified outliers to the data on the upper limits outside of the interquartile range of 20. The post-survey SHPS mean score of all participants was improved to 75.2 with a median of 72.0. No outliers were identified in the post-survey using the interquartile range of 19.0. The Senior cohort showed the most improvement from pre-survey to post-survey going from 73.9 to 69.7, indicating an improvement in sleep hygiene behaviors with the small sample size of three participants at the post-survey. The Sophomore cohort SHPS scores went from 77.4 to 74.8,

indicating an improvement in sleep hygiene. The Junior cohort’s pre-survey mean score was 75 and post-survey worsened to 86.5. This change indicated a decline of sleep hygiene habits. Of note, the Junior cohort in the post-survey only had two participants with a significant standard deviation of 30.4.

After identifying sleep habits and patterns of undergraduate students, identification of other commitments or factors that had influenced their sleep in any way within the last 14 days was compiled. Additional individualized negative factors of influence in post-survey were written in and listed below:

**Table 8**

*Controllable Factors Negatively Influencing Sleep Hygiene in Final Two Weeks*

Controllable Factors influencing sleep over two-week period after SEM.	Number of participants affected
Death of a family member	1
Social life	7
Illness/COVID	3
Work obligations	4
Clinicals	1
Stress/Worry	3
Coursework/Homework	2

Participants reported bedtimes between 10 PM and 2 AM in both the pre- and post-survey as well as getting anywhere between four and ten hours of sleep with the mean sleep hours of 6.7 hours/night for the pre-survey and the post-survey average sleep hours was 7.1 hours/night. There were no statistically significant differences in reported bedtimes between cohorts.

The sleep logs identified how well the participants felt like they slept each night over the 28 days. All nightly responses were observed and compiled for all nights combined for reportability showing 48.2% ( $n=313$ ,  $N=650$ ) of the sleep logs indicated the night prior the student slept “good”, 14% ( $n=91$ ) reported “very well”, 28% ( $n=178$ ) reporting “fair” sleep, 9.4% ( $n=61$ ) reporting “poor” sleep, and 1% ( $n=7$ ) reporting “very poor” sleep.



Identified variables to “poor” sleep included loud roommates, school/exam stress, clinicals, illness and use of sleep medication. The major identified themes resulting from SHPS responses demonstrating inadequate sleep hygiene behaviors were as follows from descending order of common occurrence: inconsistent bedtime, not getting out of bed after waking up, sleeping in on the weekends, lack of regular exercise, unresolved issues prior to going to sleep, and doing unrelated activities in bed such as homework, social media, or watching television. Due to limited respondents from the Junior and Senior cohorts, no statistically significant correlations were able to be made.

Evaluation and analysis of the data indicated the five most common modifiable sleep hygiene behaviors of participants identified by the SHPS in the pre- and post-survey below.

**Table 9**

*Identified Perceived Poor Sleep Hygiene Behaviors on SHPS Pre and Post-survey*

	Pre-survey (Frequently) N=48	Pre-survey (Always) N=48	Post-survey (Frequently) N=21	Post-survey (Always) N=21
Inconsistent bedtime	n=19 (39.6%)	n=4 (8.3%)	n=2 (9.5%)	n=12 (57.1%)
Stay in bed after awakening	n=16 (33%)	n=6 (12.5%)	n=9 (42.9%)	n=1 (4.8%)
Sleep-in on the weekends	n=14 (29.2%)	n=17 (14.6%)	n=10 (47.6%)	n=3 (14.3%)
Ponder unresolved issues prior to bed	n=11 (22.9%)	n=10 (20.83%)	n=7 (33.3%)	n=2 (9.5%)
Irrelevant activities prior to bed	n=14 (29.2%)	n=13 (27.1%)	n=8 (38.1%)	n=2 (9.5%)

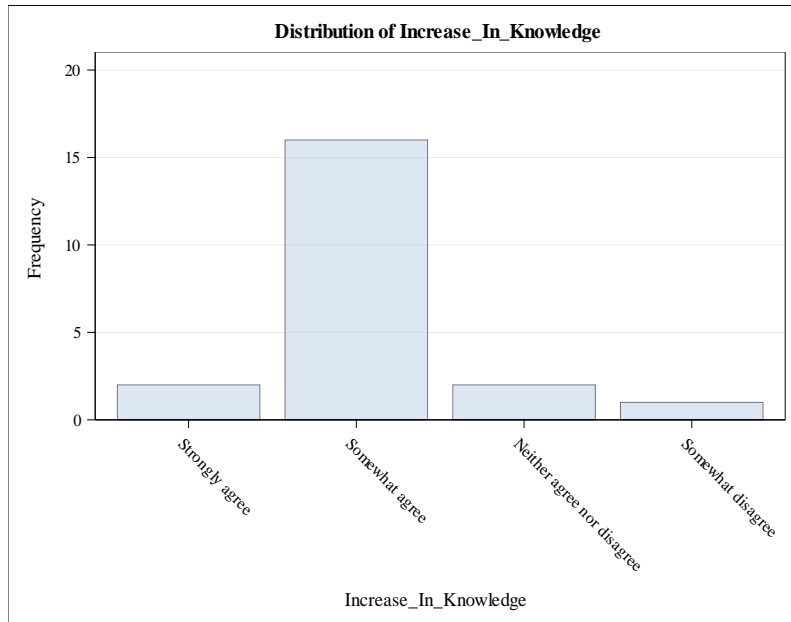
## Objective Two

Objective two was to measure if there is an increase in perceived knowledge regarding sleep importance and ways to improve sleep quality and quantity in the pre-licensure BSN students at NDSU after completion of the online SEM. After completion of all phases of the project, participants were asked in the post-survey “Did you feel an increase in perceived knowledge of how to improve sleep hygiene habits following the Sleep Education Module (SEM)?”

with results in Figure 8. Additionally, participants were asked to identify sleep hygiene behaviors which could be improved, that could further demonstrate improved perceived knowledge.

**Figure 9**

*Number of Participants Which Felt an Increase in Perceived Knowledge*



**Table 10**

*Chi-Square Test for Equal Proportions Regarding Perceived Knowledge*

Chi-Square	DF	Pr > ChiSq
29.4762	3	<.0001

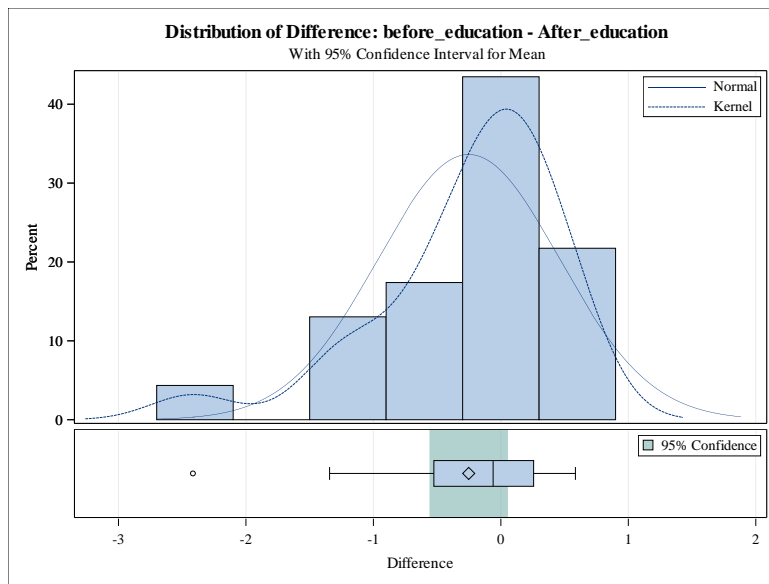
The Chi-square test was testing whether the proportions in those categories were equal or not, the p-value was less than 0.05 which indicates a statistically significant difference and improvement in perceived knowledge regarding sleep hygiene habits. From the plot above, the majority of participants agreed that there was an increase in perceived knowledge which was suggestive of improved sleep importance and hygiene after the intervention.

### Objective Three

Objective three was to identify if pre-licensure BSN students at NDSU demonstrated evidence of self-reported impact on personal sleep habits after completion of the online SEM. With statistical analysis using the SAS analytic software with the NDSU statistics department, the results were plotted in Figure 9 below regarding number of sleep hours per night both before and after the SEM module using a paired t-test.

**Figure 10**

*Sleep Hours Before and After SEM*



*Note:* Solid blue line: Before education. Dotted blue line: After education

The mean of paired difference between average sleep hours before education and after education was -0.25, but the p-value was greater than 0.05, so the average sleep hours before and after education was not significantly different.

**Table 11**

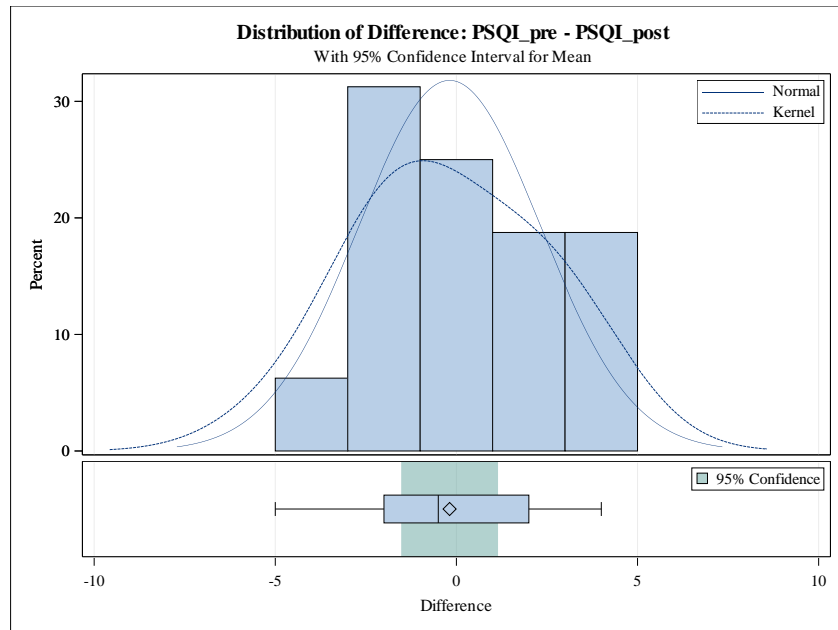
*Paired T-test of Pre and Post-PSQI of Cross-sectional Participants*

Mean	95% CL Mean	Std Dev	95% CL Std Dev	t value	Pr>{t}
-0.19	-1.52 1.15	2.51	1.85 3.88	-0.30	0.77

Comparison of the paired t-test of the PSQI pre-survey questions and PSQI post-survey among the 21 participants that completed all phases demonstrated that the paired t-test PSQI values from pre- to post-survey was not significantly different. Due to the PSQI value not being statistically different in the post-survey, sleep quality in each group was unchanged. Participants that completed all aspects of project were included to perform cross-sectional comparison.

