

Sleep Quality and Daytime Sleepiness in Pre-licensure Baccalaureate Nursing Students

A dissertation submitted

by

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to

Bryan College of Health Sciences

in partial fulfillment of the requirement

for the degree of

DOCTOR IN EDUCATION

with an emphasis on

Nursing Education

This dissertation has been accepted for the faculty of

Bryan College of Health Science by:

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## **Acknowledgements**

I would like to thank my dissertation chair, Dr. Michelle Johnson for her time, wisdom, patience, research expertise, and understanding how nurses think. I am incredibly blessed to have been educated by her through this journey. I would also like to thank my committee members, Dr. Marilyn Moore and Dr. Mark Jones for their areas of expertise and guidance. I would like to thank Mark Beck of UNL for his research analyses and interpretation assistance. Last, I would like to thank all faculty at Bryan College of Health Sciences for their continued support and encouragement.

## Table of Contents

Abstract .....	xi
CHAPTER I: INTRODUCTION.....	1
Purpose of the Study .....	1
Background and Rationale.....	2
Research Questions or Aims.....	5
Assumptions.....	5
Delimitations.....	6
Definition of Terms.....	6
Significance of the Study .....	7
CHAPTER II: LITERATURE REVIEW .....	9
Historical Context .....	9
Sleep Quality.....	23
Daytime Sleepiness.....	31
Sleep Hygiene.....	34
Theoretical Context.....	39
Summary .....	44
CHAPTER III: METHODS AND PROCEDURES .....	45
Research Design.....	45
Population and Sample .....	45
Demographics .....	46
Procedure.....	47
Data Collection .....	48

Instrumentation.....	48
Analytical Procedures.....	50
Summary.....	54
CHAPTER IV: RESULTS.....	55
Introduction.....	55
Data Analysis.....	55
Results.....	59
Findings.....	59
Results Summary.....	81
CHAPTER V: DISCUSSION AND SUMMARY.....	82
Research Questions and Interpretation.....	82
Limitations of the Study.....	92
Implications/Recommendations for Education.....	94
Future Research.....	95
Summary.....	97
REFERENCES.....	98
APPENDICES.....	113

## LIST OF TABLES

TABLE		PAGE
1.	Demographic Information	59
2.	Self-Reported Obligations as Reasons for Losing Sleep on a Daily or Weekly Basis	61
3.	Self-Reported Behaviors as Reasons for Losing Sleep on a Daily or Weekly Basis	62
4.	Domains of Sleep Quality, Sleep Disturbances, Habitual Sleep Efficiency, Sleeping Medications, and Daytime Dysfunction as Measured by the PSQI	64
5.	Content Analysis For “Other” Self-Reported Reasons Why Participants Had Trouble Sleeping	65
6.	Self-Reported Tendency to Fall Asleep in Certain Situations as Measured by the ESS	67
7.	Self-Reported Sleep Hygiene Behaviors as Measured by the SHI	68

8.	Correlations with Nursing Student Year of Study and Sleep Quality and Daytime Sleepiness as Measured by the PSQI and ESS	70
9.	Correlations Between Self-Reported Behaviors as Reasons for Sleeping Less on a Daily or Weekly Basis and Daytime Sleepiness (ESS) and Sleep Quality (PSQI)	71
10.	Correlations Between Nursing Students' Enrollment Status and Daytime Sleepiness (ESS), Sleep Quality (PSQI) and Sleep Hygiene (SHI)	72
11.	Correlations between Nursing Students' Behaviors, Nursing Students' Obligations, and Daytime Sleepiness (ESS), Sleep Quality (PSQI) and Sleep Hygiene (SHI)	74
12.	Differences with Nursing Students' Year of Study and Daytime Sleepiness (ESS) and Sleep Quality (PSQI)	75
13.	Model Results of Nursing Students' Self-Reported Obligations and Behaviors Predicting Sleep Hygiene (SHI), Sleep Quality (PSQI), and Daytime Sleepiness (ESS)	78
14.	Confidence Intervals of Behaviors as Mediating Variables Explaining Significant Indirect Effects between the IVs and DVs using Mplus	80



## LIST OF FIGURES

FIGURE		PAGE
3.1	Neuman Systems Model	40
4.1	Histogram Representing the Total Scores of Self-Reported Sleep Quality (PSQI)	56
4.2	Histogram Representing the Total Scores of Self-Reported Daytime Sleepiness (ESS)	57
4.3	Histogram Representing the Total Scores of Self-Reported Sleep Hygiene (SHI)	58

## **Abstract**

**Introduction:** Poor sleep quality and maladaptive sleep hygiene may lead to chronic daytime sleepiness, which may, in turn, impact daily functioning. The purpose of this research study was to further investigate sleep in pre-licensure baccalaureate nursing students, and describe factors that impact their sleep quality and daytime sleepiness.

**Methods:** This study used a cross-sectional descriptive design. A convenience sample was used to recruit participants from thirteen baccalaureate nursing programs from a Midwest region in the United States. An Invitation to Participate was emailed to deans who forwarded the invitation to the pre-licensure baccalaureate nursing students enrolled in their programs. Research questions included relationships and differences in student year of study, enrollment status, behaviors, obligations, and their sleep quality, daytime sleepiness, and sleep hygiene. Data were collected using a demographic questionnaire, the Pittsburgh Sleep Quality Index, the Epworth Sleepiness Scale, and the Sleep Hygiene Index. Data were analyzed using SPSS 26.0 and Mplus version 8.4.

**Results:** The sample (N = 254) was mostly 19-24 years old (83.8%), primarily White (85%) and female (93.3%). Overall, the participants reported poor sleep quality, excessive daytime sleepiness, and maladaptive sleep hygiene, regardless of their year of study or enrollment status. Student obligations and behaviors most frequently reported as reasons for losing sleep were classes (94.1%), work (72%), technology use into the night (85%), and caffeine use (44.5%), respectively. Classes and finances for food were inversely and statistically significant with sleep quality, daytime sleepiness and sleep hygiene. Mediation results indicated work, classes, and technology use into the night significantly predicted sleep hygiene; work, family, activity with friends, and classes significantly predicted sleep quality.

**Discussion:** Learning the importance of sleep hygiene, good sleep quality, and the associated health benefits may assist pre-licensure baccalaureate nursing students with achieving optimal daytime functioning. Providing undergraduate nursing students with routine educational sessions on sleep health to promote holistic well-being is essential. The findings support future research on testing the effect sleep hygiene has on academic performance and how sleep health affects their nursing profession. Consideration should be given to sleep health content as a thread through nursing curriculum.

*Keywords:* sleep, sleep quality, daytime sleepiness, sleep hygiene, nursing student, college student

## Sleep Quality and Daytime Sleepiness in Pre-licensure Baccalaureate Nursing Students

### CHAPTER I: INTRODUCTION

#### **Purpose of the Study**

Sleep is a biological necessity for normal functioning of humans, being required for physiologic repair and maintenance (Khalili, 2017). Sleep is important for physical and emotional well-being (Buboltz et al., 2009; Khalili, 2017). College students are well known for their irregular sleep schedules (Buboltz et al., 2009; Orzech, Salafsky, & Hamilton, 2011). Irregular sleep schedules may negatively impact learning, memory, performance (Baert, Omev, Verhaest, & Vermeir, 2015; Hershner & Chervin, 2014), and daytime functioning (Eliasson, Lettieri, & Eliasson, 2010; Khalil, 2017).

Daytime functioning may influence academic performance in all college students. Academic performance may be related to future professional success, leading to a higher income and better quality of life (Valladares, Ramírez-Tagle, Muñoz, & Obregón, 2018). Nursing students have reported sleep deprivation and daytime sleepiness due to lifestyle factors, behaviors, daily commitments, and sleep habits. These may affect their learning achievement (Demir, 2017; Huang, Yang, Wu, Liu, & Chen, 2014; Khalil, 2017). Prior research findings suggest that sleep deprivation and daytime sleepiness in undergraduate nursing students may influence cognitive function (Khalil, 2017), impacting patient care (Thomas, McIntosh, Lamar, & Allen, 2017; Ye & Smith, 2015).

Pre-licensure baccalaureate nursing students need to understand the benefits and complications of sleep health. For example, practicing good sleep hygiene may be a strategy to eliminate daytime sleepiness. Being less sleepy during the day may positively affect nursing students' overall academic performance in the classroom and clinical settings (Demir, 2017; Huang et al., 2014; Khalil, 2017; Postma, Tuell, James, Graves, & Butterfield, 2017). The

purpose of this quantitative study was to describe the factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students.

### **Background and Rationale**

Sleep is a biological and physiological need, a requirement for human survival (Khalili, 2017). Sleep restores energy, bodily systems, mood, and memory, all of which are vitally important for daily motor and cognitive functioning (Centers for Disease Control and Prevention [CDC], 2018). However, one third of the adults in the United States report that they usually get less than the recommended amount of seven or more hours of uninterrupted sleep per day (CDC, 2018). Over time, poor sleep quality may lead to chronic sleep deprivation (National Sleep Foundation, 2019).

Sleep deprivation occurs when an individual fails to get enough sleep (American Academy of Sleep Medicine [AASM], 2018). The amount of sleep varies from one person to another but on average most adults need seven to eight hours of sleep each day to feel rested (AASM, 2018). Persistent sleep deprivation in adults can lead to health risks and chronic conditions such as heart disease, high blood pressure, obesity, diabetes (Office of Disease Prevention and Health Promotion [ODPHP], 2018), stroke, and depression (CDC, 2018). Sleep deprivation in college students may occur from physiologic or behavioral reasons, resulting in daytime sleepiness, which in turn impairs daily functioning (Hershner & Chervin, 2014).

The primary effect of sleep deprivation is excessive daytime sleepiness (AASM, 2018). Daytime sleepiness is defined as difficulty in maintaining a desired level of wakefulness (National Sleep Foundation, 2019). Individuals who have excessive sleepiness feel drowsy and sluggish most days. These symptoms may interfere with work, school, activities, or relationships (National Sleep Foundation, 2019). According to

Hershner and Chervin (2014), 50% of college students report daytime sleepiness and 70% experience daily insufficient sleep. Daytime sleepiness and poor sleep quality may result from poor sleep hygiene (National Sleep Foundation, 2019).

Sleep hygiene is defined as a variety of different practices and habits that are necessary to have good nighttime sleep quality and full daytime alertness (National Sleep Foundation, 2019). Good sleep hygiene includes a regular sleep-wake schedule, comfortable sleep environment, and avoidance of stimulating activities before bed (Hershner & Chervin, 2014). Good sleep hygiene practices may include limiting daytime naps to 30 minutes. Other practices may include daily exercise, and exposure to morning sunlight (National Sleep Foundation, 2019). In addition, avoiding alcohol, cigarettes, and heavy meals before bedtime may improve sleep (National Sleep Foundation, 2019). Good sleep hygiene is important for physical and mental health, career performance, and overall quality of life (Kaur & Singh, 2017; National Sleep Foundation, 2019).

Sleep hygiene may be more problematic in college students, leading to poor sleep quality and daytime sleepiness (Hershner & Chervin, 2014). For example, college students may experience inconsistent sleep schedules, or tend to have less control over their environment, such as living in a dormitory (Gellis, Park, Stotsky, & Taylor, 2014). Additionally, college students may engage in behaviors that impact sleep, such as drinking alcohol, and/or caffeine, smoking, or technology use before bed (Gellis et al., 2014; Hershner & Chervin, 2014; Luo, Agley, Hendryx, Gassman, & Lohrmann, 2015). Sleep hygiene may be neglected because college students may prioritize other factors such as academics or social events before sleep, or for the simple fact that they lack sleep hygiene knowledge (Gellis et al., 2014; Huang et al., 2014; Kloss et al., 2016; Younas, 2017).

Sleep deprivation can lead to medical errors, patient safety concerns, and sentinel events. Therefore, pre-licensure baccalaureate nursing students should use self-care practices to assist in

optimal daytime functioning. Improving sleep hygiene in undergraduate nursing students may aid in better sleep quality and daytime functioning (Huang et al., 2014; Thomas et al., 2017). Undergraduate nursing students who have knowledge about healthy sleep may have a successful transition to professional practice, delivering high quality care to their patients (Thomas et al., 2017).

Educating pre-licensure baccalaureate nursing students about the importance of sleep and consequences of sleep deprivation may promote healthy lifestyles (Hershner & Chervin, 2014). Interventions in enhancing self-care activities among nursing students may promote empowerment in practice for modeling and educating patients (Nevins & Sherman, 2016). Research has shown that undergraduate nursing students who have more knowledge about sleep have better sleep quality and positive attitudes towards sleep hygiene. These students are more likely to teach their patients about sleep hygiene (Huang et al., 2014). Undergraduate nursing students should be knowledgeable about sleep health as a strategy to promote their own overall general health. Undergraduate nursing students may then share this information with their patients to promote their patients' holistic well-being (Huang et al., 2014; Nevins & Sherman, 2016). Improving undergraduate nursing students' sleep knowledge to minimize their own health risks should be a priority in order to provide safe, high quality care for their patients (Ye & Smith, 2015).

Research has shown that good sleep is essential to immune functioning and health (Wilson & Brooks, 2018). Sleep restores normal levels of activity and balance of the nervous system. Sleep is also needed for protein synthesis which allows for repair processes and is also important for psychological well-being (Berman, Snyder, & Frandsen, 2016). An individual will function at their highest level after resting their nervous system, allowing the brain to rest, and combine information. Lack of sleep may

lead to disturbances in daily functioning; therefore, the purpose of this research study was to further investigate sleep in pre-licensure baccalaureate nursing students, and describe factors that impact their sleep quality and daytime sleepiness.

### **Research Questions**

The research questions that guided this study were:

1. What is the relationship with freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?
2. Are there differences in freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?
3. What are the relationships with nursing students' behaviors and their quality of sleep and daytime sleepiness?
4. How do nursing students describe their routine obligations outside of school to (a) family, (b) work, (c) activities, (d) finances, and (e) living arrangements that cause them to sleep less on a daily or weekly basis?
5. Is there an association with nursing students' enrollment status as full-time and part-time, and their quality of sleep and correlates?
6. Do student obligations mediate the relationships between sleep quality and correlates?

### **Assumptions**

An assumption is a belief that is accepted as true, without adequate provision of evidence (Gray, Grove, & Sutherland, 2017). Assumptions are what the researcher takes for granted (Roberts, 2010). The assumption for this study was that a problem did exist with sleep quality among undergraduate nursing students enrolled in pre-licensure baccalaureate programs.