**Figure 11**

*Distribution of Difference for PSQI pre and Post-Survey*



*Note:* solid blue line: PSQI pre-survey    dotted blue line: PSQI post-survey

**Table 12**

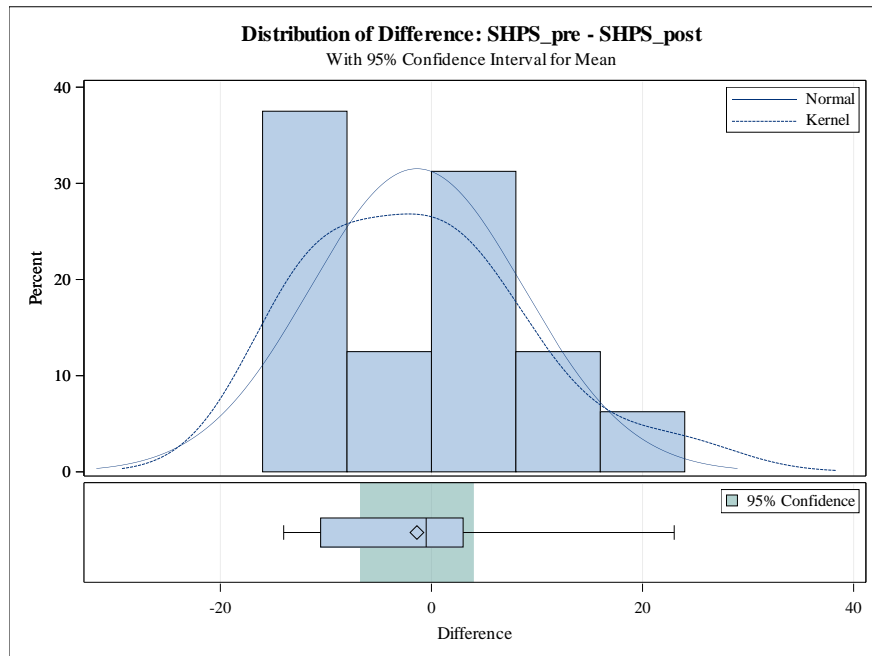
*Paired T-test of Pre and Post-SHPS of Cross-sectional Participants*

Mean	95% CL Mean	Std Dev	95% CL Std Dev	t value	Pr>{t}
-1.38	-6.77 4.02	10.13	7.48 15.67	-.54	0.60

With the results of the paired t-test of the pre- and post-survey regarding the SHPS scores of the 21 participants completing all aspects of the project a 95% confidence interval that the scores were not significantly different between pre- and post-SHPS. As noted above the t-value was -0.54 which was determined not to be statistically significant due to the t-value needs to be +/- 1.96. Therefore, the distribution depicted below indicated no significant difference in scores as shown by the curve distribution.

**Figure 12**

*Distribution of Difference in SHPS Pre and Post-survey for Cross-sectional Participants*



Note: solid blue line: SHPS pre-survey    dotted blue line: SHPS post-survey

The number of participants that completed the pre-survey that indicated achieving less than eight hours of sleep was 75% ( $n=36$ ,  $N=48$ ). The post-survey indicated that 52.4% ( $n=11$ ,  $N=21$ ) of participants noted getting less than the recommended eight hours of sleep. As for all of the nightly sleep logs, 44.3% ( $n=288$ ,  $N=650$ ) responses indicated less than 8 hours of sleep for each night recorded using the sleep log.

To further assess for behavioral change and impact on everyday life, participants were asked about their intent to improve their sleep hygiene habits. Of the students who answered, “Somewhat Unlikely”, all four participants fell in the Sophomore cohort and the participant who answered “Neither Likely nor Unlikely” fell into the Sophomore cohort as well. The intent to make changes to their sleep hygiene results are shown in Figure 10 below.

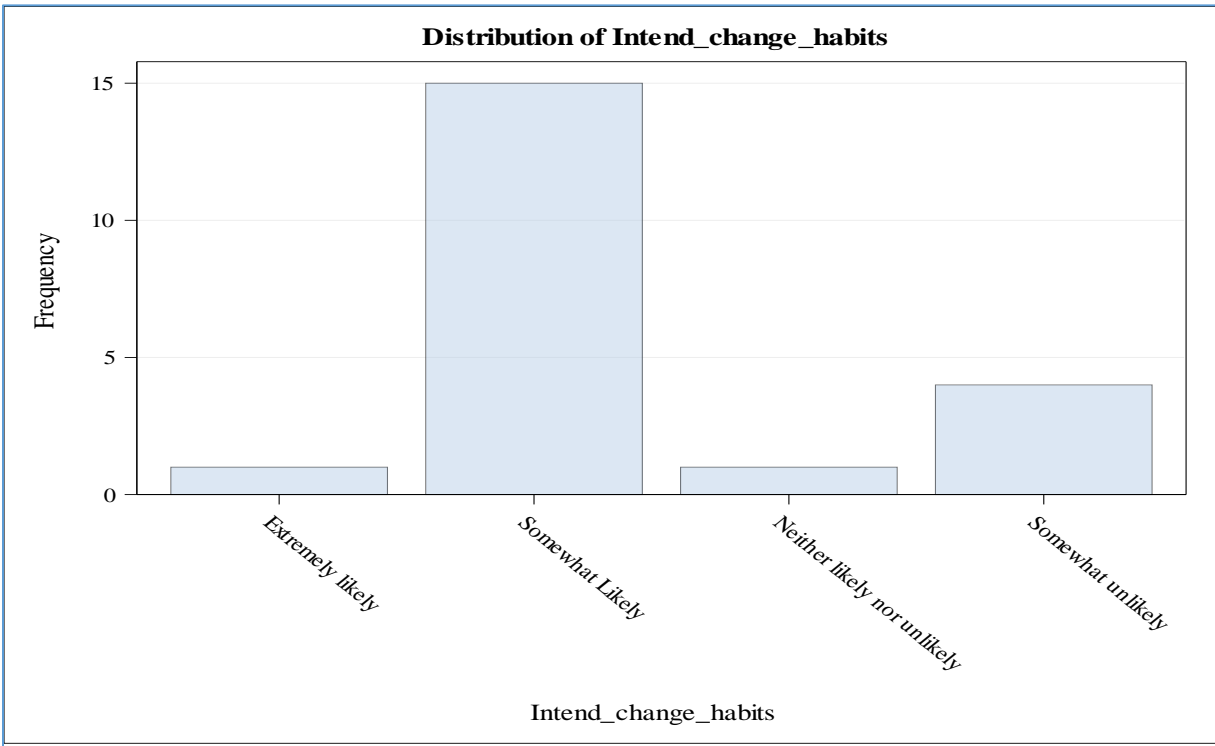
**Table 13**

*Intent to Change Sleep Hygiene Habits After Project*

Intent to change habits	Frequency	Percent	Cumulative Percent
Extremely likely	1	4.76	4.76
Somewhat Likely	15	71.43	76.19
Neither likely nor unlikely	1	4.76	80.95
Somewhat unlikely	4	19.05	100.00

**Figure 13**

*Distribution of Intent to Change Sleep Hygiene by Participants*



**Table 14**

*Chi-square Test for Equal Proportions Regarding Sleep Hygiene Change*

Chi-Square	DF	Pr > ChiSq
25.2857	3	<.0001

The Chi-square test was testing whether the proportions in the categories were equal or not and since the p-value was less than 0.05, the results indicate that the nursing students were “Somewhat Likely” to make a behavioral change related to their sleep hygiene habits.

Following the post-survey, participants were asked to list changes they intended to make to their sleep hygiene habits after the nightly sleep logs and SEM included in Table 13 with common themes.

**Table 15***Participants Intended Changes to Sleep after Project*

Intended Changes to improve Sleep Hygiene Habits	Number of participants (percent) intending to make the change
More consistent sleep schedule (going to bed and waking at the same time)	4 (19%)
Going to bed earlier	2 (9.5%)
Not using technology (phone/computer) right before bed	6 (28.6%)
Not doing homework in bed	4 (19%)
Temperature modification (making it cooler in the room)	1 (4.8%)
Not drinking caffeine within 6 hours of going to bed	1 (4.8%)
Did not identify any intended changes to sleep hygiene behavior	3 (14.3%)

Participants were also surveyed, “After using the daily sleep logs and watching the SEM do you feel more well rested and have less daytime sleepiness?” The responses included: 42.86% ( $n=9$ ,  $N=21$ ) of participants answered, “Somewhat Agree”, 47.62% ( $n=10$ ) of participants answered “Neither Agree or Disagree”, and 9.52% ( $n=2$ ) answered “Somewhat Disagree”.

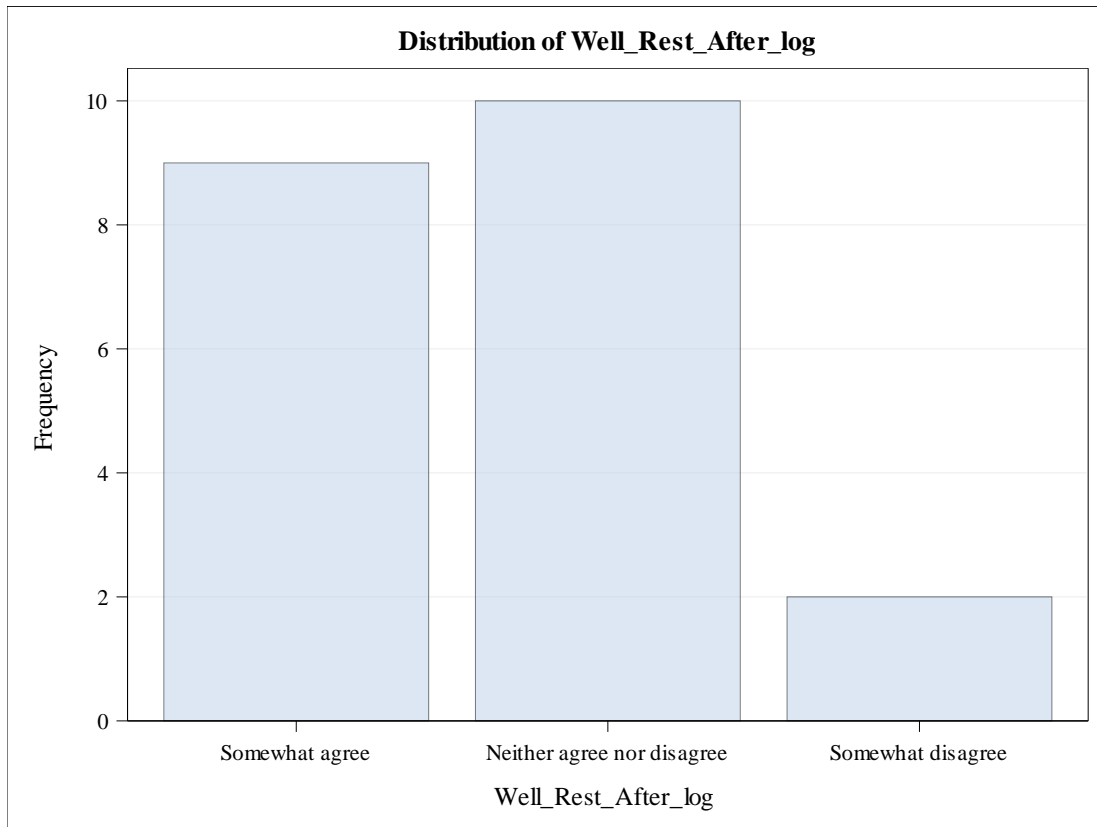
**Table 16***Felt Well Rested Following Completion of Project after SEM*

Felt Well Rested After Log	Frequency	Percent	Cumulative Percent
Somewhat Agree	9	42.86	42.86
Neither Agree nor Disagree	10	47.62	90.48
Somewhat Disagree	2	9.52	100.00



**Figure 14**

*Distribution of Participants Feeling Well Rested in Post-survey*



**Table 17**

*Chi-square Test Regarding Feeling of Rest*

Chi-Square Test for Equal Proportions	
Chi-Square	5.4286
DF	2
Pr > ChiSq	0.0663

The Chi-square test was testing whether the proportions in those categories were equal or not; since the p-value was greater than 0.05 the proportions were not significantly unequal.

From the plot above, the proportion of “Somewhat Agree” was close to “Neither Agree nor Disagree” regarding feeling well rested on the post-survey.

If participants answered, “Neither Agree nor Disagree”, or “Somewhat Disagree”, they were further asked in free text answers what was preventing them from getting good sleep and five common themes were identified in Table 15.

**Table 18**

*Quoted Responses from Question 10 on the Post-survey*

Question 10. What barriers prevent you from getting a good sleep? (N=5)	
•	“Procrastination-forced to go to bed later and wake up earlier to get everything done.”
•	“Homework.”
•	“Fear of failure, stress from clinicals/courses, and exams.”
•	“Not having a consistent bedtime or wake time.”
•	“Social life- hanging out with friends late especially on the weekends.”

**Objective Four**

Lastly, Objective four was to validate if an online education modality was an effective form of education in the pre-licensure BSN students. Due to unequal representation from the different cohorts, no statistically significant data for comparison was determined per each individual cohort, therefore data was reported as a whole.

The post-survey inquired if participants planned to make a change following the intervention and if the online module was able to keep their attention. Improvements noted to help the SEM keep their attention included more pictures and graphics.

**Table 19**

*Attention with SEM*

Did the Sleep Education Module keep your attention?	
Yes	20 (95.2%)
No	1 (4.8%)

## CHAPTER 5. DISCUSSION AND RECOMMENDATIONS

### Summary and Discussion

The literature demonstrates that over 72% of college students report insufficient sleep as less than eight hours of sleep per night, while 80% of students reported sleep insufficiency negatively impacted their academic performance (Hershner & Chervin, 2014). The cut-point of eight hours of sleep was utilized for evaluation in this project due to the brain development of students not complete until age 26 and more sleep is recommended while the brain is still developing, such as in the nursing college student population in this PIP (Campellone & Turley, 2021).

This PIP indicated that 75% ( $n=36$ ,  $N=48$ ) of nursing students that participated had less than eight hours of sleep per night on the pre-survey, consistent with published literature regarding general college students. Nursing students sleep hours could not be directly correlated to the barriers to good sleep quality, but the students did identify potential variables and barriers to good sleep in the nightly sleep logs and post-survey. Possible identified reasons for the 75% of participants getting less than 8 hours of sleep included challenging coursework with a lot homework, clinicals, choosing to forgo sleep for a social life and work commitments.

Both high quality sleep and quantity of sleep are crucial to academic success, memory and the restorative aspects of sleep. Consistently good sleep hygiene practices and sleep quality is important as the literature links poor academic performance to shorter sleep durations the whole week prior to an exam or important assignment. Students that had longer sleep durations for at least five days indicated possible better academic performance with the speculation that memory consolidation, critical thinking and the restorative aspects of sleep are able to take place more frequently. Evidence published in 2019, with the use of Fitbit trackers in 100 participants,

showed that longer sleep duration a week prior to an exam and a consistent sleep duration for five days prior to a big assignment correlated with improved academic performance.

Interestingly, the sleep duration the night prior to an important exam or assignment had no correlation to poor academic performance which demonstrates the importance of good sleep hygiene and a consistent sleep schedule (Okano et al., 2019). The literature supports the importance of consistent sleep hygiene habits and bedtimes and wake times for academic success.

Results of a survey administered in Italy to 307 college students which demonstrated sleep hygiene and quality were significantly impacted by the pandemic. The pre-pandemic lockdown PSQI scores greater than five was 58% and during lockdown, the PSQI of greater than 5 jumped to 73.3%. The almost 16% increase in PSQI scores greater than five supports the negative impact of the pandemic on sleep quality. Sleep initiation was the greatest challenge causing increased sleep latency and a delayed circadian rhythm (Marelli et al., 2021). Additionally, the pandemic likely had a significant effect on psych-emotional well-being, including worsening depressive symptoms at 27.8% of students and anxiety symptoms in 34.3% of students (Marelli et al., 2021).

The COVID-19 pandemic could have also altered sleep hygiene and patterns due to the stress it caused on the nursing community during implementation of the PIP. Changes to clinical rotations and stress of possible exposure in the clinical setting for nursing students was identified as a new variable not accounted for during the project. The pandemic could have also negatively impacted results of the PIP due to worsening sleep logs possibly due to students feeling poorly, decreasing their sleep hours and major lifestyle changes which could have negatively impacted typical sleep hygiene habits. An explanation for the high attrition rates of the project could

possibly be attributed to the pandemic as students were already spending a significantly greater amount of time on the computer, speculating that the last thing students wanted to do was complete the online project. Another possible explanation for high attrition rates could have been attributed to students feeling poorly about their sleep that they did not want to complete the nightly sleep logs.

### **Objective One**

As per objective one, sleep habits and patterns were identified using the PSQI, SHPS, and sleep logs of 21 undergraduate nursing students at NDSU in the fall of 2020. The pre-survey PSQI and SHPS demonstrated that participants had mild difficulty with sleep quality and sleep hygiene behaviors. The mild difficulty with sleep quality and sleep hygiene could indicate that nursing students that participated knew more information already at baseline or had less inadequate sleep hygiene behaviors during the fall 2020 semester than other college students in previous research. All of the participants did fall within the category of mild difficulty with sleep and this has been thought to possibly be a result of adjustment to nursing school for the sophomore cohort, rigor of coursework, and clinical commitment for the junior and senior cohorts. Due to the small sample size, no generalizations or specific correlations could be made.

Results regarding PSQI and SHPS could also have been skewed by the timing of the project, with students at a high stress or large coursework period in the semester decreasing participation for sample numbers and diversity or possibly negatively affecting sleep hygiene practices. Potentially, having implemented the PIP during the COVID-19 pandemic could have also allowed nursing students completing remote learning already with an online method to not want to further participate in an online project. The pandemic could have also stifled usual social gatherings, thus resulting in nursing students staying home more and sleeping more than in other

semesters. Finally, the pandemic could have also worsened stress and potential mental health concerns that could have deterred participation or caused increases in depressive symptoms of sleep and sleepiness.

The SHPS was developed to identify four different domains of sleep hygiene behaviors and, after evaluating, the two domains college students had most difficulty with on both the pre- and post-survey were found to be arousal-related behaviors and the sleep scheduling/timing domains. For example, students identified that they stayed up late to study or socialize which resulted in sacrificed sleep time. The participants had varying improvement or worsening of sleep hygiene behaviors from pre- to post-survey but due to the attrition rates and the possible timing of survey deployment related to rigor of courses at the time, one cannot conclude that the SEM was effective or ineffective.

As for inconsistent bedtimes, the response “always” worsened in the post-survey, whereas staying in bed “frequently” responses increased but the “always” response decreased by 8%, possibly demonstrating that nursing students improved slightly by the “always” responses moving to the “frequently” category. Additional sleep hygiene behaviors identified on the SHPS as troublesome included sleeping in on weekends, ponder unresolved issues before bed and performing irrelevant activities before bed. Sleeping in on the weekends “always” demonstrated improvement and “frequently” had an increase in percent of participants. As for pondering unresolved issues prior to bedtime, “always” responses significantly improved from 20.83% to 9.5% and responses of “frequently” increased but this finding could be indicative of “always” group improving to the “frequently” group as with sleeping in on the weekends and staying in bed upon awakening.

As of note, the PSQI results varied among nursing cohorts which demonstrated that Junior students had worse PSQI and SHPS compared to Sophomore and Senior students. Due to low cohort participation from Junior and Senior cohorts, no clear assumption could be concluded between cohorts, though there is a possibility that the Junior cohort had the worst sleep hygiene habits, thus leading to poorer sleep quality. The variations or low participation could possibly indicate a more challenging course load and increased stress for junior and senior students while sophomore student variations and/or participation rates could be related to experiencing adjustment to the nursing program or less rigor and clinical stress/time-commitments initially. Although there cannot be direct inferences in the cause of poor sleep quality and quantity per cohort due to small sample size, there was still a possibility of outlying factors individual to each participant. More research is needed to confirm inferences.

Typical sleep hours for all nursing students ranged from a mean of 6.7 hours/night from pre-survey results to a mean of 7.1 hours/night from post-survey results, indicating a slight improvement. Due to variations in cohorts and high attrition rates, this slight improvement cannot be directly attributed to the SEM intervention, as many other factors could have contributed, such as the COVID-19 pandemic (more opportunities to sleep due to more time spent in the home environment), stressors (sleep can increase or decrease with stress), time of the semester the surveys were taken, and workload per cohort.

After analysis of the sleep logs, inconsistent bedtimes and wake times appeared to be a theme of all students regardless of cohort. Sleep duration ranged anywhere from a minimum of four hours to a maximum of ten hours. Literature demonstrates that students who get less than the recommended eight hours of sleep can be at risk for difficulties with mental and physical health and poor academic performance (Peach et al., 2016; Okana et al., 2019). The consistent

themes identified as barriers to good sleep listed from major barriers to least were most notably: coursework, stress, social obligations, and work. The findings were consistent with the literature previously reviewed regarding the general college student population, but more research is needed to further correlate any possible unique needs, barriers, and patterns to nursing students in general due to low participation. For example, students identified modifiable behaviors that could impact sleep including staying up late to study or socialize which resulted in sacrificed sleep time.

Academic performance is highly researched, and a small link has been identified with poor sleep hygiene. Nursing students are a unique population due to their academic performances generally not deteriorating over time with poor sleep hygiene habits when rating academic performance solely based upon GPA. The participants' GPA in this project ranged from 3.2-4.0. Due to the rigor of the nursing program, further research on academic performance after a poor night's sleep would be beneficial. The findings from this PIP did not specifically assess changes in GPA because the time frame was only one semester; further research that can assess effects of sleep on nursing student GPA could be an important factor to further suggest if change is warranted in either sleep education or recommendations.

Objective one was partially met through evaluating sleep quality through the PSQI tool, sleep hygiene through the SHPS tool, and sleep patterns through the sleep logs. Due to a significantly poor attrition rate, no direct pre- and post-survey comparisons were possible which resulted in not being able to assess individual or cohort sleep hygiene patterns; thus, no generalizable recommendations were able to be made within the nursing cohorts at this university. Rather, with the given attrition rates, the PIP was able to add information regarding nursing students that was obtained in regard to study habits, sleep times, rigor, and aggregate



findings to provide information to NDSU's nursing program and faculty about sleep hygiene habits of their student population. give back to the institution.

## **Objective Two**

Objective two was examining if the sleep education module (SEM) was an effective form of education and if participants had a perceived increase in knowledge after the module; this objective was partially met. The majority of participants showed an increase in perceived knowledge following the sleep education module. The survey directly asked if the participants felt an increase in perceived knowledge with 9.5% of participants indicating they "Strongly agree" their perceived knowledge improved whereas 72% responded "Agree" which indicated a perceived knowledge increase. The other 14% of participants reported neutrality. One student responded "Disagree" and the reasoning identified was that they already knew the information prior to completing the SEM. The investigator suggests that agreeing to participate in the project demonstrated a willingness to improve perceived knowledge; even if participants didn't gain new perceived knowledge as a direct result of the SEM, more awareness was raised for the topic of sleep education and could hope to further inspire the students to seek out further information independently after participation.

The online modality for the SEM could have been more challenging within this university during the COVID-19 pandemic due to all the learning shifting to an online format, thus decreasing engagement due to so much screen time. The decrease in post-survey responses after the SEM also suggests that nursing students either needed to direct their time to other obligations or possibly that zoom/electronic fatigue played a role. Regardless of increased attrition rates, those participants that completed the post-survey did support that the majority of

participants reported an increase in perceived knowledge regarding sleep hygiene and met the objective.