## **Delimitations**

Delimitations are selected characteristics that limit the scope and provide boundaries within a research study (Simon, 2011). Delimitations are controlled by the researcher and entails what will be included and what will be excluded from the study (Roberts, 2010). Delimitations for this study included sample, location, and time. The study was conducted in a Midwest region of the United States with a convenience sample of pre-licensure baccalaureate nursing students enrolled in the fall semester of the year 2019. Limiting to this area, sample, and time provided better understanding of the population in this area at one given time. Allowing for any undergraduate nursing student in the selected pre-licensure baccalaureate nursing programs to participate opened a wide age range, as well as all part-time and full-time pre-licensure baccalaureate nursing students.

## **Definition of Terms**

The following is a list of terms used throughout the study:

### **Research Variables**

#### **Demographic variables.**

Demographics variables included age, gender identity, race/ethnicity, student status, year of study, housing, relationship status, obligations, and behaviors. Student status was defined as full-time student (enrolled in 12 credit hours or more), and part-time student (enrolled in 11 credit hours or less). Year of study was defined as freshman or first year nursing student, sophomore or second year nursing student, junior or third year nursing student, senior or fourth year nursing student. Housing status was defined as on-campus (dorms), on-campus (fraternity or sorority), off-campus (parents' home, own home, apartment, or other). Relationship status was defined as single and not currently in a relationship, not married but in a relationship, married, or divorced. Obligations that may impact sleep were defined as work, family, activities with

friends, finances (including food, housing, clothing, college, and transportation), classes, and living arrangements. Behaviors that may impact sleep were defined as drinking caffeine, coffee/tea, or energy drinks, drinking alcohol, cigarette use, using street drugs, and the use of technology or electronic devices into the night.

### **Conceptual definitions.**

#### ***Sleep quality.***

The conceptual definition of sleep quality was defined as the satisfaction of one's sleep experience (Kline, 2013). The operational definition of sleep quality was measured using the Pittsburgh Sleep Quality Index.

#### ***Daytime sleepiness.***

The conceptual definition of daytime sleepiness was defined as difficulty in maintaining a desired level of wakefulness (National Sleep Foundation, 2019). The operational definition of daytime sleepiness was measured using the Epworth Sleepiness Scale.

#### ***Sleep hygiene.***

The conceptual definition of sleep hygiene is using a variety of different practices and habits that are necessary to have good nighttime sleep quality and full daytime alertness (National Sleep Foundation, 2019). Sleep hygiene was measured using the Sleep Hygiene Index.

### **Significance of the Study**

Self-care practices among pre-licensure baccalaureate nursing students are lacking (Nevins & Sherman 2016). Few studies exist assessing sleep quality in pre-licensure baccalaureate nursing students. There is a prevalence of daytime sleepiness in undergraduate nursing students associated with their individual characteristics, college lifestyle behaviors, and poor sleep habits (Demir, 2017). Daytime sleepiness, sleep deprivation, and poor sleep hygiene may lead to the use of alcohol, caffeine, stimulants, and technology use into the night. In turn,

this may lead to poor academic performance, impaired mental and physical health, sleep disorders, and increased risk of accidents (Hershner & Chervin, 2014).

Researchers have found that sleep quality significantly correlates with daytime sleepiness and suggest enhancing the concept of sleep hygiene (Huang et al., 2014). Undergraduate nursing students may lack the knowledge that chronic sleep deprivation may result in personal and safety issues, and that they may be exposing themselves to acute and chronic health problems (Thomas et al., 2017). Pre-licensure baccalaureate nursing students need to protect their own health by recognizing factors that impact sleep so they can safely care for their patients. An extensive review of literature indicated that there is a gap describing sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students.

## CHAPTER II: LITERATURE REVIEW

Sleep is considered the altered state of consciousness in which an individual's perception of and reaction to the environment are decreased (Berman et al., 2016; Blanchard & Chaudhary, 2002). Sleep is characterized by minimal physical activity, variable levels of consciousness, changes in the body's physiological processes, and decreased responsiveness to external stimuli. Sleep restores normal levels of activity and balance among the nervous system (Berman et al., 2016).

A number of neurotransmitters and neuronal pathways have been proposed to be involved in the generation of sleep and wakefulness (Blanchard & Chaudhary, 2002). Neurotransmitters are chemical messengers that transmit signals across a chemical synapse, from one neuron to another neuron, or to other target cells. Neuronal activity decreases during sleep (Blanchard & Chaudhary, 2002).

Sleep is linked to functions of growth, development, and maintenance of the nervous system, for example, memory consolidation, perception, communication, motor function, and release of growth hormones (Culebras, 2002). The nervous system also regulates physiologic functions such as breathing, heart rate, digestion, and temperature (Dauvilliers, 2003).

Restoration of the nervous system after good sleep quality restores vital energies and powers of the body. Good sleep quality is followed by sensations of satisfaction and replenishment. Researchers suggest that neurotransmitters deplete after an extended period of being awake. Most neurological functions tend to weaken when an individual is tired, for example, a decrease in motor function, or reactivity time (Culebras, 2002).

The two types of sleep are non-rapid-eye-movement (NREM) and rapid-eye-movement (REM) sleep. NREM and REM cycles alternate back and forth during sleep (Berman et al., 2016). NREM sleep is divided into three stages. Stage one is the stage of very light sleep and

lasts only a few minutes. During this stage, the individual feels relaxed, the eyes may roll side to side, and the heart rate and respiratory rate drop slightly. Stage two is the onset of sleep, when the body processes slow. The eyes are generally still, heart rate and respiratory rate decrease slightly, and the body temperature falls. This stage lasts 20-30 minutes. Stage three is the deepest stage of sleep when the body is very relaxed, the blood pressure decreases, and the heart rate and respiratory rate decrease by 20%-30% below those exhibited during waking hours. During stage three breathing becomes slower, hormones are released, and blood supply to muscles increases. Stage three lasts about 50-60 minutes. These changes to the physiological state are imperative for neurological repair, maintenance, and energy restoration (Berman et al., 2016; National Sleep Foundation, 2018). Cerebral functions are restored during this cycle. Core body temperature decreases, the pituitary releases growth hormones, interleukin levels increase immune function, insulin sensitivity and response increases, and neurotransmitters are replenished (Adrien, 2003). After stage three, the sleep passes back through stages two and one over about 20 minutes. After that, the first REM stage occurs, lasting about ten minutes, completing the first sleep cycle (Berman et al., 2016).

REM sleep first occurs about 90 minutes after falling asleep. REM recurs about every 90 minutes and can last five to 30 minutes (Berman et al., 2016; National Sleep Foundation, 2018). Distinctive eye movements occur, voluntary muscle tone is decreased, and deep tendon reflexes are absent. During this sleep the gastric secretions increase, and heart rate and respiratory rate are often irregular (Berman et al., 2016; National Sleep Foundation, 2018). REM sleep is linked to functions of growth and development of the nervous system, and is thought to affect an individual's behavior (Adrien, 2003). Sleep deprivation suppresses REM sleep and may cause irritability. Alcohol and some

medications may suppress REM sleep, not allowing for dream sleep (Adrien, 2003). During this cycle, the brain is highly active and dreams may occur, and brain metabolism may increase up to 20%. Therefore, levels of acetylcholine and dopamine increase. Acetylcholine and dopamine are associated with the hormone cortisol and its activation (Berman et al., 2016; National Sleep Foundation, 2018). Cortisol is a hormone that is produced by the adrenal cortex. Cortisol is thought to have a role in stress, and brain activity, such as learning, memory, thinking, organizing of information, and promoting alertness (Berman et al., 2016; National Sleep Foundation, 2018). Decreases in cortisol have been shown to impair working memory (Miyata et al., 2019). REM sleep helps with consolidating memories and helps improve procedural skills (Culebras, 2002).

### **Brain function.**

Sleep is a function of the brain. The brain is a vital organ that communicates with the human body. The outer most layer of the brain is called the cerebral cortex. The cerebral cortex plays a role in thinking, memory, and movement. The cerebellar cortex covers the cerebellum. The cerebellum is at the base of the brain and is responsible for coordination, balance, and learning. The cerebral cortex contains sensory and motor areas. Sensory areas receive input from the thalamus. The thalamus is located in the dorsal part of the brain and has nuclei that play a part in regulating consciousness, sleep, and alertness. The hypothalamus is located below the thalamus and contains nuclei that affect sleep and arousal (Culebras, 2002).

The pituitary gland in the brain takes messages from the brain via the hypothalamus to produce hormones. The interactions among the hypothalamus, pituitary, and the adrenal glands is known as the hypothalamic-pituitary-adrenal axis (HPA). The HPA helps regulate the stress response, releasing hormones such as adrenaline and cortisol. When an individual encounters something stressful, the hypothalamus releases corticotropin-releasing hormone (CRH) (Carrier

& Bliwise, 2003). The release of CRH is followed by secretion of adrenocorticotropin hormone (ACTH) from the anterior pituitary, which then travels to the adrenal glands, stimulating secretion of cortisol. CRH also acts on other areas of the brain, such as suppressing appetite, improving memory, and selective attention. Abnormally high levels may be associated with mental health disorders, cardiovascular disease, weight gain, and eating disorders (Vgontzas, Vela-Bueno, & Chrousos, 2002).

Plasma levels of CRH, ACTH, and cortisol peak in the early morning, decline during the day, and are lowest overnight. The lowest point of ACTH and cortisol occurs during the first part of sleep and start to rise a few hours before waking (Carrier & Bliwise, 2003). When an individual lacks sleep, evening cortisol levels increase and morning cortisol levels decrease. The process facilitates disturbances associated with memory deficits and insulin resistance. HPA balance is imperative for supporting the immune system, glucose levels, intestinal tract, and neurological functions (Buxton, Spiegel, & Van Cauter, 2002).

The basal ganglia are a group of nuclei within the cerebrum that coordinate messages between the brain and motor systems that control motor functions and other behaviors. Neurons of the basal ganglia synthesize, store, and release neurotransmitters in the brain, for example, dopamine, acetylcholine, and norepinephrine. These neurotransmitters play a role in sleep, daytime functioning, learning, and memory (Adrien, 2003; Berman et al., 2016; National Sleep Foundation, 2018).

### ***Neurotransmitters.***

There are major neuronal transmitter systems that play a role in everyday functions. Neurotransmitters are stored in synaptic vesicles, clustered close to the plasma membranes of axon terminals. They are released and diffuse across the synaptic cleft

where they bind to specific receptors on the plasma membrane of the postsynaptic neuron. Binding of the neurotransmitter may influence the neuron in an inhibitory or excitatory way; excitation may result in the generation of an action potential and subsequent release of a neurotransmitter, allowing communication with the postsynaptic cell (Blanchard & Chaudhary, 2002).

Major neurotransmitter systems include norepinephrine, dopamine, serotonin, and cholinergic systems. Norepinephrine and dopamine are catecholamines that help to maintain wakefulness. They regulate arousal, cognitive control, and working memory. Dopaminergic neurons are located in the midbrain, posterior hypothalamus, and subthalamus, with projections to the basal forebrain and cortex. Dopaminergic neurons are associated with sensory stimulation, behavioral arousal, and purposeful movements. Adrenergic neurons release norepinephrine and are contained in the reticular formations of the pons and medulla and project to the forebrain. Norepinephrine release is lowest during sleep and rises during wakefulness, activating cortisol release (Blanchard & Chaudhary, 2002).

The serotonin and cholinergic systems are key in promoting sleep. Serotonin is produced in nuclei in the medulla, pons, and midbrain (Adrien, 2003; Blanchard & Chaudhary, 2002). Serotonin released to the forebrain leads to a decrease in cortisol activation, inhibiting behaviors, and preparing the individual for sleep. Serotonin also plays a role in cognition, mood, and anxiety. Serotonin is used by the body to produce melatonin. Melatonin is converted from serotonin in the pineal gland in the brain (Blanchard & Chaudhary, 2002). Melatonin helps induce and maintain sleep (Lu, Manthena, & Zee, 2006; National Sleep Foundation, 2018).

Cholinergic systems have pathways to the forebrain and brainstem nuclei. They are responsible for arousal, mood, learning, memory, and motor function. Acetylcholine is a neurotransmitter that is synthesized and released by neurons within the cerebral cortex.



Acetylcholine is greatest during states of cortisol arousal, for example, during the awake state and REM sleep. Acetylcholine is also used to transmit signals between motor neurons and skeletal muscles (Blanchard & Chaudhary, 2002). Acetylcholine and dopamine are associated with the hormone cortisol and its activation (Berman et al., 2016; National Sleep Foundation, 2018).

Adenosine and gamma-Aminobutyric acid (GABA) are inhibitory neurotransmitters. They promote sleep and suppress arousal. Adenosine is found in neurons in the hypothalamus and can increase REM sleep. Adenosine builds up throughout the day and declines through the night after the body has received a certain amount of restorative NREM sleep. GABA is found in the limbic system of the brain. The limbic system is comprised of the amygdala, hippocampus, thalamus, hypothalamus, and basal ganglia. GABA acts by inhibiting the activating systems of acetylcholine, norepinephrine (wakefulness transmitters) and controls the thalamocortical system burst of the excitatory neurotransmitters. GABA cells are unaffected by histamine, therefore inhibiting cortisol activation (Blanchard & Chaudhary, 2002).

***Reticular activating system.***

The brain stem is located between the spinal cord and the rest of the brain. The brain stem communicates with the hypothalamus to control transitions between wake and sleep. The reticular formation is an important region within the brain stem that includes nuclei that form the reticular activating system and other systems, such as cardiovascular and respiratory systems (Dauvilliers, 2003). The reticular activating system connects brain stem nuclei to the cortex via the thalamus and hypothalamus. The hypothalamus contains the suprachiasmatic nucleus and hypocretin system. The hypocretin system produces neurotransmitters such as dopamine and histamine. These neurotransmitters

promote wakefulness. Histaminergic neurons maintain cortisol activation (Blanchard & Chaudhary, 2002).

The thalamus relays information from every sense except olfaction to the cerebral cortex. Many neurons in the thalamocortical system utilize the excitatory neurotransmitter glutamate, which is found in neurons of the reticular formation, thalamus, and cortex. Glutamate is highest during wakefulness. Excess glutamate may cause brain damage, and too little glutamate may cause psychosis, coma, or death. Glutamate is responsible for sending signals between nerve cells, playing a role in learning, memory, and cognition. (Blanchard & Chaudhary, 2002).