### **Objective Three**

The third objective was to see a self-reported behavioral change in sleep hygiene habits and sleep hours after all phases of the project; the objective was partially met. Analysis of the sleep hours using the pre-survey, sleep logs, and post-survey demonstrated a slight increase in sleep hours from 6.7 to 7.1 hours a night. With a 95% confidence interval for the mean, the p-value was 0.1034 which is greater than 0.05, indicating the average number of sleep hours before and after the project was not statistically different. Although the sleep hours did not indicate a statistical improvement, over 76% of participants indicated “Somewhat Agree” regarding intent to improve future sleep hygiene behaviors, indicating a desire for change even if specific change was not possible during the constraints of the PIP timeframe. The most common intended changes identified by participants included: not using technology before bed, creating a consistent sleep/wake schedule, and not doing homework in bed. Participants identified coursework, a social life, and stress of school as barriers to good sleep hygiene and quality, which is consistent with the current literature regarding general college students.

Participants were also surveyed regarding if daytime sleepiness improved and if they felt well rested at the conclusion of all phases, which established no statistical significance for “Somewhat agree” versus “Neutral” responses. Due to not seeing a change in sleep hours, no change in daytime symptoms would have been expected. Possible contributing factors affecting sleep hours and sleep hygiene could have been increased screen times with blue-light exposure (due to classes and school-work being all online during the COVID-19 pandemic), less ability to socialize (resulting in less social support systems and less working to complete coursework with

classmates due to social isolation during the COVID-19 pandemic), and only completing the PIP over the course of one semester (also impacted due to the COVID-19 pandemic).

Although there was not statistical evidence of changes to the PSQI and SHPS after the four-week project, participants were able to identify specific sleep hygiene practices that could be improved and the intent to change his or her behavior. Over four percent of participants were “Extremely Likely” to make a change and over 76% of participants were “Somewhat Likely” to change their sleep hygiene behaviors, likely due to increased awareness and knowledge of the importance of sleep. The pre- and post-survey indicated a concern related to good sleep hygiene as the average of both surveys scoring in the 70’s out of a possible 168. The SHPS has been used in the general population but has not been frequently utilized in the general college student population. The instrument was chosen for this project due to the focus specifically on sleep hygiene practices.

#### **Objective Four**

Lastly, the fourth objective of the project aimed to identify if an online module was an effective mode of education by keeping the participants attention through its entirety; this objective was met. Almost all of the participants stated the module kept their attention although one participant stated already knowing the information prior to the module so staying engaged was more difficult. Participants were further surveyed on what could be improved within the module and the most common answer was more graphics throughout the presentation.

This project was developed just prior to the abrupt transition to distance/remote learning. Most of the nursing education pre-pandemic was completed in-person in the classroom compared to virtual learning during the implementation of this PIP secondary to the COVID-19 pandemic suggesting possible zoom/electronic learning fatigue during implementation of the project. The

switch to virtual learning resulted in even more screen time for college students, which, if completed prior to bedtime, the blue light exposure could have further contributed to difficulty initiating sleep.

### **Recommendations**

Although all the results of the project were not statistically significant due to the small sample size of 21 participants out of a possible 566 nursing students, the results trend towards some degree of poor sleep hygiene and insufficient sleep in college nursing students within this academic institution. The results are consistent with most research on the college student population. There is limited information specifically on nursing students, which indicates an area for growth and a recommendation to make improved correlations pertaining to the college nursing student population.

### **Recommendations for Future Research**

After assessing the data, most nursing students initially were unaware how the choices made prior to going to sleep could impact the quality of sleep. Behaviors prior to sleep such as blue light exposure on their phone, inconsistent bed/wake times, doing homework in bed and even adjusting the room temperature can affect sleep quality. This PIP suggests that a short module on the importance of sleep and proper sleep hygiene behaviors was possibly effective to create an intent to change sleep behaviors by participants. Recommendations for a future project on sleep hygiene in college students could include half of the participants randomly completing the SEM and half of the participants just completing the sleep logs. The randomization would allow the researcher to determine if the SEM was an effective approach to creating a behavior change or further increasing knowledge over other modalities of sleep education. A method to

further improve validity and assess the knowledge pre-education and post-education would be to provide a short quiz to quantitatively evaluate for an increase in knowledge.

After additional research on the noteworthy impact that sleep can have on mental health, future research could also include screening questions for mental health concerns such as the PHQ-2/PHQ-9 for depression and the GAD-7 for anxiety pre- and post-intervention. To better assess the overall health of the nursing students, a possible recommendation might also be to administer the PHQ-9/GAD-7 upon admittance into the program, periodically throughout the program, and at the end of the program to follow how students are managing their mental health.

Providing education and offering resources to the nursing students regarding mental health and sleep hygiene would be beneficial in nursing schools. The literature demonstrates that sleep and mental health education can be a major concern with college students. Further research is needed to establish a possible link to mental health and mood concerns with college nursing students, though a link already exists between sleep quality/quantity and mental health.

### **Recommendations for Future Projects**

There is limited information specifically on nursing students, which indicates an area for growth and a recommendation for further research. College nursing students are a unique population due to clinical requirements and rigor of their education requirements leading to possible higher risk for poor sleep hygiene behaviors and sleep quality. The education requirements could put them at higher risk for poor sleep hygiene and more research is needed to establish this possibility.

Additionally, following the completion of the PIP, a recommendation was to provide sleep education to nursing students upon admission into the NDSU nursing program. Initial sleep education could set the students up for success for the remainder of their education and to

promote self-care and importance of sleep hygiene in academic performance, mental health, and overall wellness. Providing sleep education initially highlights that the program identifies wellness and overall health of the nursing student as a priority. Additionally, providing reminders and education throughout the program would also be beneficial.

A third recommendation might be to tailor education to the needs of the student populations. Following further research on comparison of the best modalities to provide education, it is important to use the best educational modality whether that is an online module, posters, e-mails, curriculum development, or in-person education. In addition to the sleep hygiene education, promotion of good sleep hygiene can be completed in classrooms, across college campuses, student living spaces, student health centers, and student organizations to promote improved sleep practices and sleep quality to nursing students and all students in general (Peach et al., 2016). High quality sleep can be promoted campus-wide by providing rest/sleep rooms for students on campus, student led organizations bringing in speakers from sleep medicine experts, and providing high quality education to all faculty to educate and advocate for students.

A letter written to the editor (2018) by Shelley Hershner, MD, a professor at the University of Michigan with a specific interest in neurology/sleep in college student and Loise O'Brien, PhD and MS in neurology with interest in sleep as well, outlined recommendations to improve sleep hygiene in college students and the importance of sleep education. Hershner and O'Brien proposed crucial recommendations to educate students, particularly in healthcare fields; at that time, 72% of medical schools provided no sleep education and only 12% of colleges of health professions were educating students on sleep topics. In addition to advocating for proper

education of students and staff, a list of recommendations is listed below to combat poor sleep quality and sleep hygiene:

- 1) Minimizing 8 AM classes due to the delayed circadian rhythm of most college students.
- 2) Assignments due date and times midday, as an early morning assignment deadline can encourage all-nighters negatively impacting sleep.
- 3) Enforcing quiet time hours in dorms.
- 4) Creating nap locations on campus to promote better learning.
- 5) Post sleep hygiene information across college campuses such as unions, wellness centers, student health, and other common areas for all students.
- 6) Discuss sleep deprivation and the harmful effects on health.

(Hershner & O' Brien, 2018).

These recommendations focused on the importance of sleep and why sleep education needs to be discussed with students just like drugs and alcohol are discussed on college campuses. “Many students are unaware that insufficient sleep, erratic sleep patterns, and overall poor sleep behaviors may have a deleterious impact on grades, learning, mood, risk-taking behavior, and overall performance” (Hershner & O'Brien, 2018, para. 1).

### **Guiding Model and Theory**

The Iowa Model guided the PIP step by step and allowed for frequent re-evaluation at many steps along the way. The Iowa Model provided an evidence-based framework from topic selection to literature review to conducting the project. After completion of the project, project redesign is recommended to more precisely hone in on the goal of identifying sleep patterns and increasing knowledge of nursing students. The Iowa Model guided how to make changes to the project with the goal of evidence-based practice to the core.

The Health Promotion model was utilized to guide the project and determine how to foster participation from college nursing students. As stated previously by the health promotion model, the participant had to have greater perceived benefit to changing sleep hygiene behaviors compared to the perceived barriers to action. The SEM was developed to target sleep habits pertaining to college students, barriers often identified by college students through the literature, and recommendations for overcoming those barriers. There are many competing demands in college students and many situations that are in each individual's control as well as outside of his/her control. The sleep logs were designed to examine the competing demands and influences that are and are not in their control to further assess variables in college nursing students' lives.

### **Dissemination**

Dissemination of this PIP was planned to occur in a few different ways. This PIP was already disseminated through a virtual poster presentation at the 2020 North Dakota State Nurse Practitioner Association Pharmacology conference. Due to the virtual aspect of the conference, there was a limited number of individuals who viewed the poster.

Following completion of the project, the project will be presented at NDSU's School of Nursing poster presentation event in May of 2021. The dissertation will also be placed on the NDSU ProQuest website for review. Priority dissemination will be to nursing faculty and students who are interested in sleep hygiene and to further understand sleep and barriers to good sleep hygiene in nursing students. Although nursing students may not be interested in sleep hygiene, providing them information can influence their sleep behaviors. An executive summary was developed with intent to distribute to nursing faculty for information to possibly include in their courses for future students. There are potential plans to disseminate this PIP by publication in the Journal of Sleep Medicine or other applicable journals.



## **Strengths and Limitations**

This PIP had a multitude of strengths and limitations. One of the strengths of this project included buy-in from nursing faculty in promoting undergraduate nursing students to participate in the project. The buy-in from the Sophomore nursing cohort was evident in the pre-survey as 38 of the total 48 participants due to project promotion by faculty in the Sophomore cohort. A limitation in the project was that faculty for the Junior and Senior cohorts possibly did not promote the PIP or the Junior and Senior cohorts involved higher work-loads leading those students to be less likely to volunteer their time for research purposes.

Additionally, a strength of the project design included using validated tools including the Pittsburgh Quality Sleep Index (PSQI). As stated in the tools section above, the PSQI has a high correlation to sleep log results in which sleep logs are the gold standard for studying sleep. The PSQI has a specificity of 84.4 and sensitivity of 98.7 which indicates a quality indicator of sleep (Backhaus, et al., 2002).

There were several other limitations to the project. The sample size of the project was one significant limitation to the validity of the results in order to make comparisons. Although there were 48 participants with the pre-survey, participation dropped by over 56% at the post-survey making comparison between each individual challenging and possibly skewing results of the project. Data from all participants were analyzed regardless if the participants completed the final phase to examine sleep hygiene habits of nursing students more thoroughly. Data was utilized from all participants, but cross-sectional examination from pre-survey to post-survey and sleep logs were unable to be identified if all phases were not completed.

Another limitation included modifications to the project due to the inability to go into the undergraduate nursing classrooms to promote participation in the project due to COVID and

virtual learning which resulted in limited recruitment opportunities. In addition, as the project was only implemented over one semester. The COVID pandemic was also a limitation that likely impacted the results with increased stress and decreased sleep due to the pandemic, or, possibly giving more opportunity for sleep with students being within the home environment with more time due to social distancing recommendations. Students potentially had less opportunity for social engagements, thus sleeping more and not sacrificing as much of their time for sleep compared to previous semesters due to the pandemic.

Another significant limitation to the project was the substantial time commitment required to complete all phases of the project (28 days over the 6-week time period) As the literature suggested, 4-8 weeks is an adequate time period for studying sleep but that also requires time and energy from participants which could be challenging with their schedules and coursework. Additionally, some students could have felt that a chance to win a \$5 gift card was not enough incentive to complete all phases of the project.

Additionally, the surveys may have created some limitation in the project. The length of the surveys may have been a limitation in the project. The survey questions could have been further cut down to include questions most applicable to the college student population to make it less of a time commitment. Due to copyright concerns, permission from the PSQI creators to modify the scales was not granted upon implementation but could be sought. The SHPS was already paired down on the number of questions in the survey but could have been further modified into categories. Qualtrics also posed some limitations with question format and data collection. Contacting the NDSU Statistics Department prior to deploying the survey could have created less of a limitation to optimize data collection and analysis.

A possible limitation identified through research and the population being studied was participation bias due to the small sample size of participants initially and more noticeable in the post-survey. Participation bias could have impacted the results as the nursing students that participated could have identified as good sleepers and wanted to reinforce the fact that they were good sleepers, versus individuals that were poor sleepers and wanted to actually improve sleep. Participant bias could also be a factor with nursing students as the population frequently goes above and beyond when posed with a task as evident by their high GPA's and the rigor of course work for acceptance into program (Mthimunye & Daniels, 2019). Although there were higher attrition rates in participation from pre- to post-survey, 21 undergraduate nursing students completed all stages of the project despite the middle of a pandemic suggesting that the nursing student population could be a great population to recruit for research.

### **Impact on the Nurse Practitioner Role**

Sleep hygiene and quality should be addressed at every wellness visit, as well as any mental health visit or generalized fatigue visit with college students and more specifically nursing students . NPs need to address sleep needs just as consistently as addressing diet, exercise, and hypertension due to the overarching affect poor sleep can have on all aspects of health. NPs should take a proactive approach to sleep in college students in order to make a positive impact on nursing students by preventing daytime sleepiness, poor academic performance, poor nutrition, and mental health concerns such as depression and anxiety.

The NP must act as an educator and advocate for sleep hygiene in everyday practice with every patient. Along with acting as an educator, providing the ways to improve sleep hygiene is an important aspect of health promotion which is a cornerstone of NP practice. Additional to NP's providing quality information to college students regarding good sleep hygiene, staying up

to date on sleep medicine and medications that can aid in sleep is crucial to the outcomes of patients. Knowing when to refer patients to a sleep medicine specialist is also important. NP's need to not only educate their patients but also the community and colleagues about sleep practices and small modifications prior to sleep that can significantly impact quality of sleep.

### **Conclusion**

The purpose of this PIP was to evaluate, educate, and increase the knowledge of NDSU undergraduate nursing students regarding sleep. The sleep of nursing students was examined using surveys and sleep logs for evaluation of the sleep and to gain further insight into sleep patterns. Education was provided to the nursing students via an online module that confirmed evidence of increase knowledge following the project.

College students rank sleep problems as the second leading cause of difficulties with academic performance followed by stress as number one (Huss, 2018). Sleep difficulties in college students can be addressed appropriately by nurse practitioners in family practice by asking important questions regarding sleep hygiene and patterns. Additionally, providers giving the college students information on sleep hygiene practices will help to promote optimal wellness.

As research and this project demonstrate, homework, work commitments, and stress are the primary concerns for poor sleep hours. Poor sleep hygiene is greatly related to technology, inconsistent bedtimes/wake times, and doing homework in bed. Although sleep is an important element to wellness in all populations, the college student is especially at high risk for poor sleep hygiene. Sleep hygiene and healthy sleep quality can be addressed by consistently inquiring about sleep hygiene at wellness visits and providing demographic appropriate information to these college students.

## REFERENCES

- Allison, K. C., Lundgren, J. D., Oreardon, J. P., Geliebter, A., Gluck, M. E., Vinai, P., ...  
Stunkard, A. J. (2010). Proposed diagnostic criteria for night eating  
syndrome. *International Journal of Eating Disorders*, 43(3), 1–12. doi:  
10.1002/eat.20693
- American Academy of Sleep Medicine. (2017, November 6). College students: getting enough  
sleep is vital to academic success. Retrieved from [https://aasm.org/college-students-  
getting-enough-sleep-is-vital-to-academic-success/](https://aasm.org/college-students-getting-enough-sleep-is-vital-to-academic-success/)
- Appleby, D. (2014). How do college freshmen view the academic differences between high  
school and college? *American Psychological Association*. Retrieved from:  
<https://www.apa.org/ed/precollege/ptn/2014/08/college-freshmen>
- Backhaus, J., Junghanns, K., Broocks, A., Riemann, D., & Hohagen, F. (2002). Test–retest  
reliability and validity of the Pittsburgh Sleep Quality Index in primary  
insomnia. *Journal of Psychosomatic Research*, 53(3), 737–740. doi: 10.1016/s0022-  
3999(02)00330-6
- Bunjo, Z., Bunjo, L. J., Bacchi, S., Donnelly, F., Hudson, J. N., & Symonds, I. (2019). Sleep  
patterns and risky driving behaviors in clinical medical and nursing students. *Academic  
Psychiatry*, 43(5), 555–556. doi: 10.1007/s40596-019-01100
- Buysse, D.J., Reynolds, C.F., Monk, T.H., Berman, S.R., & Kupfer, D.J. (1989). The Pittsburgh  
Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice.  
*Psychiatry Research*, 28(2), 193-213. The detailed scoring instructions are at the end of  
this journal article.

- Campellone, J., & Turley, K. (2021). Understanding the Teen Brain - Health Encyclopedia - University of Rochester Medical Center. <https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=1&ContentID=3051>.
- Carney, C., Buysse, D., Ancoli-Israel, S., Edinger, J., Krystal, A., Lichstein, K., & Morin, C. (2012). The consensus sleep diary: Standardizing prospective sleep self-monitoring. *SLEEP* 2012;35(2):287-302.
- CDC. (2017). CDC - data and statistics - sleep and sleep disorders. Retrieved February 23, 2021 from [https://www.cdc.gov/sleep/data\\_statistics.html](https://www.cdc.gov/sleep/data_statistics.html)
- Chattu, V. K., Samhamuri, S. M., Kumar, R., Spence, D. W., Bahammam, A. S., & Pandi-Perumal, S. R. (2018). Insufficient Sleep Syndrome: Is it time to classify it as a major noncommunicable disease? *Sleep Science*, 11(2), 56–54. doi: 10.5935/1984-0063.20180013
- Chiang, Y.C. & Arendt, S. W. (2017) Benefits of sleep for undergraduate students' academic performance, *Journal of Hospitality & Tourism Education*, 29:2 6170, DOI: 10.1080/10963758.2017.1297713
- Cirelli, C. (2019, September 9). Insufficient sleep: Definition, epidemiology, and adverse outcomes. Retrieved October 3, 2019, from [https://www.uptodate.com/contents/insufficient-sleep-definition-epidemiology-and-adverse-outcomes?source=bookmarks\\_widget](https://www.uptodate.com/contents/insufficient-sleep-definition-epidemiology-and-adverse-outcomes?source=bookmarks_widget).
- Cleveland Clinic. (2012). Sleep Basics. Retrieved from: <https://my.clevelandclinic.org/health/articles/12148-sleep-basics>.
- Cunningham, Jack. (2019). “College students aren't getting nearly enough sleep.” *Sleep Education*, American Academy of Sleep Medicine, 18 July 2019.

<http://sleepeducation.org/news/2019/07/18/college-students-are-not-getting-nearly-enough-sleep>.

Davis, K. (2018, January 25). Sleep deprivation: Causes, symptoms, and treatment. *Medical News Today*. Retrieved from <https://www.medicalnewstoday.com/articles/307334.php>.

Dement, W. & Kleitman, N. (1957). Cyclic variations in EEG during sleep and their relation to eye movements, body motility, and dreaming. *Electroencephalography and Clinical Neuropsychology*, 9(4), 673-690. [https://doi.org/10.1016/003-4694\(57\)90088-3](https://doi.org/10.1016/003-4694(57)90088-3).

Diagram 1: N1 (2019). Retrieved from [https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see\\_link](https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see_link)

Diagram 2: N2 (2019). Retrieved from [https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see\\_link](https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see_link)

Diagram 3: N3 (2019). Retrieved from [https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see\\_link](https://www.uptodate.com/contents/image?imageKey=SLEEP/103288&topicKey=SLEEP/7710&source=see_link)

Diagram 4: REM sleep (2019). Retrieved from: [https://www.uptodate.com/contents/image?imageKey=SLEEP%2F103292&topicKey=SLEEP%2F7710&source=see\\_link](https://www.uptodate.com/contents/image?imageKey=SLEEP%2F103292&topicKey=SLEEP%2F7710&source=see_link)

Dietch, J. R., Taylor, D. J., Sethi, K., Kelly, K., Bramoweth, A. D., & Roane, B. M. (2016). Psychometric evaluation of the PSQI in U.S. college students. *Journal of Clinical Sleep Medicine*, 12(08), 1121–1129. doi: 10.5664/jcsm.6050

Ducharme, J. (2019, October 2). How Sleep Influences College Students' Grades. Retrieved from <https://time.com/5689957/sleep-college-students-grades/>.

- Fox, M., Writer, S., & News, N. B. C. (2013, May 20). Sleep-deprived teens cause crashes, study shows. Retrieved from <https://www.nbcnews.com/health/health-news/sleep-deprived-teens-cause-crashes-study-shows-f6C10002034>.
- Gurera, J. W. (2018). Locus of control, anxiety, and the effects of sleep hygiene education on college student sleep. *Lucerna*, 12, 102–119. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&site=edslive&db=a9h&AN=129839470&custid=s6224580>
- Hershner, S., & Chervin, R. (2014). Causes and consequences of sleepiness among college students. *Nature and Science of Sleep*, 6, 73–84. doi: 10.2147/nss.s62907
- Hershner, S., & O'Brien, L. M. (2018). The impact of a randomized sleep education intervention for college students. *Journal of Clinical Sleep Medicine*, 14(03), 337–347. doi: 10.5664/jcsm.6974
- Hershner S & O'Brien L. (2018). Sleep education for college students. *Journal of Clinical Sleep Medicine*. 14(7):1271–1272.
- Huss, M. J. (2018, August 6). The Importance of Sleep for College Students. The Importance of Sleep for College Students | USF Admissions. <https://admissions.usf.edu/blog/the-importance-of-sleep-for-college-students#:~:text=College%20students%20rank%20sleep%20problems,1>.
- Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. *Sleep Medicine Reviews*, 22, 23–36. doi: 10.1016/j.smrv.2014.10.001
- Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing*, 14(3), 175-182. doi:10.1111/wvn.12223