The suprachiasmatic nucleus in the hypothalamus has direct neural connections from photoreceptors in the retina of the eye. Light and dark signals travel to the suprachiasmatic nucleus from the optic nerve in the eye, signaling the internal clock that it is time to be awake or sleepy. The suprachiasmatic nucleus also signals to other parts of the brain to regulate body systems that control hormones, body temperature, and metabolism (Lu et al., 2006; National Sleep Foundation, 2018). The reticular activating system also receives input from the lower part of the brain stem that has an inhibitory effect, limiting sleep initiation. The system is known as the circadian rhythm (Adrien, 2003).

### **Circadian rhythm and sleep/wake cycle.**

The sleep/wake cycle is known as the homeostatic sleep drive. It is an internal biochemical system that generates a pressure to sleep since the last adequate sleep episode. The homeostatic sleep drive acts as a timer that reminds the body to sleep after a certain time of being awake (National Sleep Foundation, 2018). It also helps individuals to maintain enough sleep throughout the night to make up for the hours of being awake (Hershner & Chervin, 2014; National Sleep Foundation, 2019). The homeostatic sleep drive is a balance between sleep and

wakefulness. This process is known to be a restorative process (National Sleep Foundation, 2018). The homeostatic sleep drive, along with the circadian rhythm, keeps an individual at their best mental and physical functioning (National Sleep Foundation, 2018).

The circadian rhythm is a 24-hour internal clock that is running in the background of the brain, cycling between sleepiness and alertness (National Sleep Foundation, 2018). The circadian rhythm may be influenced by internal and external factors (Soares et al., 2012). Internal factors may include psychological, behavioral, or biological variables, such as performance, mood, alertness, cortisol, and melatonin secretions. External factors may include work schedules, academics, or social commitments (Selvi et al., 2017).

Light exposure in the mornings causes the suprachiasmatic nucleus to send signals to raise body temperature and produce the hormone cortisol. The HPA process releases cortisol and helps the body regulate metabolism, resist stress, and reduce inflammation (Hall, 2016). Cortisol is also thought to have a role in brain activity, such as learning, thinking, organizing of information, and promoting alertness (Berman et al., 2016; National Sleep Foundation, 2018). Less light at the end of the day causes the suprachiasmatic nucleus to signal the pineal gland in the brain to produce melatonin. Melatonin helps induce sleep and maintain sleep (Lu et al., 2006; National Sleep Foundation, 2018). Continued light exposure will suppress melatonin, therefore disturbing the circadian cycle.

Researchers measured melatonin, cortisol, and timing of circadian rhythms in college students. On average, melatonin was released 2.6 hours later in students with irregular sleep patterns (Phillips et al., 2017). College students who are exposed to blue-

light from electronic devices have been shown to have a significant reduced amount of melatonin concentration (Figueiro, Wood, Plitnick, & Rea, 2011).

College students who had poor sleep quality were found to have decreased cortisol secretion (Suh, 2018). Decreased cortisol secretions are related to health and brain activity (Berman et al., 2016; Hall, 2016; National Sleep Foundation, 2018; Suh, 2018). Cortisol is linked to deep NREM sleep (Dauvilliers, 2003), which is vital for neurological repair, maintenance, energy restoration (Berman et al., 2016; National Sleep Foundation, 2018), and replenishing neurotransmitters (Adrien, 2003). Researchers have found that decreased cortisol secretions in college students are significantly correlated with daytime sleepiness (Miyata et al., 2019). College students who adopt irregular sleep patterns are subject to a light pattern that encourages circadian delay, affecting day time functioning (Miyata et al., 2019; Phillips et al., 2017).

The cumulative effect of the homeostatic sleep drive and delayed circadian rhythm may make young adults feel more awake in the evening, having a difficult time falling asleep, leading to insufficient sleep (Hershner & Chervin, 2014). When college students are sleep deprived, sleep cycles are disrupted and their bodies respond with a decreased ability to concentrate and perform tasks (Ranasinghe, Gayathri, & Priya, 2018).

### **United States Adults**

In 2014, the CDC (2018) reported 35.2% United States adults had a sleep duration of less than seven hours a night. Researchers have examined trends in sleep duration in the United States between the years 1975-2006. Findings have shown that sleep deprivation had increased over time due to changes in the labor force. For example, women in the labor force had increased, as well as the proportion of individuals working extended hours (Knutson, Van Cauter, Rathouz, DeLeire, & Lauderdale, 2010). Knutson et al. (2010) showed those who had a

shorter sleep duration had some degree of college education, worked full-time, were single, or divorced. Those who worked extended hours had a shorter sleep duration due to personal and social obligations (Knutson et al., 2010).

Other causes of sleep deprivation in adults may include inconsistent bedtimes, late night technology use, medical conditions, personal obligations, shift work, or working long hours (AASM, 2018; CDC, 2018; Johnson, Jung, Brown, Weaver, & Richards, 2014; Whipps, Byra, Gerow, & Guseman, 2018). Instead of regularly going to bed some adults prefer to stay up watching television, using technology, or staying out to socialize. Others may need to have inconsistent sleep patterns due to their job obligations. Adults may also have family, other personal obligations, or other factors that impact their sleep; for instance, young children, illnesses, family members, living arrangements, medications, or sleep disorders (AASM, 2018; CDC, 2018).

### **Physical health.**

The role of sleep health has grown since sleep deprivation has been connected to poor health. Insufficient sleep has been linked to the development of chronic diseases and conditions, for example, diabetes, cardiovascular disease, obesity, and depression (CDC, 2018; ODPHP, 2018; Owens, Christian, & Polivka, 2017). Chemicals and hormones that are released during stages of sleep cycles may be impaired, leading to a risk of poor health conditions. REM sleep is linked to functions of active growth and development of the nervous system (Culebras, 2002).

### ***Insulin resistance.***

Multiple research studies have been conducted on the association of sleep duration and the development of insulin resistance. Sleep deprivation has been positively associated with insulin resistance, and a higher risk in developing type 2 diabetes (Alnaji,

Law, & Scott, 2016). In a cohort study by Lee et al. (2016), the risk of type 2 diabetes was more than two-fold higher in subjects with poor sleep quality. Results indicated that sleep quality is a better predictive factor for type 2 diabetes rather than the number of hours of sleep duration (Lee et al., 2016). Similarly, a research study by Benedict et al. (2016) of nine adult males was conducted to see if sleep deprivation affects gut microbiota. After two days of partial sleep deprivation, participants had exhibited almost a 40% greater increased insulin resistance (Benedict et al., 2016).

### ***Cardiovascular disease.***

A systematic review and meta-analysis by Cappuccio, Cooper, D'Elia, Strazzullo, and Miller (2011) noted that short sleep duration was associated with a greater risk of developing, or dying, of coronary heart disease and stroke. Sleep deprivation was shown to increase the risk of cardiovascular disease and stroke in adult men and women. Subsequently, in a study over two years, Yadav, Hyun, Ahn, Koh, and Kim (2017) indicated a 9.56% increase in new onset hypertension with those participants sleeping less than six hours a night.

From findings of experimental and epidemiologic studies, it may be concluded that sleep duration affects stroke incidence through risk factors of circadian variations, sleep disorders, hypertension and diabetes (Patyar & Patyar 2015). Researchers suggest that preventing sleep disturbances, improving sleep quality, and providing sleep treatments may play a potential role in decreasing cardiovascular disease and stroke (Patyar & Patyar 2015).

### **College Students**

From 1969 to 2009, college students had reported a decline in sleep duration from seven hours and 45 minutes to seven hours (Taylor & Bramoweth, 2010). A decline in sleep duration may be due to the college transition, for example, reduced parental supervision, new social opportunities, living arrangements, working, and academics (Owens et al., 2017; Taylor &

Bramoweth, 2010). In a 31-year study on sleep duration from the years 1975-2006 in the United States, researchers found that college students reported spending more time studying, working, or engaging in activities with friends instead of sleeping (Knutson et al., 2010).

Current statistics show that some college students have reported a sleep duration of less than seven hours a night (CDC, 2018; Taylor & Bramoweth, 2010). Data from the 2014 Behavioral Risk Factor Surveillance System reported 25.4% to 31.7% of the Midwest population aged 18-24 years being studied received less than seven hours of sleep per night (CDC, 2018). The traditional college student fell into this category. Traditional college students are defined as age 24 or less (National Center for Education Statistics 2019). Adults living in this Midwest region who reported sleeping less than seven hours a night had significantly higher risk factors for obesity, physical inactivity, and smoking (CDC, 2018). This same population reported a higher prevalence of chronic conditions of heart attack, coronary heart disease, asthma, chronic obstructive pulmonary disease, arthritis, depression, chronic kidney disease, and diabetes (CDC, 2018).

Research has shown that college students who report poor sleep quality have an increase in daytime sleepiness, physical, and psychological complaints (Buboltz et al., 2009; Khalil, 2017; Nagane, Suge, & Watanabe, 2016). College students report lack of motivation, drowsiness, fatigue, and feeling tired in the morning (Buboltz et al., 2009; Nagane et al., 2016). With the delayed circadian rhythm, melatonin release, and decrease in cortisol, early morning activities or classes may impede daytime functioning (Nagane et al., 2016). Along with these hormone release timings, irregular sleep patterns, poor sleep quality, and sleep deprivation may also lead to difficulty in daytime functioning, impeding academic performance (Khalil, 2017).

A systematic review of literature of United States college students age 24 or younger also showed that sleep deprivation was linked to insulin resistance, hypertension, diabetes, weight gain, and stress (Owens et al., 2017). Young adults' sleep patterns and hormone changes affect metabolic functioning. This may lead to increased insulin resistance, affect appetite, and stress levels (Benedict et al., 2016; Owens et al., 2017). College students are at higher risk for weight gain related to decreased physical activity and possible poor food choices due to their college lifestyles (Owens et al., 2017).

### ***Weight.***

Sleep influences weight and physical condition. Sleep deprivation primes higher body mass index, leading to poor physical fitness (Chang & Chen, 2015; Vargas, Flores, & Robles, 2014). In a study of 539 university college freshmen, Chang and Chen (2015) indicated that over 60% of female college students had poor sleep quality. The prevalence of overweight was approximately 31% in the freshmen included, which was higher than that in a national survey (Chang & Chen, 2015). College students who slept less had a higher body mass index, and poor physical fitness (Chang & Chen, 2015). Similarly, Vargas et al. (2014) showed that sleep disturbances were significantly linked to overweight and obesity in a population of 536 university students. Sleep disturbances, rather than sleep duration, were associated with a higher body mass index. Researchers suggest expanding wellness programs to promote healthy sleep among college students (Vargas et al., 2014).

### **Psychological Health in College Students**

College students who reported poor sleep quality have more problems with psychological health (Lund, Reider, Whiting, & Prichard, 2010; Orzech et al., 2011). The American College Health Association National College Health Assessment II database discovered college students with depression or anxiety reported more sleep disturbances than students who did not have



depression or anxiety (Boehm, Lei, Lloyd, & Prichard, 2016). Mental health factors such as depression, anxiety disorders (Boehm et al., 2016), rumination (Slavish & Graham-Engeland, 2015), and emotion dysregulation (Semplonius & Willoughby, 2018) are further reasons for sleep deprivation in college students. Not only prevalent in the United States, in a study among university students from 26 countries, Peltzer and Pengpid (2016) also found that poor mental health and poor life satisfaction were associated with sleep deprivation.

### **Psychological Health in Undergraduate Nursing Students**

Female college students have reported more stress-related sleep troubles compared to males (Lund et al., 2010). Undergraduate nursing students are primarily female (National Center for Education Statistics, 2019). Studies on undergraduate nursing students have reported more sleep deprivation, depression (Chen et al., 2015; Güneş & Arslantaş, 2017; Menon, Karishma, & Mamatha 2015; Zhang, Chernaik, & Hallet, 2017; Zhang, Peters, & Bradstreet, 2018), stress, coping problems, daytime sleepiness, and anxiety compared to general college students (Bartlett, Taylor, & Dirk Nelson, 2016; Zhang et al., 2017; Zhang et al., 2018; Zhang, Peters, & Chen, 2018).

Comparing 156 undergraduate nursing students to 76 general college students, Bartlett et al. (2016) found that undergraduate nursing students had significantly more anxiety and sleep disturbances that affected academics compared to the general college student. Similarly, in a study of 242 undergraduate nursing students, Zhang et al. (2017) found that 56.6% reported moderate to severe anxiety and 54.5% reported symptoms of depression, which were higher rates than reported by general college students in the United States. Zhang et al. (2018) also reported that undergraduate nursing students had

poor sleep quality that was positively associated with symptoms of anxiety and depression.

In a study of junior level nursing students in Taiwan, 32.6% had depression symptoms that correlated with lower GPA, poor sleep quality, stress, and anxiety (Chen et al., 2015). Comparatively, a study of 151 Brazil undergraduate nursing students reported 78.8% had poor sleep quality that resulted from higher levels of stress (Benavente, da Silva, Higashi, de Azevedo Guido, & Costa, 2014). It would seem that undergraduate nursing is stressful in most programs with health promotion being an important implication for nursing education (Chen et al., 2015).

### **Physical and Psychological Health in Undergraduate Nursing Students**

Undergraduate nursing students who study and work have reported more symptoms of poor digestion, headache, classroom sleepiness, and insomnia (Mattos Moraes dos Santos, Figueiredo De Martino, Girnos Sonati, De Faria, & de Almeida Nascimento, 2016). Other studies of sleep quality in nursing students also showed physical complaints. For example, in a study of sleep quality and health complaints in 713 nursing students, 45% reported headache, 39% tiredness, 27% back pain, 10% acid peptic disease, 9% insomnia, and 7% depression (Menon et al., 2015). Researchers suggest addressing self-care, stress management skills, sleep promotion, and coping strategies in undergraduate nursing programs for use in both academic preparation and in future careers (Bartlett et al., 2016; Güneş & Arslantaş, 2017; Zhang et al., 2018). This may decrease physical complaints associated with sleep deprivation. Sleep deprivation in traditional college students has been studied; however, factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate students need further exploration.

### **Sleep Quality**

Sleep quality can be defined as the satisfaction of one's sleep experience (Kline, 2013). The key determinants of sleep quality include sleeping at least 85% of one's total time while in

bed, falling asleep in 30 minutes or less, waking up no more than once per night, and being awake for 20 minutes or less after initially falling asleep (National Sleep Foundation, 2019). Sleep quality refers to how well one sleeps. There are challenges to attaining good sleep quality, for example, environmental factors, timing, and daily obligations.