- Kirsch, D. (2019, November 6). Stages and architecture of normal sleep. Retrieved from [https://www.uptodate.com/contents/stages-and-architecture-of-normal-sleep?search=phases of sleep cycle&source=search\\_result&selectedTitle=1~150&usage\\_type=default&display\\_rank=1](https://www.uptodate.com/contents/stages-and-architecture-of-normal-sleep?search=phases%20of%20sleep%20cycle&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1).
- Lederman, D. (2019, June 5). Online Is (Increasingly) Local. Retrieved from <https://www.insidehighered.com/digital-learning/article/2019/06/05/annual-survey-shows-online-college-students-increasingly>.
- Lund HG, Reider BD, Whiting AB, et al. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of Adolescent Health, 46*:124–132.
- Marelli, S., Castelnovo, A., Somma, A., Castronovo, V., Mombelli, S., Bottoni, D., Leitner, C., Fossati, A., & Ferini-Strambi, L. (2021). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *Journal of neurology, 268*(1), 8–15. <https://doi.org/10.1007/s00415-020-10056-6>
- Mattos dos Santos, T. C. de, Figueiredo De Martino, M. M., Girnos Sonati, J., De Faria, L., & de Almeida Nascimento, E. F. (2016). Sleep quality and chronotype of nursing students. *Acta Paulista de Enfermagem, 29*(6), 658–663. <https://doi-org.ezproxy.lib.ndsu.nodak.edu/10.1590/1982-0194201600092>
- Medic, G., Wille, M., & Hemels, M. (2017). Short- and long-term health consequences of sleep disruption. *Nature and Science of Sleep, 9*, 151–161. doi: 10.2147/nss.s134864
- Menon, B., Karishma, H. P., & Mamatha, I. V. (2015). Sleep quality and health complaints among nursing students. *Annals of Indian Academy of Neurology, 18*(3), 363–364. <https://doi.org/10.4103/0972-2327.157252>

- Musto, P., & Millonig, L. (2018, October 1). Does using technology in the classroom help college students? Retrieved from <https://learningenglish.voanews.com/a/does-using-technology-in-the-classroom-help-or-harm-college-students/4591704.html>.
- Mthimunye, K., & Daniels, F. M. (2019). Predictors of academic performance, success and retention amongst undergraduate nursing students: A systematic review. *South African Journal of Higher Education*, 33(1). <https://doi.org/10.20853/33-1-2631>
- National Highway Transportation Safety Administration (NHTSA). (2019, July 22). Drowsy Driving. Retrieved from <https://www.nhtsa.gov/risky-driving/drowsy-driving#issue-scope-problem>.
- National Sleep Association (2018). Sleep Health Index. Retrieved 2019, From: <https://www.sleepfoundation.org/shi>.
- National Sleep Foundation (2019). What is Sleep Hygiene? *National Sleep Foundation*. Retrieved from: <https://www.sleepfoundation.org/articles/sleep-hygiene>
- NDSU Enrollment Report Student Data Statistics Fall 2020. (2020, September 22). <https://www.ndsu.edu/data/enrollment/demographics/>.
- Office of Disease Prevention and Health Promotion. (2020). *Sleep: HealthyPeople2030*. <https://health.gov/healthypeople/objectives-and-data/browse-objectives/sleep>.
- Okano, K., Kaczmarzyk, J.R., Dave, N., et al.(2019). Sleep quality, duration, and consistency are associated with better academic performance in college students. *Nature Partners Journal Science of Learning*. 4(16) <https://doi.org/10.1038/s41539-019-0055-z>
- Owens, H., Christian, B., & Polivka, B. (2017). Sleep behaviors in traditional-age college students. *Journal of the American Association of Nurse Practitioners*, 29(11), 695–703. doi: 10.1002/2327-6924.12520

- Owens, H., Polivka, B., Christian, B., King, K., & Ridner, S. L. (2019). Mediating effect of sleep behaviors when predicting weight-related behaviors in nursing students. *Journal of the American Association of Nurse Practitioners*, *31*(5), 309–318. doi:10.1097/jxx.000000000000151\
- Paterson, J. L., Reynolds, A. C., Duncan, M., Vandelanotte, C., & Ferguson, S. A. (2017). Barriers and enablers to modifying sleep behavior in adolescents and young adults: A qualitative investigation. *Behavioral Sleep Medicine*, *17*(1), 1–11. doi: 10.1080/15402002.2016.1266489
- Peach, H., & Gaultney, J. F. (2016). Charlotte Attitudes Towards Sleep (CATS) Scale: A validated measurement tool for college students. *Journal of American College Health*, *65*(1), 22–31. doi: 10.1080/07448481.2016.1231688
- Peach, H., Gaultney, J.F., & Gray, D. (2016) Sleep hygiene and sleep quality as predictors of positive and negative dimensions of mental health in college students, *Cogent Psychology*, *3*:1, DOI: 10.1080/23311908.2016.1168768
- Peever, J., & Fuller, P. M. (2017). The biology of REM sleep. *Current Biology*, *27*(22). doi: 10.1016/j.cub.2017.10.026P
- Pender, N.J., Murdaugh, C., & Parsons, M.A. (2011). *Health Promotion in Nursing Practice* (6th ed.). Boston, MA: Pearson.
- Petiprin, A. (2016). Nola Pender. *Nursing Theory*. Retrieved from <https://nursing-theory.org/nursing-theorists/Nola-Pender.php>. Wallace, D. D., Boynton, M. H., & Lytle, D. (2016). *Nursing Theory: A Practical Approach* (2nd ed.). Boston, MA: Allyn and Bacon.
- Pacheco, D. (2021, January 9). *Memory & Sleep: How Deprivation Affects The Brain*. Sleep Foundation. <https://www.sleepfoundation.org/how-sleep-works/memory-and-sleep>.

- Schlarb, A., Friedrich, A., & Claßen, M. (2017). Sleep problems in university students – an intervention. *Neuropsychiatric Disease and Treatment, Volume 13*, 1989–2001. doi: 10.2147/ndt.s142067
- Schulz, H. & Salzarulo, P. (2016). The development of sleep medicine: a historical sketch. *Journal of Clinical Sleep Medicine. 12*(7). 1041-1052. Doi: 10.5664/jcsm.5946
- “Sleep Health.” (2019, November 5). U.S. Department of Health and Human Services. *Sleep Health. Healthy People 2020*. Retrieved from: <https://www.healthypeople.gov/2020/topics-objectives/topic/sleep-health>.
- “Sleep Hygiene Tips.” (2019). American Sleep Association. Retrieved from: <https://www.sleepassociation.org/about-sleep/sleep-hygiene-tips/>
- Tarsitano, Nicole. (2019, September 6). Stress: an epidemic among college students. *The American Institute of Stress*. Retrieved from: <https://www.stress.org/stress-an-epidemic-among-college-students>
- Wallace, D. D., Boynton, M. H., & Lytle, L. A. (2017). Multilevel analysis exploring the links between stress, depression, and sleep problems among two-year college students. *Journal of American College Health: J of ACH*, 65(3), 187–196. <https://doi.org/10.1080/07448481.2016.1269111>
- Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., Buysse, D., ... Tasali, E. (2015). Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Sleep*, 38(6), 843–844. doi: 10.5665/sleep.4716

- Wyatt, J. K. (2019, July 31). Overview of circadian sleep-wake rhythm disorders . Retrieved October 3, 2019, from [https://www.uptodate.com/contents/overview-of-circadiansleep-wake-rhythm-disorders?source=bookmarks\\_widget](https://www.uptodate.com/contents/overview-of-circadiansleep-wake-rhythm-disorders?source=bookmarks_widget).
- Yahia, N., Brown, C., Potter, S., Szymanski, H., Smith, K., Pringle, L., ... Geliebter, A. (2017). Night eating syndrome and its association with weight status, physical activity, eating habits, smoking status, and sleep patterns among college students. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 22(3), 421–433. doi: 10.1007/s40519-017-0403-z
- Yang, C.-M., Lin, S.-C., Hsu, S.-C., & Cheng, C.-P. (2010). Maladaptive Sleep Hygiene Practices in Good Sleepers and Patients with Insomnia. *Journal of Health Psychology*, 15(1), 147–155. <https://doi.org/10.1177/1359105309346342>
- Zhang, Y., Chernaik, M., & Hallet, K. (2017). Relationship issues among college nursing students: associations with stress, coping, sleep, and mental disorders. *Teaching & Learning in Nursing*, 12(4), 246–252 <https://doiorg.ezproxy.lib.ndsu.nodak.edu/10.1016/j.teln.2017.06.00>

## APPENDIX A. IRB APPROVAL



August 24, 2020

Dr. Heidi Saarinen  
School of Nursing

Re: IRB Determination of Exempt Human Subjects Research:  
Protocol #PH21023, "Sleep Hygiene Analysis & Education for Nursing Students"

NDSU Co-investigator(s) and research team: Kayla Sorenson

Date of Exempt Determination: 8/24/2020 Expiration Date: 8/23/2023

Study site(s): NDSU Funding Agency: n/a

The above referenced human subjects research project has been determined exempt (category 2(ii)) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the original protocol materials with revised information sheet received 8/20/2020.

Please also note the following:

- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

Sincerely,

A handwritten signature in purple ink that reads "Kristy Shirley".

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult [https://www.ndsu.edu/research/for\\_researchers/research\\_integrity\\_and\\_compliance/institutional\\_review\\_board\\_irb/](https://www.ndsu.edu/research/for_researchers/research_integrity_and_compliance/institutional_review_board_irb/). This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

### INSTITUTIONAL REVIEW BOARD

NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | [ndsu.edu/irb](https://www.ndsu.edu/irb)

Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

NDSU is an EO/AA university.

## APPENDIX B. EXECUTIVE SUMMARY

### EXECUTIVE SUMMARY

## Sleep Hygiene Analysis & Education for NDSU BSN Nursing Students

### BACKGROUND

- 70% of college aged students report less than seven hours of sleep nightly due to the challenges that come with balancing school, a social life, and possible work obligations (Owens et al., (2017).
- Poor sleep can result in daytime sleepiness, academic concerns, poor nutrition, and mental health challenges such as anxiety and depression.

### PURPOSE

- The purpose of this practice improvement project was to evaluate, educate, and increase the knowledge of North Dakota State University (NDSU) undergraduate nursing students regarding sleep.
- The goal was to increase knowledge regarding good sleep hygiene, negative impacts of poor sleep and empower nursing students to modify their sleep behaviors.

### PROJECT DESIGN

- 4-week online project w/ use of Qualtrics
- Pre-survey w/ incorporated demographics, PSQI & SHPS
- 2 weeks of nightly sleep logs prior to SEM
- Sleep Education Module (SEM) at week 2 of 4
- 2 weeks of nightly sleep logs post SEM
- Post-survey w/ follow-up questions regarding intervention, intent to change behavior, PSQI, & SHPS