### **Sleep Quality in College Students**

Since sleep quality is defined as the satisfaction of one's sleep experience (Kline, 2013), the meaning of good sleep quality may be subjective (Harvey, Stinson, Whitaker, Moskowitz, & Virk, 2008). However, college students may have poor sleep quality and sleep deprivation due to their homeostatic sleep drive and delayed circadian rhythm (Hershner & Chervin, 2014). Research has shown that college students have a delay in melatonin release and decrease in cortisol secretion (Hershner & Chervin, 2014; Phillips et al., 2017; Suh, 2018). This will make them feel less sleepy in the evening, prolonging their bedtime. This may lead to poor sleep quality if they need to wake up early for daily commitments such as classes or employment (Hershner & Chervin, 2014; Suh, 2018).

College students have reported poor sleep quality (Buboltz et al., 2009; Lund et al., 2010). Along with their homeostatic sleep drive and delayed circadian rhythm, college students may have poor sleep quality due to their daily responsibilities (Hershner & Chervin, 2014). A study of 197 incoming college freshmen found that females reported a greater stress level than males (Garrett, Liu, & Young, 2017). Increased stress levels were significantly associated with poor sleep quality. Reasons for increased stress levels were time-management, transition to college, academic performance, personal relationship issues, and poor coping skills (Garrett et al., 2017).

Research has shown that poor sleep quality negatively impacts learning, memory, and performance (Baert et al., 2015; Hershner & Chervin, 2014). Studies by Baert et al. (2015) concluded that good sleep quality is essential in helping memory and cognitive performance. This same study showed that those college students who had poorer sleep quality scores had a decrease in exam scores by 4.85 percentage points (Baert et al., 2015).

Similarly, Valladares et al. (2018) found that those college students who stayed up later in the evening had poorer academic performance. Those who were more alert and awake in the mornings had a higher GPA compared to those who were more awake and alert in the evening and night hours. Timing of class schedules and daily obligations may assist in successful academic performance. Good sleep quality is essential for learning and memory (Hsiu-Chin, Ting-En, Chia-Hsuan, Whei-Mei, & Mei-Hsiang, 2014), and may assist in successful academic performance.

### **Sleep Quality in Undergraduate Nursing Students**

Poor sleep quality has also been reported in undergraduate nursing students (Hsiu-Chin et al., 2014; Mattos Moraes dos Santos et al., 2016). In a study of undergraduate nursing students, Hsiu-Chin et al (2014) found that 53% had poor sleep quality. In this study, those undergraduate nursing students who had better sleep quality reported higher scores of learning satisfaction (Hsiu-Chin et al., 2014). Similarly, a study by Mattos Moraes do Santos et al. (2016) reported 24.52% of undergraduate nursing students had poor sleep quality. In this same sample, however, 59.80% reported poor sleep quality if they were employed while in college (Mattos Moraes do Santos et al., 2016). Daily obligations of work and academics will impact sleep quality.

Poor sleep quality may result in sleep deprivation, leading to daytime sleepiness (Benavente et al., 2014). There is lack of research in undergraduate nursing students that associates sleep quality to successful academic performance (Benavente et al., 2014). Successful

academic performance may be a predictor of professional success (Valladares et al., 2018). Professional success may lead to high quality patient care.

### **Sleep Deprivation in College Students**

Sleep deprivation occurs when an individual fails to get enough sleep (AASM, 2018). College students typically sleep, but do not have enough adequate sleep (Hershner & Chervin, 2014). Sleep deprivation in college students may occur for multiple reasons. Many college students go to sleep late and wake up early (Hershner & Chervin, 2014) before the average seven to eight hours of sleep that are needed each night to feel alert and well rested (AASM, 2008). Researchers have stated those who sleep less than seven hours of sleep will get less REM sleep, which is vital for storing knowledge and consolidating memory (Baert et al., 2015). REM sleep allows for new information to associate with existing knowledge, and is important for rehearsing, understanding, reproducing, and applying knowledge in preparation for successful academic performance (Baert et al., 2015).

Causes for sleep deprivation in college students may include activities with friends, lifestyle behaviors, noisy living conditions, daily commitments, sleep disorders, inconsistent sleep, and early morning class schedules (Buboltz et al., 2009; Demir, 2017; Gellis et al., 2014; Hershner & Chervin, 2014; Huang et al., 2014; Khalil, 2017). College students may not prioritize sleep, or they may lack knowledge about the importance of sleep (Gellis et al., 2014; Huang et al., 2014; Kloss et al., 2016; Younas, 2017).

Personal obligations, employment, environmental, physiological, or behavioral reasons impact sleep (AASM, 2008; Hershner & Chervin, 2014). College students report that daily commitments are one of the main reasons for sleep deprivation (Benn & Lanier, 2016). Daily commitments may include academics, social activities, and working

(Benavente et al., 2014; Soares et al., 2012). In a survey of 80 university students, Benn and Lanier (2016) reported 53% students admitted sleeping four to six hours per night, and Soares et al. (2012) found a mean sleeping time of less than six hours a night in college students. Sleep deprivation caused poor academic performance for students in these two studies. Reported causes for their sleep deprivation were due to working, academics, technology use, stress, environment, physiological, and psychological factors (Benn and Lanier, 2016; Soares et al., 2012). Compromising sleep or having irregular sleep patterns will in turn affect daily commitments and accomplishments.

Research has shown that college students have irregular sleep patterns (Gellis et al., 2014; Lund et al., 2010), possibly causing their sleep deprivation. Sleep deprivation has a negative effect on academic performance (Baert et al., 2015; Benn & Lanier, 2016; Eliasson et al., 2010; Khalil, 2017; Nagane et al., 2016; Soares et al., 2012; Van Der Heijden et al., 2018). College students who have earlier bedtimes have successful academic performance (Eliasson et al., 2010). In a study of 157 college students, timing of sleep correlated with a higher GPA. Specifically, those who went to bed earlier and woke earlier had a higher GPA (Eliasson et al., 2010). Similarly, Nagane et al. (2016) studied 141 university students and found that those who went to bed earlier also had a higher GPA.

A study of 1,378 college students by Van Der Heijden et al. (2018) found that chronic sleep deprivation led to worse concentration and poorer academic performance. Those who were sleep deprived and had inadequate knowledge about sleep hygiene had worse academic performance (Van Der Heijden et al., 2018). Moreover, a study by Benn and Lanier (2016) reported 82% of university students had sleep deprivation that affected their grades. Similarly, 394 first year university students were surveyed on their sleep quality by Baert et al. (2015). This

study indicated that poor sleep quality led to poor academic performance during their first examination period of the semester.

Coveney (2014) reported that college students compromised sleep to fit around their academics and social engagements by self-regulating their sleeping patterns. Although sleep is a necessity, college students compromise sleep to engage in daily commitments. For optimal return on their investment of time, money, and effort, college students need to maximize their learning and academic growth; however, sleep deprivation may compromise accomplishing these goals (Hershner & Chervin, 2014).

Both sleep and academics have been known to be affected by technology (Li, Lepp, & Barkley, 2015). Multiple research has been found that college students who have a high use of technology have poor sleep quality and quantity (Mohammadbeigi et al., 2016; Towne Jr et al., 2017; Whipps et al., 2018). Other studies have shown that technology usage is associated with high stress levels of incoming freshmen college students, especially females (Garett et al., 2017). In a study of 516 undergraduate university college students, Li et al. (2015) reported that using the cell phone at bed time was negatively related to sleep quality and that using the cell phone in class, and while studying, was negatively related to academic performance. Researchers have found that late night technology may cause sleep deprivation by interrupting the sleep cycle (Benn & Lanier, 2016; Whipps et al., 2018). Light emitted from electronic devices may reduce melatonin production, delaying the sleep cycle (Figueiro et al., 2011; Mohammadbeigi et al., 2016).

College students who delay the circadian rhythm even more will have greater sleep deprivation. This may impact their daytime functioning, as well as academic performance. Research has shown that irregular sleep schedules negatively impact

learning and memory (Hershner & Chervin, 2014). Regular sleep schedules are important to align with the homeostatic sleep drive and circadian rhythm in college students. Learning is dependent on specific sleep states of memory that are repaired during REM and NREM sleep (Hershner & Chervin, 2014). Therefore, the use of nighttime technology may delay the circadian rhythm cycle, shortening the phases of REM and NREM sleep, affecting memory and academics (Hershner & Chervin, 2014).

### **Sleep Deprivation in Undergraduate Nursing Students**

Similar to other college students, undergraduate nursing students have reported lack of sleep and poor sleep quality. Reasons stated for lack of sleep and poor sleep quality included using sleep time for academics, social activities, and working (Benavente et al., 2014; Mattos Moraes dos Santos et al., 2016; Nevins & Sherman, 2016). In turn, they have reported receiving poor grades (Menon et al., 2015). Additionally, in a study of 130 undergraduate nursing students, Khalil (2017) found that 33.2 % had abnormal sleep habits. In this study there was also a significant relationship between daytime sleepiness, sleep quality, and daytime functioning (Khalil, 2017).

Researchers have found that female college students have been known to have poor sleep quality and low levels of cortisol (Suh, 2018). Undergraduate nursing students are predominantly female (National Center for Education Statistics, 2019). In a study comparing cortisol levels after a psychological stress in males and females, researchers found that females had a lower cortisol level than males (Reschke-Hernandez, Okerstrom, Edwards, & Tranel, 2017). Researchers have noted that hormones, such as cortisol, are affected by age, gender, and hormonal contraceptive use (Reschke-Hernandez et al., 2017). Low levels of cortisol are related to brain activity (Berman et al., 2016; Hall, 2016; National Sleep Foundation, 2018; Suh, 2018). If brain activity of learning, thinking, organizing, and alertness are compromised (Berman et al., 2016; National



Sleep Foundation, 2018), then it would seem that female undergraduate nursing students are at high risk for impaired memory.

Undergraduate nursing students learn classroom content as well as clinical content. Undergraduate nursing students acquire knowledge and skill in application to enhance the health of patients (Nevins & Sherman, 2016). Undergraduate nursing curriculum includes successful completion of classroom preparation, as well as clinical experiences. In the classroom, stressors may include exams, not understanding new content, or overload of academic work. In the clinical setting, stressors may include fear of unknown situations; such as diagnosis and treatment of patients, possibility of medical errors, management of unfamiliar medical equipment, or skill incompetence (Benavente et al., 2014). Both classroom and clinical experiences may impact sleep quality.

Undergraduate nursing students report for clinical rotations during any hours of the day. Waking up before dawn, or staying up late into the night to fulfill these clinical rotations, or to prepare for patient care the next morning, may affect their homeostatic sleep drive and circadian rhythm, therefore disturbing sleep. With compromised brain activity and impaired memory, undergraduate nursing students may not learn everything there is to know about patient care. In a study by Thomas et al. (2016), 87% of undergraduate nursing students reported needing eight hours of sleep or more to feel rested. However, 62% obtained six hours or less before class time, and 83% received six hours or less before a clinical experience. This places the undergraduate nursing student at risk for decreased learning and creates safety issues for patients (Thomas et al., 2016). Undergraduate nursing students need to understand the importance of sleep, along with sleep promotion strategies, to eliminate neglectful clinical practices (Ye & Smith, 2015).

## **Daytime Sleepiness**

The primary effect of sleep deprivation is excessive daytime sleepiness (AASM, 2018). Daytime sleepiness is defined as difficulty in maintaining a desired level of wakefulness (National Sleep Foundation, 2019). REM sleep provides energy to the brain and body, supporting daytime performance (National Sleep Foundation, 2018). REM sleep is thought to have a role in the brain learning, thinking, organizing of information, and promoting morning alertness (Berman et al., 2016; National Sleep Foundation, 2018). College students who have sleep deprivation may miss out on the last few hours of REM sleep, which tend to be the most important for integrating new information, affecting academics and daily accomplishments (Benn and Lanier, 2016; Buboltz, Brown, & Soper, 2001).

### **Daytime Sleepiness in College Students**

College students have reported that sleep deprivation causes daytime sleepiness, affecting their daily accomplishments (Benn and Lanier, 2016; Buboltz et al., 2001). Sleep has been shown to be the strongest predictor of daytime functioning and well-being (Flueckiger, Lieb, Meyer, Witthauer, & Mata, 2017; Ridner, Newton, Staten, Crawford, & Hall, 2016). Research has shown that when college students have better sleep quality, they have a more positive affect, and improved daytime functioning (Flueckiger et al., 2017). For example, college students may exercise daily, eat healthier, and have better learning with better sleep quality. Flueckiger et al. (2017) stated that self-report measurements of health behaviors correlated with behavioral measurements in their study. These findings may assist health promotion programs aimed at supporting college students in their daily functioning in good physical and mental health (Flueckiger et al., 2017).

In a study of 568 college students, Ridner et al. (2016) found that sleep quality was the strongest predictor of well-being. Other predictors of well-being included physical activity,

which also led to a higher reported GPA. Lower levels of well-being were associated with depression and tobacco use. Researchers recommend encouraging health promotion with exercise, tobacco-free policies, and support services to improve well-being and overall health (Ridner et al., 2016).

### **Daytime Sleepiness in Undergraduate Nursing Students**

Although the research is minimal, it has been found that undergraduate nursing students experience excessive daytime sleepiness (Demir, 2017; Huang et al., 2014). Studies by Demir (2017) found second year nursing students, and those who experienced difficulty falling asleep or staying asleep, had excessive daytime sleepiness. Second year nursing students may have more clinical hours and may sacrifice sleep to study. They may also have more stress with more clinical hours related to patient diagnosis, patient cares, and different environments (Demir, 2017). Huang et al. (2014) studied 93 first year nursing students and found 74.2% had poor sleep quality that correlated with daytime sleepiness. Researchers suggest enhancing the importance of sleep to undergraduate nursing students to eliminate daytime sleepiness (Huang et al., 2014), so they are not at risk for medical errors.

### **Medical errors**

Sleep deprivation and daytime sleepiness have been linked to medical errors. Research has shown that nurses are sleep deprived (Johnson et al., 2014; Thomas et al., 2017; Wolf, Perhats, Delao, & Martinovich 2017), and have had medical errors (Melnik et al., 2018). Fifty six percent of hospital night shift nurses have reported being sleep deprived (Johnson et al., 2014), which may explain why 50% of nurses across the United States have reported having medical errors in the past five years (Melnik et al., 2018). Researchers found a significant inverse relationship between hours slept and patient care

error. As the hours of sleep decreased, the number of patient care errors increased (Johnson et al., 2014). Sleep deprivation and disrupted circadian rhythms may cause daytime sleepiness, impeding daytime functioning (Wolf et al., 2017; Ye & Smith, 2015), therefore, impacting patient care (Melnyk et al., 2018; Wolf et al., 2017).

### **Transition to practice.**

Undergraduate nursing students may have poor sleep practices and poor sleep quality, leading to daytime sleepiness. Poor sleep practices may carry over into their nursing career. Lack of education for nursing students about the importance of sleep, consequences of impaired sleep, and sleep promotion strategies may directly lead to neglectful clinical practices (Ye & Smith, 2015). Undergraduate nursing students' transition to shift work may pose risks to their own health, as well as their patients' health (Postma et al., 2017).

Researchers have found that little is known about the transition from traditional classes to clinical rotations and shift work in regard to sleep, sleep disturbances, and safe practice behaviors (Postma et al., 2017). However, poor sleep quality may impact daytime sleepiness. When the undergraduate nursing student has daytime sleepiness, they do not obtain proper learning, memory (Hershner & Chervin, 2014), application, or analysis. They may not learn the pertinent information necessary to care for patients. Compromising academics may decrease the quality of nursing care the student will provide (Benavente et al., 2014). Without proper classroom knowledge and comprehension, they will not be able to apply skills or critically think about patient care.

The first year of a nursing career may be stressful. Relationships, shift work, job satisfaction, colleague conflict, and lack of experience may affect psychological and physiological well-being (Khammar et al., 2017). In a study of hospital nurses, Khammar et al. (2017) found that conflict with coworkers, and lacking adequate skills were main causes of stress

among nurses. Thorough new employee orientation, support, and mentoring for new nurses may decrease stress.

Themes were identified by Postma et al. (2017) from final semester undergraduate nursing students completing their clinical practicum. Themes related to personal well-being. Included were problems associated with workplace and personal well-being. Disrupted sleep, unhealthy habits, irregular sleep habits, and staying asleep were identified problems in beginning their transition to practice. Solutions identified by undergraduate nursing students included making time to relax, decompress, healthy behaviors, and identifying curriculum changes. Undergraduate nursing students suggested curriculum changes. These changes included learning sleep pathology, studying the impact of sleep on patient safety, and implications for self-care in undergraduate nursing programs (Postma et al., 2017). Similarly, Nevins and Sherman (2016) reported that undergraduate nursing students have a desire to improve their well-being in the area of sleep, and improve their knowledge in self-care activities. Increasing knowledge and improving sleep habits may assist the undergraduate nursing student to provide high quality care in their professional practice.

### **Sleep Hygiene**

Having healthy sleep habits is often referred to as having good sleep hygiene. Sleep hygiene is defined as a variety of different practices and habits that are necessary to have good nighttime sleep quality and full daytime alertness (National Sleep Foundation, 2019). Sleep hygiene encompasses simple behavioral practices and environmental factors that promote healthy sleep (Kaur & Singh, 2017). Behavioral practices may include a consistent sleep schedule, stress management, daily physical activity, and avoiding caffeine, alcohol, and large meals before bed (CDC, 2018; Hershner & Chervin, 2014;

Kaur & Singh, 2017). Environmental factors may include eliminating electronic devices, sleeping in an atmosphere that is dark, quiet, and that has a comfortable temperature (CDC, 2018; Hershner & Chervin, 2014; Kaur & Singh, 2017).

### **Sleep Hygiene in College Students**

Lifestyle and behavioral changes leading to poor sleep hygiene have been noticed in college students (Hershner & Chervin, 2014). Many college students are sleep deprived due to inadequate sleep hygiene, homeostatic sleep drive, and the delayed circadian rhythm (Hershner & Chervin, 2014; Van Der Heijden et al., 2018). Melatonin levels rise later at night in teenagers and adults (National Sleep Foundation, 2019), leading to the delayed circadian rhythm. This will make young adults feels more awake in the evening and sleepier in the morning (Hershner & Chervin, 2014). Class times are often scheduled without consideration to the delayed circadian rhythm. Colleges need to understand, acknowledge, and publicize that class schedules may have an impact on sleep and learning (Hershner & Chervin, 2014).

Studies in college students have shown that poor sleep hygiene is associated with poor sleep quality and daytime sleepiness (Brown, Buboltz, & Soper 2002; Kaur & Singh, 2017; Mastin, Bryson, & Corwyn, 2006; Whipps et al. 2018). College students may have some sleep hygiene knowledge, but may fail to practice or change sleep habits (Felix, Campsen, White, & Buboltz, 2017; Kaur & Singh, 2017; Kloss et al., 2016). Even with sufficient knowledge, studies have shown that college students still have irregular bedtimes, worry about sleeping, exercise before bed, and drink caffeine before bed (Felix et al., 2017). Poor sleep hygiene may lead to poor sleep quality and daytime sleepiness. Researchers suggest educating college students about sleep, and target behavioral interventions in colleges to improve sleep (Felix et al., 2017).

### **Sleep Hygiene in Undergraduate Nursing Students**

Although studies are limited in pre-licensure baccalaureate nursing students, they also have reported insufficient sleep hygiene, leading to daytime sleepiness (Unal, 2018). Results of a survey by Unal (2018) showed that female undergraduate nursing students had poorer sleep hygiene practices compared to males. This may be because more neurotic disorders are common in females, and females consider somatic symptoms more than males (Becker et al., 2018). Poorer sleep hygiene practices may lead to a higher daytime sleepiness in females. Sleep hygiene practices, along with self-care behaviors in pre-licensure baccalaureate nursing students may improve their health so they can perform better academically in the classroom and clinical settings.

### **Behaviors in College Students**

College students' behaviors may impact sleep. College students are prone to risk taking behavior; for example, experimenting with drugs, smoking, and drinking alcohol (Kaur & Singh, 2017). It has been found that college students use medication and alcohol as sleep aids, and as stimulants for alertness (Hershner & Chervin, 2014; Taylor & Bramoweth, 2010). In a study by Taylor and Bramoweth (2010), 4.8% of undergraduate college students used a prescription medication as a sleep aid, and 2.02% used an over the counter sleep aid medication.

The use of alcohol has been shown to shorten sleep latency, or going to sleep faster. In Taylor and Bramoweth's (2010) study, alcohol was used as a sleep aid by 11.36% participants. Stimulants to increase alertness such as soda and coffee were used by 60% of the participants. Caffeine and energy drinks are known to increase sleep latency, or prolonging falling asleep. Caffeine blocks the neurotransmitter adenosine to inhibit sleep (Blanchard & Chaudhary, 2002). Therefore, the use of caffeine and energy

drinks result in affecting the normal cycles of REM and NREM sleep (Hershner & Chervin, 2014).

The American College Health Association's National College Health Assessment Survey II reported sleep problems in United States college students. College students with sleep problems were an average age of 19.87 years old, 68.5% were female, 75.9% were Caucasian, 97.8% were enrolled as full-time students, and 94.9% were single. Three significant predictors of sleep problems reported were increased stress, poorer general health, and frequent use of alcohol and cigarettes (Valerio, Kim, & Sexton-Radek, 2016). Daily tobacco use increased the risk for sleep problems more than did illegal substance use, binge-drinking, or working more than 20 hours a week (Boehm et al., 2016).

In a study of 1,215 Indian college students, Kaur and Singh (2017) reported 77.7 % had poor sleep hygiene. The college students who had poor sleep hygiene had two-time higher odds of poor sleep quality, and more than two and a half odds of excessive daytime sleepiness (Kaur & Singh, 2017). Sleep health may affect academics, health, cognitive, and future career performance. Researchers suggest the need to educate college students about sleep hygiene practices through educational sessions and workshops, as well as be screened for sleep problems. Those requiring help should be referred to a medical professional for an expert opinion (Kaur & Singh, 2017).

College students who live in dormitories, or community living, such as a fraternity or sorority, live in a condensed space. This may lead them to engage in behaviors in the bedroom other than sleep, for example, television watching or reading. In such condensed living arrangements, college students may have less control over conditions such as room temperature or loud noises. This may lead to an uncomfortable sleeping environment (Gellis et al., 2014). This may impact their sleep and put them at risk for daytime sleepiness.



Along with good sleep hygiene practices, the CDC (2018) recommends healthy behaviors of not smoking, moderate or no alcohol consumption, maintaining a healthy weight, and daily sufficient sleep of seven or more hours. College students who engage in risky behaviors, in conjunction with their delayed circadian rhythm, may have insufficient sleep.

### **Self-care practices in college students.**

Since poor sleep hygiene behaviors are more frequent in college students (Gellis et al., 2014), education must be provided on the importance of good sleep hygiene, work-life balance, caffeine use, sleep schedules, and dealing with stress (Kloss et al., 2016; Postma et al., 2017). This may assist the college student with academic performance, leading to a professional career, higher income, and better quality of life.

A systematic review has shown that sleep education programs demonstrate positive outcomes (Dietrich, Francis-Jimenez, Knibbs, Umali, & Truglio-Londrigan, 2016). Other research has shown that after sleep courses, undergraduate college students had better sleep hygiene habits, and reported significantly fewer symptoms of depression and anxiety (Baroni, Bruzzese, Di Bartolo, Ciarleglio, & Shatkin, 2018). As an individual understands the content, they will be able to self-regulate their own sleep patterns (Coveney, 2014), promoting sleep quality, therefore, improving overall health (Ridner et al., 2016).

### **Self-care practices in undergraduate nursing students.**

Undergraduate nursing students have reported barriers in self-care activities due to stress and time commitments to complete course requirements (Nevins & Sherman, 2016). Undergraduate nursing students need to protect their own health and have successful academic performance. By doing so, they will learn theory content and apply

it to clinical content in order to safely care for their patients. Nursing graduates are expected to role-model self-care practices to their patients for health promotion. Educators must recognize barriers to self-care practices and implement strategies for health promotion in students so they can role-model to their patients (Nevins & Sherman, 2016).

Undergraduate nursing students have reported fatigue, sleep disturbances, and overstimulation during clinical days (Postma et al., 2017). Undergraduate nursing students have suggested the need for education addressing sleep hygiene and healthy behaviors in the curriculum (Postma et al., 2017). Findings from Nevins and Sherman (2016) conclude that undergraduate nursing students are interested in improving their health, but need support from educators to accomplish these goals.

Self-care practices for undergraduate nursing students are crucial. Their attitudes and perceived behavioral control can be the strongest predictors to engage in healthy sleep behavior (Robbins & Niederdeppe, 2015). Attending programs may be necessary to facilitate coping strategies to reduce stress (Wallace, Boynton, & Lytle, 2017; Zhang et al., 2018), deal with relationship issues (Zhang et al., 2017), and enhance mental health (Slavish & Graham-Engeland, 2015; Wallace et al., 2017; Zhang et al., 2018). This may improve sleep and overall health. Self-care practices of undergraduate nursing students may improve healthy lifestyles and empowerment in translation to practice (Nevins & Sherman, 2016).

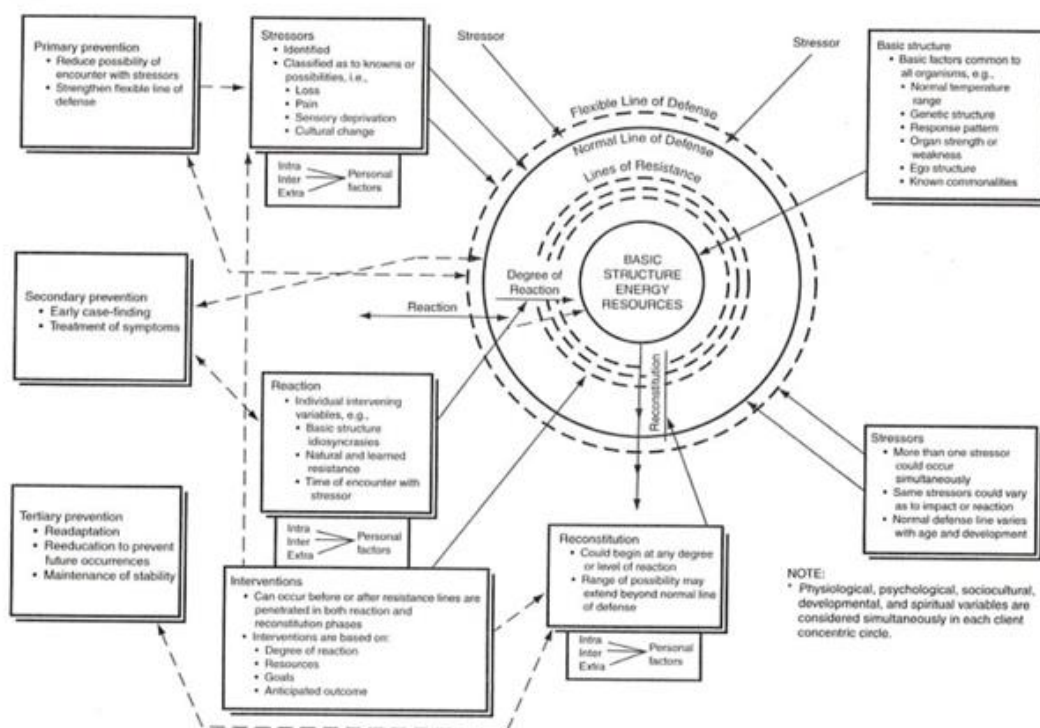
### **Theoretical Framework**

The Neuman Systems Model (Neuman Systems Model, 2019) is the theoretical framework guiding this research study. This is a grand nursing theory focused on human needs of protection (Neuman & Fawcett, 2011). The base of this theory encompasses a holistic approach, wellness orientation, client perception, and motivation with variable interactions with

the environment to lessen harm from stressors. Outcome goals include health retention, restoration, and maintenance (Neuman & Fawcett, 2011).

The model views an individual as an open system that responds to stressors. The individual is protected by lines of resistance. The usual level of health is called the normal line of defense. The normal line of defense is protected by the flexible line of defense. The flexible line of defense acts as a protective shield to health. Examples of a flexible line of defense can include sleep patterns, perception of events, and social support. When stressors break through the normal line of defense, the system is invaded (Neuman & Fawcett, 2011) (see Figure 3.1).

Figure 3.1



For this study, The Neuman Systems Model considers the pre-licensure baccalaureate nursing student as the client, an open system, engaging in constant change. The system is composed of five interacting variables including physiological, psychological, sociocultural, developmental, and spiritual health. The variables are considered a central core and represent the human process of living and dying. Ideally, all variables function fluidly and harmoniously throughout, and are stable in relation to internal and external stressors (Neuman & Fawcett, 2011).