### RESULTS

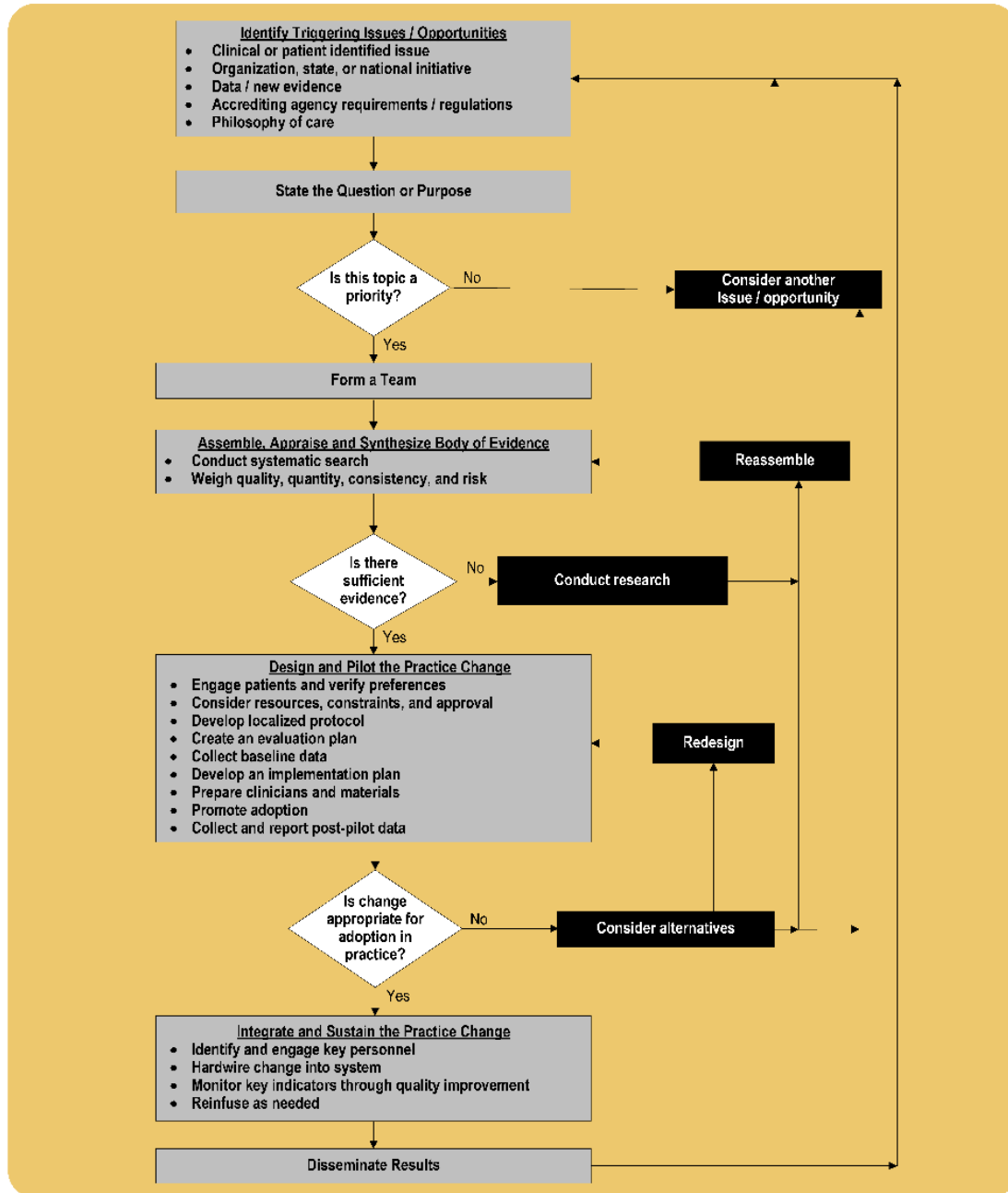
- Post-survey demonstrated participants getting less than 8 hours of sleep/night improved to 52.4% from 75% initially. Pre-survey sleep hours were 6.7 hours/night whereas post-survey sleep hours were 7.1 hours/night.
- Improved sleep quality after 4 week intervention as demonstrated by PSQI and improved sleep hygiene behaviors as indicated by the SHPS.
- Barriers to good sleep hygiene were stress, coursework, social life and clinicals.
- Consistent themes of poor sleep hygiene behaviors included: inconsistent bedtime, staying in bed after awakening, sleeping in on the weekends, pondering unresolved issues before bed, irrelevant activities in bed prior to going to sleep.
- Over 76% of participants that completed post-survey were at least somewhat likely to change sleep hygiene habits.
- Online education appears to be effective form of education, but further research is required.

### RECOMMENDATIONS

- Further research on college nursing students needed due to small body of research.
- Research study with a greater sample size.
- Provide sleep hygiene education upon admittance to nursing program.
- Periodic sleep hygiene education throughout program to promote wellness.
- Promote optimal sleep hygiene and quality across college campuses .
- Nurse Practitioners need to assess and educate on sleep hygiene and sleep quality at every visit due to the impact it can have on physical, emotional, and mental health.

## APPENDIX C. IOWA EVIDENCE-BASED MODEL

### The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care



◆ = a decision point  
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## **APPENDIX D. EMAIL TO FACULTY REGARDING PROJECT**

### **Sleep Hygiene Analysis & Education for NDSU BSN Nursing Students**

Dear Nursing Faculty:

My name is Kayla Sorenson. I am a graduate student in the Doctor of Nursing Practice program at North Dakota State University (NDSU), and I am conducting a practice improvement project with Heidi Saarinen to examine the sleep hygiene habits of undergraduate nursing students. It is our hope, that by student participation, we will learn more about sleep habits of undergraduate nursing students during nursing school.

I will be e-mailing students through the nursing listserv regarding participating in the project. Because you teach undergraduate BSN nursing students here at NDSU, I am asking you to take a moment to let your students know they have the opportunity to take part in this project during September-October of this fall semester and to watch for my e-mail when you introduce your class this semester.

Their participation is entirely by choice and they may change their mind or quit participating at any time, without penalty. All participant information will be kept confidential and be written about in my dissertation as combined data.

Possible risks might include distress/anxiety in learning how poor sleep or poor sleep habits affect their health, though this is not a significant risk. Benefits of participation might include improved sleep hygiene practices to help their sleep throughout the rest of their nursing education and future career. They will also be able to contribute to the information about how much sleep and sleep habits of nursing students in this program. However, they may not get any benefit from being in this study.

Each student will be asked to complete a total of two surveys, pre- and post-, (10 minutes to complete over 5 days) and four minutes daily to fill out the sleep logs during the two weeks before and after the education piece. An online Sleep Education Module (SEM) will be sent to each participant e-mail educating him/her on sleep quality importance and adequate sleep hygiene in the nursing student population (about 15 minutes long and 7 days to complete) before completing the post-survey and sleep logs. Students will receive a chance to win one of 30-\$5 gift cards to Caribou Coffee as compensation for their participation. Each student must complete all aspects of participation (pre-survey, 2 week sleep logs, SEM education, post-survey, 2 week sleep logs) in order to be eligible for the gift card.

If you have any questions about this project, please contact me at 320-333-0538 or [kayla.j.sorenson@ndsu.edu](mailto:kayla.j.sorenson@ndsu.edu), or contact my advisor Heidi Saarinen at 701-231-7821 or [heidi.saarinen@ndsu.edu](mailto:heidi.saarinen@ndsu.edu).

Sincerely,

Kayla Sorenson

## **APPENDIX E. PARTICIPATION OPPORTUNITY EMAIL TO STUDENTS**

### **Sleep Hygiene Analysis & Education for BSN Nursing Students**

Dear Nursing student :

My name is Kayla Sorenson. I am a graduate student in the Doctor of Nursing Practice program at North Dakota State University (NDSU), and I am conducting a practice improvement project to examine the sleep hygiene habits of undergraduate nursing students. It is our hope, that by your participation, we will learn more about sleep habits of undergraduate nursing students during nursing school.

Because you are an undergraduate BSN nursing student here at NDSU, you are invited to take part in this research project. Your participation is entirely your choice, and you may change your mind or quit participating at any time, with no penalty to you.

If you agree to participate in this project, you will be asked to complete:

- A pre-survey on your current sleep habits which will take approximately 8 minutes.
- Log your sleep for two weeks with a daily two-minute survey.
- View a 10-15 minute Sleep Education Module (SEM) within one week of receiving it.
- Log your sleep daily for an additional two weeks.
- A post-survey that will take approximately 8 minutes.
- The total time commitment of participating in this practice improvement project is about 2 hours over the course of a month.

It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known risks. These known risks might include: distress/anxiety in learning how poor sleep or poor sleep habits affect your health, though this is not a significant risk. Benefits of participation might include improved sleep hygiene practices to help your sleep throughout the rest of your nursing education and future career. You will also be able to contribute to the information about how much sleep and sleep habits of nursing students in this program. However, you may not get any benefit from being in this study.

It should take about 10 minutes to complete each survey (pre- and post-) and four minutes daily to fill out the sleep logs during the two weeks before and after the education piece. A 10-15 minute online Sleep Education Module (SEM) will be sent to your e-mail at day 13-17 and you will have 7 days to complete viewing the SEM education piece before you can complete the post-survey and sleep logs. You will receive a chance to win one of 30-\$5 gift cards to Caribou Coffee as compensation for your participation. You must complete all aspects of participation (pre-survey, 2 week sleep logs, SEM education, post-survey, 2 week sleep logs) in order to be eligible for the gift card.

We will keep any and all information you provide during the study confidential. Your information will be combined with information from other people taking part in the study to be written in combined form for my dissertation paper. You will not be personally identified in

these written materials. We may publish the results of the study; however, we will keep your name and other identifying information private.

If you have any questions about this project, please contact me at 320-333-0538 or [kayla.j.sorenson@ndsu.edu](mailto:kayla.j.sorenson@ndsu.edu), or contact my advisor Heidi Saarinen at 701-231-7821 or [heidi.saarinen@ndsu.edu](mailto:heidi.saarinen@ndsu.edu).

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701.231.8995, toll-free at 1-855-800-6717, or by email at [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu).

Thank you for your taking part in this research. If you wish to receive a copy of the results, please email [kayla.j.sorenson@ndsu.edu](mailto:kayla.j.sorenson@ndsu.edu) or you can obtain the completed dissertation on the NDSU library website.

## APPENDIX F. PRE-SURVEY

### **Initial: Sleep Hygiene Analysis and Education for NDSU Nursing Students**

Instructions: The following questions relate to your usual sleep habits during the school year.

Welcome to this practice improvement study!

We are interested in understanding sleep hygiene in NDSU nursing students. You will be presented with information relevant to sleep hygiene and habits and asked to answer some questions about your sleep habits. Please be assured that your responses will be kept confidential. No personal identifiers will be utilized in data analysis in order to keep your information private. After your pre-survey, your data will be collected and you will be identified to me by the last 4 digits of your student ID number and will not be shared with anyone else.

This initial survey should take you around less than 10 minutes to complete, and you will have 5 days to take this survey to start the project. After completing all aspects of participation, you will be entered to win a Caribou Coffee gift card. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any penalty. If you would like to contact me, the co –investigator, in the study to discuss, please e-mail Kayla Sorenson at [kayla.j.sorenson@ndus.edu](mailto:kayla.j.sorenson@ndus.edu).

After this pre-survey, you will be asked to fill out a sleep log each morning regarding the previous night of sleep for a total of 14 days prior to the online Sleep Education Module (SEM) and for 14 days after that should take about 4 minutes daily to complete. At the end, you will be asked to complete a post-survey that will take about 10 minutes to complete and will have 5 days to complete. Each of these steps will be e-mailed to you using Qualtrics, so please monitor your e-mail to complete each piece. You will have 7 days to complete the SEM regarding sleep hygiene, how sleep hygiene impacts sleep quality, and simple ways to help your sleep as a nursing student that should take about 15 minutes to view.

By clicking the button below, you acknowledge consent to participate in this study, that your participation is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

- I consent, begin the study (1)
- I do not consent, I do not wish to participate (2)

1) Please enter the last four digits of your NDSU student ID number

last 4 digits of NDSU ID (1) \_\_\_\_\_

2) How many credits are you taking this semester?

\_\_\_\_\_

3) What is your year of birth?

Year of Birth (1) \_\_\_\_\_

4) Choose one or more races that you consider yourself to Be:

White (1)

Black or African American (2)

American Indian or Alaska Native (3)

Asian (4)

Native Hawaiian or Pacific Islander (5)

Other (specify) (6) \_\_\_\_\_

5) What year in the NDSU Nursing program are you in?

Sophomore Semester 1 (1)

Sophomore Semester 2 (2)

Junior Semester 1 (3)

Junior Semester 2 (4)

Senior Semester 1 (5)

Senior Semester 2 (6)

6) Please tell us your desired major and minor.