The physiological variable refers to bodily structure and internal function. This includes the extent of physical and physiological intactness of body cells, tissues, organs, and systems. The psychological variable refers to mental processes and interactive environmental effects, both internally and externally. This includes the extent of sense of self and cognition. The sociocultural variable refers to combined effects of social cultural conditions, and influences. This includes the extent of integration into a culture and the larger society. The developmental variable refers to age-related developmental processes and activities. This includes the extent of accomplishment of developmental tasks. The spiritual variable refers to spiritual beliefs and influences. This includes the extent of understanding of the meaning of life and faith (Neuman & Fawcett, 2011).

The interrelationship of the variables determines the nature and degree of system reaction or possible reaction to the stressor. The client, or pre-licensure baccalaureate nursing student, is a composite of the interacting variables - physiological, psychological, developmental, sociocultural, and spiritual - that are ideally functioning in harmony, or are stable in relation to internal and external stressor influences (Neuman & Fawcett, 2011).

The Neuman Systems Model views health as a continuum. Health for the pre-licensure baccalaureate nursing student is equated as optimal system stability. The Neuman Systems

Model wellness-illness continuum implies that energy flow between is continuous between the pre-licensure baccalaureate nursing student and the environment. To conceptualize wellness is to determine the possible effects of the stressors that invade existing system energy levels.

Instability in the wellness-illness continuum is caused by a stressor invading the normal line of defense, or usual level of health (Neuman & Fawcett, 2011). Stressors may be classified as intrapersonal, interpersonal, or extrapersonal in nature. For example, intrapersonal stressor is an autoimmune response, interpersonal stressor is conflict, extrapersonal stressor is a concern about finances (Neuman & Fawcett, 2011). When these stressors impact the flexible line of defense, or sleep, then the normal line of defense, or health of the pre-licensure baccalaureate nursing student, is impacted. By finding ways to eliminate stressors and have healthy sleep, the health of the pre-licensure baccalaureate nursing student may remain stable.

There are three types of prevention that can be used to assist in a breakdown of the wellness-illness continuum. The three types are labeled primary, secondary, and tertiary prevention. Outcome goals include health retention, restoration, and maintenance (Neuman & Fawcett, 2011). Prevention strategies are utilized to strengthen the flexible line of defense and help the body maintain harmony. Primary prevention occurs before the system reacts to a stressor. This includes health promotion and maintaining wellness. The goal is to promote wellness by stress prevention and reduction of risk factors. Secondary prevention occurs before or after the system reacts to a stressor. This type of prevention can include health screenings and maintenance that are intended to recognize stressors early. The goal is to provide appropriate treatment of symptoms to attain wellness. Tertiary prevention occurs after the system reacts to a stressor. This prevention includes wellness maintenance, treatment of diseases, and is intended to protect the client system to return to a healthy state (Neuman & Fawcett, 2011).

The Neuman Systems Model is a holistic perspective in which the client is viewed as a composite of the five interacting variables that are ideally functioning in harmony and are stable in relation to both internal and external environmental stressors (Neuman & Fawcett, 2011). By understanding the process and triggers, one can use primary interventions to strengthen the flexible line of defense, avoiding a system breakdown. If the flexible line of defense is broken, then secondary or tertiary interventions must come into play.

A Neuman Systems Model guided study by Pines et al. (2012) discovered that nursing students had higher than average stress, and most often used avoiding and accommodating styles rather than competing and collaborating styles to manage conflict. In this study of 166 baccalaureate nursing students, it was perceived by the students that they had little or no choice in carrying out their role tasks, and focused on the negatives of situations. This predisposed them to stress, and compromised their sense of autonomy in decision making. These stressors may potentially weaken the line of defense. Students may benefit from strengthening the flexible line of defense by learning how to deal with interpersonal conflict, and by gaining confidence in their abilities.

Coupled with another study using The Neuman Systems Model, Pines et al. (2014) found interpersonal conflict as a stressor. The researchers emphasized using stress resiliency, psychological empowerment, and teamwork skills to strengthen the nursing students' flexible line of defense. Pines et al. (2014) suggested to integrate conflict resolution skills throughout the curriculum. With this intention, Pines et al. (2012) concluded that a systems approach in curriculum development can assist in preparing students to confront stressors. For example, nurse educators may repeat practices in simulation to practice using a variety of styles of conflict management so students can apply an appropriate conflict management styles when confronted in real-world situations (Pines et al., 2014).

Primary interventions are needed to avoid breaking the flexible line of defense. Sleep, exercise, nutrition, and healthy lifestyle habits contribute to strengthening the lines of defense. Analyzing other stressors and factors that impact sleep of pre-licensure baccalaureate nursing students may avoid system failure. Prevention strategies are necessary to facilitate the pre-licensure baccalaureate nursing student's optimal wellness.

### **Summary**

Practicing good sleep hygiene may lead to good sleep quality, decrease sleep deprivation, and daytime sleepiness. This is vital for pre-licensure baccalaureate nursing students as sleep deprivation can lead to medical errors, patient safety concerns, and sentinel events. Pre-licensure baccalaureate nursing students desire to provide patients with safe and effective care; however, the factors that impact sleep may diminish their ability to maintain high quality care. Improving sleep hygiene, sleep quality, and decreasing daytime sleepiness will aid in a positive role transition, preparing pre-licensure baccalaureate nursing students for a lifetime of healthy, safe practices. Good sleep hygiene and self-care practices in pre-licensure baccalaureate nursing students may promote health for themselves and their community, meeting the healthcare needs of an ever-changing society.

### **CHAPTER III: METHODS AND PROCEDURES**

#### **Research Design**

A cross-sectional descriptive design using mediational analysis was used. Descriptive studies offer researchers a way to discover new meaning, describe what exists, determine frequency with which something occurs, and categorizes information. The general purpose of using descriptive research was to explore and describe ideas (Gray et al., 2017). Cross-sectional designs examine change at one point in time, using data from different groups of subjects in various stages of a process. All data were collected at about the same time (Gray et al., 2017). This study used all pre-licensure baccalaureate nursing students at one point in time, and examined factors that impacted their sleep.

Mediating variables are variables that occur as intermediate links between independent and dependent variables. Often, they provide insight into the proposed relationship between cause and effect (Gray et al., 2017). For this study, mediational analysis included the direct and indirect effects of student obligations with their sleep quality, daytime sleepiness, and sleep hygiene.

#### **Population and Sample**

The anticipated sample size was approximately 300 pre-licensure baccalaureate nursing students. Participants were recruited by the PI through the process of an electronic mail (email) sent to program deans of thirteen regional programs offering the Bachelor of Science in Nursing degree. If the program deans forwarded the Invitation to Participate to all pre-licensure baccalaureate nursing students in their programs, this would have brought the total amount of potential participants to approximately 7,540 (National Center for Education Statistics, 2019). After meeting with the statistician and utilizing a formula using a triangular model for



correlations with a 0.8 power (Schoemann, Boulton, & Short, 2017), it was determined that an adequate number of participants to be 256.

Inclusion criteria included all pre-licensure baccalaureate nursing students who were enrolled in a baccalaureate nursing program in a region of the Midwest in the United States. Participants were excluded if they were enrolled in other nursing completion options such as associate, diploma, or vocational programs. Participants were also excluded if they had already obtained a nursing license, or were in an accelerated program. The participants were age 19 or older and either full-time or part-time students. Full-time students were defined as those enrolled in 12 credit hours or more. Part time students were defined as those enrolled in 11 credit hours or less. Participants needed to have access to an electronic device with internet capabilities in order to complete the questionnaires using Google Forms. The participants must have been able to read and comprehend the English language.

### **Demographics**

The sample consisted of both traditional and non-traditional pre-licensure baccalaureate nursing students ages 19 or older. The percentage of traditional college students in the Midwest region are age 24 or under and ranged from 51% - 91%. Students age 25 and over ranged from 2%-49% (National Center for Education Statistics 2019). In this study, the anticipated sample size was 300 pre-licensure baccalaureate nursing students.

Ethnicity of the undergraduate nursing student population in this Midwest region consists of mostly White females. The percentage identifying as White ranged from 53%-90%. Other ethnicities included Hispanic or Latino at 1%-14%, Black or African American at 1%-8%, Asian at 1%-9%, and two or more identities ranged from 1%-5% (National Center for Education Statistics, 2019). Genders identifying as female ranged from 51%-99%, and male 1%-49% (National Center for Education Statistics, 2019).

## Procedure

A cross-sectional descriptive design using mediational analysis was used. After IRB approval, a convenience sample was used to recruit the study's sample. A letter was sent by electronic mail (email) to the deans of thirteen regional programs offering the Bachelor of Science in Nursing degree. The email served as an introduction of the principal investigator (PI), the research study, and their role in assisting distribution of the Invitation to Participate (Appendix A). If the dean of the program chose, the dean forwarded the email to all students in the program, and the invitation to the survey was extended to the potential participants (Appendix B). If the students chose to participate after reading the Invitation to Participate, they completed questionnaires through Google Forms. Participation in this study was voluntary and participants were able to withdraw at any time during the study without negative consequences.

Withdrawing from the study did not affect the relationship the participants had with their college/university, Bryan College of Health Sciences, the PI, or their grades. Accessing the Google Forms survey link and responding to the questionnaires implied the students' consent to participate in the study. All answers were kept confidential through the use of Google Forms, housed in Google Drive. There was no IP address collection with Google Forms. The data was downloaded into an Excel file removing the textual information and replaced with numerical coding. The prepared Excel spreadsheet was uploaded into SPSS 26.0 version for Windows and Mplus version 8.4 (Muthén & Muthén, 2017) for analysis. The data was housed in a personalized folder, on a password protected computer, of which only the PI had access. Printed Excel spreadsheets and outputs were kept in a locked drawer in a locked office.

The Google Forms survey link was available for one month and was distributed September 3, 2019 through October 1, 2019. Reminders to voluntarily participate in the survey were sent by email at week one, September 9, 2019, and week three, September 23, 2019

(Appendix C). Due to lack of participation and a possibility that the Google Forms link did not work for some participants outside Bryan College of Health Sciences, a review of change in protocol was sent to Bryan College of Health Sciences IRB to extend the survey through October 8, 2019. After permission was granted from the IRB, the survey link and reminder were extended through October 8, 2019, with a final email reminder sent to the Deans to forward to potential participants.

### **Data Collection**

The Invitation to Participate included a Google Forms survey link. The survey link provided questionnaires of demographic questions (Appendix D), the Pittsburgh Sleep Quality Index (PSQI) (Appendix E), the Epworth Sleepiness Scale (ESS) (Appendix F), and the Sleep Hygiene Index (SHI) (Appendix G). Permission was granted through a fillable form on the Mapi Research Trust website linked to ePROVIDE platform for the PSQI (Appendix E) and ESS (Appendix F). Although the SHI is in the public domain, permission was granted by the author via email (Appendix G).

### **Instrumentation**

The Pittsburgh Sleep Quality Index (PSQI) (Appendix E) is a 19 item self-report questionnaire with seven clinically derived domains of sleep difficulties. The seven domains are sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The items are scaled using a 0-3 Likert Scale (American Thoracic Society, 2016), with three reflecting the negative extreme on the Likert Scale (Smyth, 2012).

The PSQI is designed to measure sleep quality and disturbances over a one-month period. The first four items are fill in the blank and ask participants about their usual bedtime, wake times, sleep latency, and sleep duration. The remaining 14 items ask how often participants

experienced certain symptoms within the past month. The questions include how often has the participant had trouble sleeping due to not being able to get to sleep within 30 minutes, waking up in the middle of the night or early morning, use of the bathroom, inability to breathe comfortably, coughing or snoring, felt too hot or too cold, had bad dreams, had pain, and any other reasons the participant may list. Other questions include, over the past month, how often the participant had to take medication to help them sleep, how often have they had trouble staying awake while driving, eating meals, or engaging in social activity, and how much of a problem was it for them to keep up enthusiasm to get things done. Lastly, participants were to rate their overall sleep quality (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

The 19 primary items yield a global sleep quality score, ranging from 0 (no difficulties) to 21 (severe sleep difficulties). The PSQI global score has good internal consistency with a Cronbach's alpha of 0.83, and good test-retest reliability with a correlation coefficient of 0.85 (American Thoracic Society, 2016; Brown et al., 2002).

The Epworth Sleepiness Scale (ESS) (Appendix F) measures average daytime sleepiness. There are eight items on the questionnaire with the domain of tendency of falling asleep. The participant self-rates on a four-point Likert Scale how likely it is that they would doze in eight different situations (American Thoracic Society, 2016; Smyth, 2018). The situations include sitting and reading, watching television, sitting inactive in a public place, as a passenger in a car for an hour without a break, lying down to rest in the afternoon, sitting and talking to someone, sitting quietly after lunch without alcohol, or in a car while stopped for a few minutes in traffic. Scoring of the answers is 0-3 with 0 being "would never doze" and 3 being "high chance of dozing". Scores above 10 indicate excessive daytime sleepiness (Johns, 2019). Numerous studies have supported high validity and reliability with a Cronbach's alpha of 0.73 to 0.90, and a correlation coefficient which has varied between 0.81 and 0.93 (Johns, 2019).

The Sleep Hygiene Index (SHI) (Appendix G) assesses the presence of behaviors thought to compromise sleep hygiene. The SHI is a 13 item self-reported index derived from the diagnostic criteria for a diagnosis of inadequate sleep hygiene. Each of the items is rated on a five-point Likert Scale ranging from 0 being “never” to 4 being “always”. The statements include behaviors such as taking a nap, going to bed at different times, exercising before bed, staying in bed longer, using substances before bed, engaging in games or internet before bed, going to bed stressed, angry, or worried, using the bed for things other than sleeping or sex, environmental factors, and working before bed. Item scores are summed providing a global assessment of sleep hygiene. Higher scores are indicative of more maladaptive sleep hygiene status (Mastin et al., 2006). Although the SHI Cronbach’s alpha for the SHI is 0.66, the index has stable test-retest reliability with an alpha coefficient of 0.71. This is reportedly higher than previously published sleep hygiene instruments (Mastin et al., 2006). There are two past existing instruments that have measured adult sleep hygiene that have been found to have only fair internal consistency as measured by Cronbach’s alphas of 0.47 and 0.54. The SHI reliability analyses suggest that sleep hygiene behaviors as measured by the SHI are relatively stable over time, and demonstrates comparable psychometric properties with evidence of validity (Mastin et al., 2006).

## **Data analysis**

### **Data Analysis Procedure**

An Excel spreadsheet was used to prepare the data for analysis using SPSS 26.0 version for Windows and Mplus version 8.4. A codebook was written that defines numerical codes associated with the research variables, such as 1=full-time student, 2=part-time student, etc. The Excel spreadsheet was imported into SPSS 26.0 version for Windows and Mplus 8.4 for analysis. The PI worked with the statistician to analyze and interpret the data.

Research questions one, three, and five would use Pearson's Correlation Coefficient to analyze parametric data. If the data are nonparametric, then Spearman's Coefficient would be used. A histogram evaluated the data to determine if they are parametric or nonparametric. Research question two will be analyzed using ANOVA or structural equation modeling if the data were parametric. If the data are nonparametric then Kruskal-Wallis would be used. Research question four will use descriptive statistics and percentages to describe the study's sample in relation to their routine obligations. Research question six used mediational analysis to determine if students' obligations mediate the relationship between sleep quality and correlates. Mplus was used for research question six with the following types of analysis.

### **Mediating Variables and Analysis**

Mediation is a statistical technique that allows researchers to study naturally occurring relationships in nonexperimental studies. Mediating variables may directly or indirectly explain the relationship between the independent and dependent variables (Gray et al., 2017). In this study, the mediation model will analyze if student behaviors can directly or indirectly explain the relationship between student obligations and the outcomes (sleep quality, daytime sleepiness and sleep hygiene).

### **Structural Equation Modeling**

Structural equation modeling (SEM) is a statistical technique to measure theoretical constructs by testing measurement and theoretical models simultaneously. The measurement model tests how constructs are measured, whereas the theoretical model tests the relationships between the constructs (Plichta & Kelvin, 2013). Model fit is tested using a 0 – 1 scale, where a good-fitting model is considered to be  $> 0.9$ . These higher values aid in reducing a type II error (failure to accept the null hypothesis when it is true) (Plichta & Kelvin, 2013).

## Bootstrapping and Confidence Intervals

Bootstrapping is a statistical approach that uses random sampling with replacement when calculating estimates as used with confidence intervals. Bootstrapping works by randomly selecting observations from a data set and then replacing the observation before randomly selecting another observation. The estimates are calculated once all observations have been randomly selected. The same observations might be randomly selected, whereas other observations may not be selected. The steps are repeated  $J$  times, where  $J$  is the number of different bootstrap samples for bootstrap estimates. It is important to note that increasing the number of sample (i.e.  $J$  times) does not increase the information within the data. Increasing the number of bootstrapping samples provides a more reliable estimate of the standard error (Shrout & Bolger, 2002).

The confidence interval (CI) works with the idea the groups may be different. The CI provides a range in which the population mean may fall. CI are affected by sample variation and size. Less variation within the sample will yield a narrower interval range, suggesting the sample mean will be closer to the population mean. Similarly, greater variation in the sample leads to a wider interval range, and thus less representative of the population mean. Sample size also effects the interval range. There is more variation in smaller samples, causing more variation in the interval range, whereas larger samples will be more similar to one another and therefore narrowing the interval range. 95% CI indicates a 95% assurance the true value of the population mean falls within the interval (Plichta & Kelvin, 2013).

Sampling error (S.E.) is reduced with larger samples. The S.E. is a measure of the variation between different samples and their means. Bootstrapping is good to use with smaller samples. A power analysis is conducted to determine the minimum number of participants

needed for the sample to support statistical analyses like determining confidence intervals (Plichta & Kelvin, 2013).

### **Ethical Considerations**

Approval for the study was sought from Bryan College of Health Sciences IRB. The risks of participating in this study were minimal and included loss of time given to completing the questions and a perceived burden with answering the questions. There was minimal potential for breaching confidentiality with participants' responses being identified through electronic mediums. A separate Google Forms account was created and used by the PI for the purpose of protecting the participants. To protect the participants' identities, and provide anonymity of responses, name and contact information was not asked. There was no IP address associated with the data through Google Forms.

Participation in this study was voluntary and participants were able to withdraw at any time during the study without repercussions to their relationship with the college/university, the PI, Bryan College of Health Sciences, or their grades. By participating in the study, the participant agreed to consent. All answers were kept confidential through Google Forms.

All data were uploaded into an Excel spreadsheet, prepared for analysis, and numerically coded. The demographic information received was analyzed as aggregated data only. The data was housed in a personalized folder, on a password protected computer, of which only the PI had access. Printed Excel spreadsheets and statistical outputs were kept in a locked drawer in a locked office. At the close of the study, the PI deleted the Google Forms link and all of the participants' responses contained within. NIH Ethics in Research Certificates were completed by the PI and dissertation chair (Appendix H).

There was no compensation given to the pre-licensure baccalaureate nursing students. Pre-licensure baccalaureate nursing students may have heightened awareness about their own



sleep quality, daytime sleepiness, and sleep hygiene practices after completing the questionnaires.

### **Summary**

The purpose of this study was to better describe factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students. Knowing what factors exist may assist nursing education on how to better support pre-licensure baccalaureate nursing students. This in turn may positively affect pre-licensure baccalaureate nursing students' overall academic performance in the classroom and clinical settings, maintain a healthy lifestyle, and allowing them the capability to safely care for their patients.

## CHAPTER IV: RESULTS

This chapter will discuss the statistical tests used to analyze the data, results of the data analysis, and the significant findings of the research for each of the research questions. A convenience sample was used to recruit 297 pre-licensure baccalaureate nursing students. Study participants were age 18-60 and were either enrolled as full-time or part-time students. Forty-three (14.5%) identified as 18 years old. Since the age of inclusion was 19 years and older, the legal age of adulthood in the state where the study was conducted, those younger than 19 years old were eliminated from all analyses. Therefore, the sample size was reduced to  $N = 254$ . Missing data were also eliminated from analyses.

### Data Analysis

Statistical analysis used SPSS version 26.0 for research questions 1-5. Research question 6 was analyzed using Mplus version 8.4 (Muthén & Muthén, 2017). Demographic data were analyzed using descriptive statistics. Histograms analyzed the total scores from the instruments used to collect data on sleep quality (PSQI, see Figure 4.1), daytime sleepiness (ESS, see Figure 4.2), and sleep hygiene (SHI, see Figure 4.3) and found the data to be parametric. Research question 1 (What is the relationship with freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?), research question 3 (What are the relationships with nursing students' behaviors and their quality of sleep and daytime sleepiness?), and research question 5 (Is there an association with nursing students' enrollment status as full-time and part-time, and their quality of sleep and correlates?) were analyzed using Pearson's product-moment correlation. Research question 2 (Are there differences in freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?) was analyzed using ANOVA. Research question 4 (How do nursing students describe their routine obligations outside of school to (a) family, (b) work, (c) activities, (d)

finances, and (e) living arrangements that cause them to lose sleep on a daily or weekly basis?) was analyzed using descriptive statistics to describe the sample in relation to their routine obligations. Research question 6 (Do student obligations mediate the relationships between sleep quality and correlates?), was analyzed using mediational analysis to determine if students' obligations explained the relationship between sleep quality and correlates.

### Histograms.

Figure 4.1

Histogram Representing the Total Scores of Self-Reported Sleep Quality (PSQI)

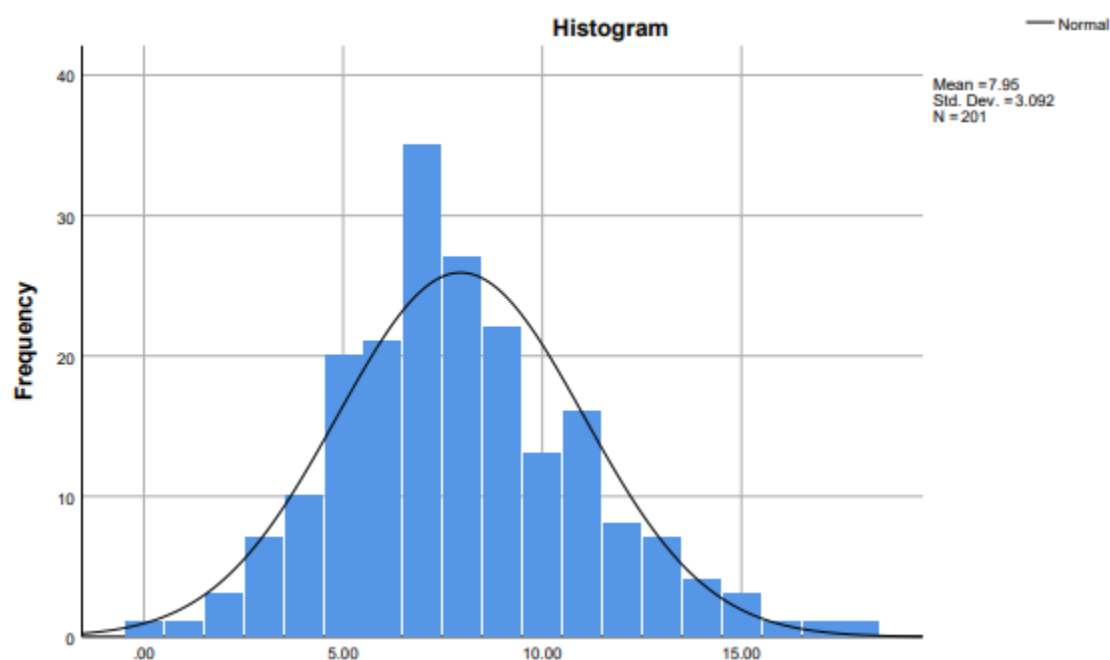


Figure 4.2

Histogram Representing the Total Scores of Self-Reported Daytime Sleepiness (ESS)

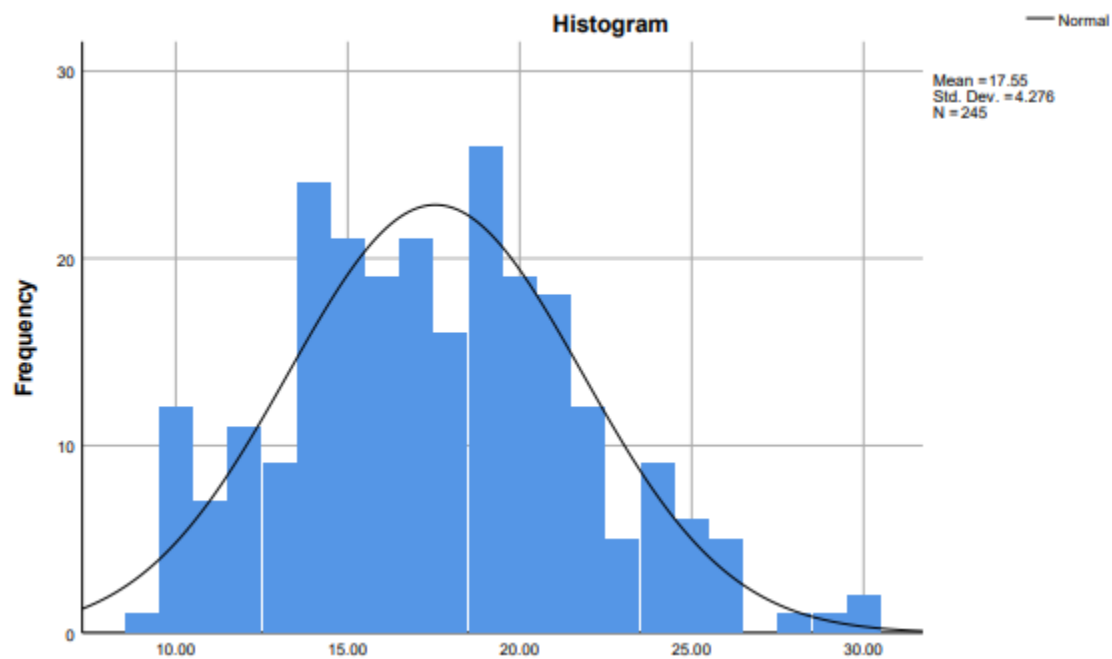
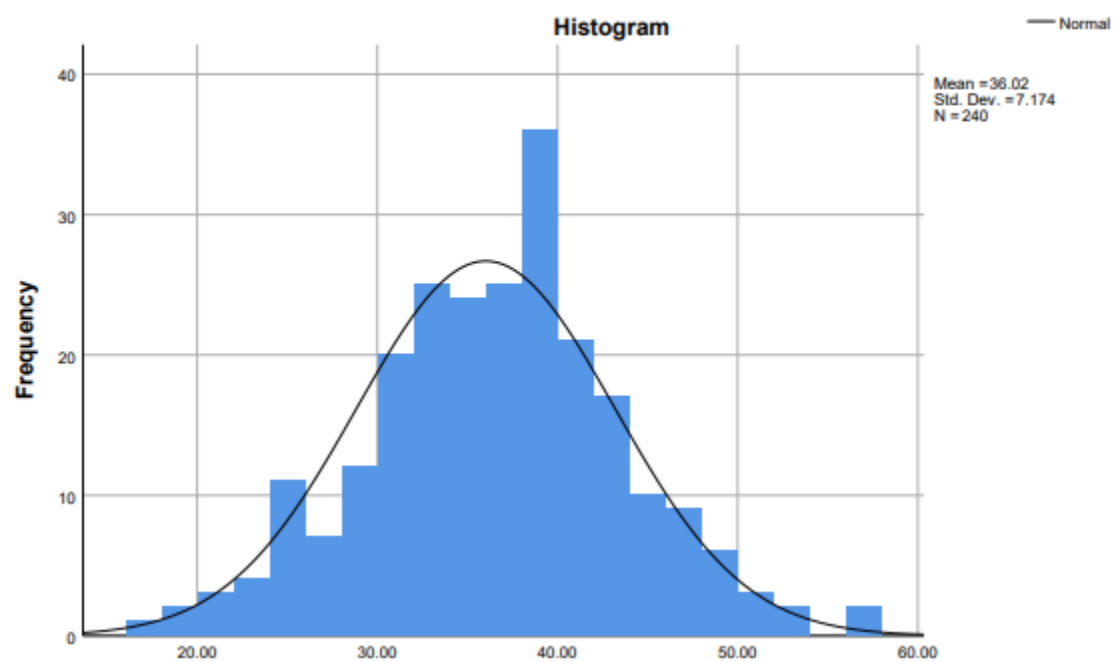


Figure 4.3

Histogram Representing the Total Scores of Self-Reported Sleep Hygiene (SHI)



### Demographics and descriptive results.

Demographic variables included age, gender identity, race/ethnicity, student status, year of study, housing, relationship status, obligations, and behaviors. Student status was defined as full-time student (enrolled in 12 credit hours or more), and part-time student (enrolled in 11 credit hours or less). Year of study was defined as freshman or first year nursing student, sophomore or second year nursing student, junior or third year nursing student, senior or fourth year nursing student. Housing status was defined as on-campus (dorms), on-campus (fraternity or sorority), off-campus (parents' home, own home, apartment, or other). Relationship status was defined as single and not currently in a relationship, not married but in a relationship, married, or divorced.