Desired Major (optional) (1) \_\_\_\_\_

Desired Minor (optional) (2) \_\_\_\_\_

7) What is your current GPA (4.0 Scale):

---

8) The Pittsburgh Sleep Quality Index (PSQI): Instructions: The following questions relate to your usual sleep habits during the past 2 weeks only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions. During the past month,

\*\*Reproduced with permission from the University of Pittsburgh, PSQI creator.

9) When have you usually gone to bed?

---

10) How long (in minutes) has it taken you to fall asleep each night?

---

11) When have you usually gotten up in the morning?

---

12) How many hours of actual sleep do you get at night? (this may be different than the number of hours you spend in bed)

---

13) During the past month, how often have you had trouble sleeping because you...

	Not during the past 2 weeks (0) (1)	Less than once a week (1) (2)	Once or twice a week (2) (3)	Three or more times a week (3) (4)
Cannot get to sleep within 30 minutes (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wake up in the middle of the night or early morning (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have to get up to use the bathroom (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cannot breathe comfortably (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
cough or snore loudly (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feel too cold (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Feel too hot (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have bad dreams (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have pain (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other reason (s), please describe, including how often you have had trouble sleeping because of this reason: <hr style="width: 100%; border: 0.5px solid black;"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(10)				

---

14) describe other reasons you have had trouble sleeping: (describe below: if not applicable to you type NA)

---

15) During the past 2 months, how would you rate your sleep quality overall?

- Very Good (0) (1)
- Fairly Good (1) (2)
- Fairly Bad (2) (3)
- Very Bad (3) (4)

16)

	Not during the past 2 weeks (0) (1)	Less than once a week (1) (2)	Once or twice a week (2) (3)	Three or more times a week (3) (4)
During the past 2 weeks, how often have you taken medicine (prescribed or “over the counter”) to help you sleep? (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During the past 2 weeks, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During the past 2 weeks, how much of a problem has it been for you to keep up enthusiasm to get things done? (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



17) if you have a roommate or bed partner, ask him/her how often in the past 2 weeks you have had...

	Not during the past 2 weeks (1)	Less than once a week (2)	once or twice a week (3)	Three or more times a week (4)
loud snoring (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
long pauses between breaths while asleep (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
legs twitching or jerking while you sleep (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
episodes of disorientation or confusion during sleep (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
other restlessness while you sleep... please describe below: (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18) other restlessness while you sleep reasons: (if applicable, otherwise comment NA)

19) Sleep Hygiene Practices Scale (SHPS): The following items are descriptions of common sleep habits, daily life activities, and sleep environments. Please circle the number to indicate how often the situations fit your personal experiences within the last 2 weeks:

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
Bedtime not consistent daily (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Get out of bed at inconsistent times (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stay in bed after waking up in the morning. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
sleep in on the weekends. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Napping or resting in bed for over an hour during the day. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of exposure to outdoor light during the day. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of regular exercise. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unpleasant Conversation prior to sleep. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not enough time to relax prior to sleep. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Falling asleep with TB or music on. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pondering about unresolved matters while lying in bed. (11)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Check the time in the middle of the night. (12)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
Doing sleep-irrelevant activities in bed (watching TV, reading, doing homework, etc.) (13)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worry about not being able to fall asleep in bed. (14)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worry about night-time sleep during the day. (15)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vigorous exercise during the 2 hours prior to sleep. (16)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
drinking caffeinated drinks (e.g., coffee, tea, soda) within 4 hours prior to bedtime. (17)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drinking alcohol within 2 hours of bedtime. (18)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
Consuming stimulating substances (e.g., nicotine) during the 2 hours prior to bedtime. (19)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Going to bed hungry. (20)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drinking a lot of fluid during the hour prior to sleep. (21)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eating too much food during the hour prior to sleep. (22)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleep environment is either too noisy or too quiet. (23)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleep environment is either too bright or too dark. (24)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleep environment is either too humid or too dry. (25)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling too hot or too cold during sleep. (26)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
Too many sleep-unrelated items in the bedroom. (27)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleep is interfered by bed partner. (28)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**APPENDIX G. SLEEP LOG**

Sleep Log

1) What is the last 4 digits of your ID number? (for tracking of data only)

---

2) What time did you get into bed?

---

3) what time did you try to go to sleep?

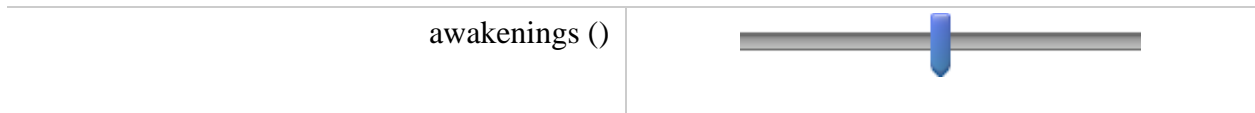
---

4) How long did it take you to fall asleep?

---

5) How many times did you wake up, not counting your final awakening?

0 1 2 3 4 5 6 7 8 9 10



6) In total, how long did these awakenings last?

---

7) What time was your final awakening?

---

8) What time did you get out of bed for the day?

---

9) How would you rate the quality of your sleep?

Very Poor (1)

Poor (2)

Fair (3)

Good (4)

Very Good (5)

10) Comments/Variables to good sleep for the night (activities/exam studying/work, ect):

---

## APPENDIX H. COMPLETION/POST-INTERVENTION SURVEY

### Post-Survey: Sleep Hygiene Analysis and Education for NDSU Nursing Students

Instructions: The following questions relate to your usual sleep habits during the school year.

This is the last step in this project, so thank you!

You will be presented with information relevant to sleep hygiene and habits and asked to answer some questions about your sleep habits. Please be assured that your responses will be kept confidential. No personal identifiers will be utilized in data analysis in order to keep your information private. Your data will be collected, and you will be identified to me by the last 4 digits of your student ID number and will not be shared with anyone else.

This post-survey should take you around less than 10 minutes to complete, and you will have 5 days to take this survey to end the project. After completing all aspects of participation, you will be entered to win a Caribou gift card. If you would like to contact me, the co –investigator, in the study to discuss, please e-mail Kayla Sorenson at [kayla.j.sorenson@ndus.edu](mailto:kayla.j.sorenson@ndus.edu).

Please note that this survey will be best displayed on a laptop or desktop computer. Some features may be less compatible for use on a mobile device.

- 1) Please enter the last four digits of your student ID number (for data tracking purposes only)

last 4 digits of your student ID (1) \_\_\_\_\_

- 2) Did you feel an increase in knowledge of how to improve sleep hygiene habits following the Sleep education module?
  - A) Strongly agree
  - B) Somewhat agree
  - C) Neither agree nor disagree
  - D) Somewhat disagree
  - E) Strongly disagree



- 3) After watching the sleep education module, do you intend to change any of your sleep hygiene habits?
- A) Extremely likely
  - B) Somewhat likely
  - C) Neither likely nor unlikely
  - D) Somewhat unlikely
  - E) Extremely unlikely
- 4) If you intend to make a change following the sleep education module and intervention, please list at least one habit you plan to change or incorporate:
- 
- 
- 5) Did the Sleep education module keep your attention to watch the entire module?
- A) YES
  - B) NO
- 6) If you answered no to the previous questions, what could have been improved to keep your attention?
- A) \_\_\_\_\_
- 7) After using the daily sleep logs and watching the sleep education module do you feel more well rested and have less daytime sleepiness?
- A) Strongly agree
  - B) Somewhat agree
  - C) Neither agree nor disagree
  - D) Somewhat disagree
  - E) Strongly disagree
- 8) If you answered C, D or E to the previous question, what do you feel is preventing you from getting good sleep:
- A) \_\_\_\_\_
- 9) List any specific activities/commitments outside of course work that impacted your sleep within the last 14 days:
-

10) The modified Pittsburgh Sleep Quality Index (PSQI): Instructions: The following questions relate to your usual sleep habits during the past 2 weeks only. Your answers should indicate the most accurate reply for the majority of days and nights in the past 2 weeks. Please answer all questions. During the past 2 weeks ,

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11) When have you usually gone to bed?

---

12) How long (in minutes) has it taken you to fall asleep each night?

---

13) When have you usually gotten up in the morning?

---

14) How many hours of actual sleep do you get at night? (this may be different than the number of hours you spend in bed)

---

15) During the past two weeks, how often have you had trouble sleeping because you...

	Not during the past 2 weeks (0) (1)	Less than once a week (1) (2)	Once or twice a week (2) (3)	Three or more times a week (3) (4)
Cannot get to sleep within 30 minutes (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wake up in the middle of the night or early morning (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
have to get up to use the bathroom (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cannot breathe comfortably (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
cough or snore loudly (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feel too cold (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feel too hot (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have bad dreams (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have pain (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other reason (s), please describe, including how often you have had trouble sleeping because of this reason:  _____	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(0)				

16) describe other reasons you have had trouble sleeping: (describe below: if not applicable to you type NA):

---

17) During the past 2 weeks, how would you rate your sleep quality overall?

- Very Good (0) (1)
- Fairly Good (1) (2)
- Fairly Bad (2) (3)
- Very Bad (3) (4)

18)	Not during the past 2 weeks (0) (1)	Less than once a week (1) (2)	Once or twice a week (2) (3)	Three or more times a week (3) (4)
During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep? (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?  
(3)

19 if you have a roommate (check here if roommate) \_\_\_\_\_ &/or  
or bed partner (check here if bed partner) \_\_\_\_\_

ask him/her how often in the past 2 weeks you have had...

	Not during the past month (1)	Less than once a week (2)	once or twice a week (3)	Three or more times a week (4)
loud snoring (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
long pauses between breaths while asleep (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
legs twitching or jerking while you sleep (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
episodes of disorientation or confusion during sleep (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
other restlessness while you sleep... please describe below: (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20) other restlessness while you sleep reasons: (if applicable, otherwise comment NA)

---

21) Hygiene Practices Scale (SHPS): The following items are descriptions of common sleep habits, daily life activities, and sleep environments. Please circle the number to indicate how often the situations fit your personal experiences within the last 2 weeks:

**Sleep Hygiene Practices Scale**

	Never (1)	Rarely (2)	Occasionally (3)	Sometimes (4)	Frequently (5)	Always (6)
Bedtime not consistent daily (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Get out of bed at inconsistent times (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stay in bed after waking up in the morning. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sleep in on the weekends. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Napping or resting in bed for over an hour during the day. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of exposure to outdoor light during the day. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Lack of regular exercise. (7)

Unpleasant Conversation prior to sleep. (8)

Not enough time to relax prior to sleep.

Falling asleep with TV or music on. (10)

Pondering about unresolved matters while lying in bed. (11)

Check the time in the middle of the night. (12)

Doing sleep-irrelevant activities in bed (watching TV, reading, doing homework, etc.) (13)

Worry about not being able to fall asleep in bed. (14)

Worry about night-time sleep during the day. (15)

Vigorous exercise during the 2 hours prior to sleep. (16)

drinking caffeinated drinks (e.g., coffee, tea, soda) within 4 hours prior to bedtime. (17)

Drinking alcohol within 2 hours of bedtime. (18)

Consuming stimulating substances (e.g., nicotine) during the 2 hours prior to bedtime. (19)

Going to bed hungry. (20)

Drinking a lot of fluid during the hour prior to sleep. (21)

Eating too much food during the hour prior to sleep. (22)



Sleep environment is either too noisy or too quiet. (23)

Sleep environment is either too bright or too dark. (24)

Sleep environment is either too humid or too dry. (25)

Feeling too hot or too cold during sleep. (26)

Poor ventilation of bedroom. (27)

Uncomfortable bedding and/or pillow. (28)

Too many sleep-unrelated items in the bedroom. (29)

Sleep is interfered by bed partner. (30)