Most of the participants were 19-24 years old (83.8%); the largest group of participants were 21 years old (25.6%). The participants were primarily White (85%) and female (93.3%). Participants' year of study included freshman or first year nursing student (13%), sophomore or second year nursing student (22.8%), junior or third year nursing student (29.1%), and senior or fourth year nursing student (33.1%). Ninety percent of the participants were full-time students, enrolled in twelve credit hours or more. Most of the participants lived off campus either renting or owning a home (35.8%), or in an apartment (28.0%). Participants were primarily single, and not currently in a relationship (42.5%), or not married but in a relationship (45.7%) (see Table 1).

Table 1  
*Demographic Information*

Variable (N = 254)	Frequency (n)	Percentages
Age		
19	38	15.0
20	44	17.3
21	65	25.6
22	27	10.6
23	12	4.7
24	11	4.3
25	5	2.0

26	8	3.1
27	2	.8
28	5	2.0
29	1	.4
30	1	.4
31	2	.8
32	2	.8
35	4	1.6
36	3	1.2
37	1	.4
42	1	.4
48	2	.8
60	1	.4
Gender Identity		
Female	237	93.3
Male	11	4.3
Student status		
Full-time student (enrolled in 12 credit hours or more)	229	90.2
Part-time student (enrolled in 11 credit hours or less)	20	7.9
Year of study		
Freshman or first year nursing student	33	13.0
Sophomore or second year nursing student	58	22.8
Junior or third year nursing student	74	29.1
Senior or fourth year nursing student	84	33.1
Race/ethnicity		
White	216	85.0
Hispanic or Latino	15	5.9
Black or African American	2	.8
Native American or American Indian	2	.8
Asian/Pacific Islander	13	5.1
Other	2	.8
Housing		
On-campus (dormitory)	43	16.9
On-campus (fraternity or	0	0

sorority)		
Off-campus (parent's home)	43	16.9
Off-campus (own or rent home)	91	35.8
Off-campus (apartment)	71	28.0
Other	1	.4
Relationship status		
Single, not currently in a relationship	108	42.5
Not married but in a relationship	116	45.7
Married	23	9.1
Divorced	2	.8

***Research question 4.***

Obligations that might have impacted sleep were defined as work, family, activities with friends, finances (including food, housing, clothing, college, and transportation), classes, and living arrangements. Participants were asked to self-report their obligations using the scale always, sometimes, or never losing sleep on a daily or weekly basis. The obligation of college classes was reported as the most frequent reason why participants always lost sleep on a daily or weekly basis (53.3%). The obligation of work was the next frequent reported reason why participants always lost sleep on a daily or weekly basis (18.9%). Obligations of family, activities with friends, living arrangements, and finances were less frequently reported as reasons the participants always lost sleep on a weekly or daily basis (see Table 2).

Table 2  
*Self-Reported Obligations as Reasons for Losing Sleep on a Daily or Weekly Basis*

Obligation	Frequency in percentages		
	Always	Sometimes	Never
Work	18.9	53.1	24.4
Family	6.3	48.0	42.5
Activities with friends	7.5	74.4	15.7
Classes	53.5	40.6	3.9



Living arrangements	3.5	32.3	61.0
Finances for			
Food	5.5	20.5	70.9
Housing	6.3	22.8	67.3
Clothing	1.6	16.1	78.3
College	13.8	34.6	48.4
Transportation	3.9	23.2	69.7

### ***Research question 3.***

Behaviors that might have impacted sleep were defined as drinking caffeine, coffee/tea, or energy drinks, drinking alcohol, cigarette use, using street drugs, and the use of technology or electronic devices into the night. Technology or electronic device use into the night was reported as the most frequent reason why participants always lost sleep on a daily or weekly basis (31.9%). Drinking caffeine, coffee/tea, or energy drinks were reported as the next behavior participants always lost sleep on a daily or weekly basis (6.3%). The least frequent behaviors reported as reasons participants always lost sleep on a daily or weekly basis included drinking alcohol (2.4%), cigarette use (0.4%), and street drug use (0%) (see Table 3).

Table 3  
*Self-Reported Behaviors as Reasons for Losing Sleep on a Daily or Weekly Basis*

Behavior	Frequency in percentages		
	Always	Sometimes	Never
Drinking caffeine, energy drinks, coffee/tea	6.3	38.2	53.5
Drinking alcohol	2.4	33.1	61.4
Cigarette use	.4	2.0	94.5
Using street drugs	0	1.2	94.9
Technology or electronic devices into the night	31.9	53.1	12.6

***Pittsburgh Sleep Quality Index (PSQI) results.***

The Pittsburgh Sleep Quality Index (PSQI) (Appendix E) is a 19 item self-report questionnaire with seven clinically derived domains of sleep difficulties. The seven domains are sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. The items are scaled using a 0-3 Likert Scale (American Thoracic Society, 2016), with three reflecting the negative extreme on the Likert Scale (Smyth, 2012); higher scores indicate poorer sleep quality.

The participants' PSQI scores ranged from 0-18 ( $M = 7.95$ ,  $SD = 3.09$ ); 89.1% identified as poor sleepers ( $PSQI > 5$ ). The mean sleep duration was 6.5 ( $SD = 1.09$ ) hours, and the mean sleep latency was 32.78 ( $SD = 31.10$ ) minutes. Sleep latency is defined as the amount of time it takes to fall asleep. Of the nine factors describing trouble with sleeping, the four most frequently reported responses were inability to get to sleep within 30 minutes (22.4%, 3 or more times a week), waking up in the middle of the night or early morning (33.9%, 3 or more times a week), feeling too hot (11.4%, 3 or more times a week), and having to get up to use the bathroom (16.5%, 3 or more times a week). Other factors less frequently reported were having bad dreams (6.7%, 3 or more times a week), having pain (3.5%, 3 or more times a week), cannot breathe comfortably (3.1%, 3 or more times a week), coughing or snoring loudly (2.4%, 3 or more times a week), feeling too cold (2.4%, 3 or more times a week), and other (9.4%, 3 or more times a week) (see Table 4).

Only 12.6% of the participants used medication to help them sleep, and 6.7% had trouble staying awake while driving, eating meals, or engaging in social activity 3 or more times a week. When asked how much of a problem was it for them to keep up enthusiasm to get things done, 31.9% responded more than 3 times a week, 37.0% responded once or twice a week, 22.0% responded less than once a week, and 7.1% responded not during the past month. Overall,

participants rated their own sleep quality as fairly good (53.1%), followed by fairly bad (34.6%) (see Table 4) in light of the overall total PSQI scores indicating poor sleep quality.

The “other” category asking why participants had trouble sleeping allowed the participants to fill in the blank as qualitative data. Content analysis was used to analyze the qualitative data. Frequencies of common responses included family or children disturbances, noises, anxiety, stress, wondering thoughts, or inability to shut their minds off (see Table 5).

Table 4

*Domains of Sleep Quality, Sleep Disturbances, Habitual Sleep Efficiency, Sleeping Medications, and Daytime Dysfunction as Measured by the PSQI*

Self-reported frequencies (%) of domains within the past month				
Variable	Not during past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes	21.3	33.1	20.9	22.4
Wake up in the middle of the night or early morning	12.2	19.7	31.5	33.9
Have to get up to use the bathroom	36.6	25.2	19.7	16.5
Cannot breathe comfortably	79.5	10.2	4.3	3.1
Cough or snore loudly	81.5	11.4	2.8	2.4
Feel too cold	61.4	25.6	8.3	2.4
Feel too hot	26.0	30.7	29.5	11.4
Have bad dreams	49.6	27.6	6.7	2.4
Have pain	67.7	17.7	8.7	3.5

Other reasons	65.4	2.8	6.3	9.4
How often have they taken medicine to help sleep	58.7	16.1	10.6	12.6
How often have they had trouble staying awake while driving, eating meals, or engaging in social activity	30.3	35.4	25.6	6.7
How much of a problem has it been for them to keep up enthusiasm to get things done	7.1	22.0	37.0	31.9
Overall rating of own sleep quality	Very good (7.1%)	Fairly good (53.1%)	Fairly bad (34.6%)	Very bad (3.1%)

Table 5

*Content Analysis For “Other” Self-Reported Reasons Why Participants Had Trouble Sleeping*

Theme	Frequency (n) <sup>a</sup>	Percentages
Anxiety/stress	28	11.2
Kids/children/family	13	5.2
Wondering thoughts/inability to shut mind off	8	3.2
Noise	6	2.4
Cats/dogs/pets	3	1.2
Getting up early for school/work/clinical	2	.8
Uncomfortable	2	.8

Working	2	.8
Narcolepsy	1	.4
Lights	1	.4
School/work/friends	1	.4
Seasonal allergies	1	.4
Illness	1	.4
Sleep paralysis	1	.4
Bug bites	1	.4
Technology	1	.4
Medication	1	.4

*Note.* Frequency denotes number of tally marks given to a similar self-reported phrase the participants wrote as reasons for having trouble sleeping.

### ***Epworth Sleepiness Scale (ESS) results.***

The Epworth Sleepiness Scale (ESS) (Appendix F) measures average daytime sleepiness. There are eight items on the questionnaire with the domain of tendency to fall asleep. Data are collected using a four-point Likert Scale (American Thoracic Society, 2016; Smyth, 2018). Participants self-reported the likelihood they would doze off in eight different situations, which included sitting and reading, watching television, sitting inactive in a public place, as a passenger in a car for an hour without a break, lying down to rest in the afternoon, sitting and talking to someone, sitting quietly after lunch without alcohol, or in a car while stopped for a few minutes in traffic. Scoring of the answers is 0-3 with 0 being “would never doze” and 3 being “high chance of dozing”. Scores above 10 indicate excessive daytime sleepiness (Johns, 2019). The

data were recoded so that the answers were scored 1-4 with 1 being “would never doze” and 4 being “high chance of dozing”.

ESS scores ranged from 9-30 ( $M = 17.55$ ,  $SD = 4.28$ ). All but one participant (99.6%) reported excessive daytime sleepiness ( $ESS > 10$ ). The top four reported daily activities in which participants would most likely doze off were sitting and reading ( $M = 2.65$ ,  $SD = .94$ ), watching television ( $M = 2.71$ ,  $SD = .91$ ), riding as a passenger in a car for an hour without a break ( $M = 2.57$ ,  $SD = 1.08$ ), and lying down to rest in the afternoon ( $M = 3.41$ ,  $SD = .8$ ) (see Table 6).

Table 6  
*Self-Reported Tendency to Fall Asleep in Certain Situations<sup>a</sup> as Measured by the ESS*

Variable	Would never doze	Slight chance of dozing	Moderate chance of dozing	High chance of dozing
Sitting and reading	11.4 <sup>a</sup>	32.7 <sup>a</sup>	33.1 <sup>a</sup>	20.9 <sup>a</sup> , 2.65 <sup>b</sup> (.94) <sup>b</sup>
Watching television	8.3	33.5	34.6	21.7, 2.71 (.91)
Sitting inactive in a public place	34.3	40.6	16.9	5.9, 1.94 (.88)
As a passenger in a car for an hour without a break	20.1	26.4	26.8	24.8, 2.57 (1.08)
Lying down to rest in the afternoon when circumstances permit	2.0	13.4	24.8	57.9, 3.41 (.8)
Sitting and talking to someone	83.1	13.0	1.2	.4, 1.17 (.44)
Sitting quietly after a lunch without alcohol	42.5	34.3	15.4	5.5, 1.83 (.89)

In a car, while stopped for a few minutes in the traffic	78.7	14.6	3.9	.4, 1.24 (.54)
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*Note.* <sup>a</sup>Percentages indicating tendency to fall asleep in certain situations. <sup>b</sup>ESS sub-total mean score (with standard deviation).

### ***Sleep Hygiene Index (SHI) results.***

The Sleep Hygiene Index (SHI) (Appendix G) assesses the practice of common behaviors thought to compromise sleep hygiene. The SHI is a 13-item index measuring inadequate sleep hygiene. SHI uses a five-point Likert Scale ranging from 0 being “never” to 4 being “always”. Data are collected on self-reported behaviors such as taking a nap, going to bed at different times, exercising before bed, staying in bed longer, using substances before bed, engaging in games or internet before bed, going to bed stressed, angry, or worried, using the bed for things other than sleeping or sex, environmental factors, and working before bed. Higher scores are indicative of a more maladaptive sleep hygiene status (Mastin et al., 2006).

The general range of SHI scores is 13-65. In this study, the participants’ scores ranged from 17-57 with a mean of 36.02 (SD = 7.17) The highest scores reported by the participants were using their bed for things other than sleeping or sex (23.6% frequently, 25.6% always), doing important work before bedtime, such as studying (30.3% frequently, 30.7% always), and thinking, planning, or worrying while in bed (30.7% frequently, 31.5% always) (see Table 7).

Table 7  
*Self-Reported Sleep Hygiene Behaviors as Measured by the SHI*

Variable	Never	Rarely	Sometimes	Frequently	Always
Taking daytime naps lasting two or more hours	26.0 <sup>a</sup>	33.5 <sup>a</sup>	24.8 <sup>a</sup>	10.6 <sup>a</sup>	3.1 <sup>a</sup> 2.30 (1.078) <sup>b</sup>

Going to bed at different times from day to day	2.4	22.0	31.5	27.6	14.6 3.31 (1.05)
Getting out of bed at different times from day to day	2.0	19.3	35.4	27.2	13.8 3.32 (1.01)
Exercising to the point of sweating within one hour of going to bed	57.5	31.5	6.7	1.6	.4 1.52 (.73)
Staying in bed longer than they should two or three times a week	18.1	26.0	25.2	21.3	7.1 2.73 (1.2)
Using alcohol, tobacco, or caffeine within four hours of going to bed or after going to bed	41.3	26.0	23.6	5.5	1.6 1.98 (1.02)
Doing something that may wake them up before bedtime	10.6	16.5	24.0	28.3	18.1 3.27 (1.25)
Go to bed feeling stressed, angry, upset, or nervous	5.1	19.3	31.9	26.8	14.2 3.26 (1.1)
Using bed for things other than sleeping or sex	14.6	13.4	20.5	23.6	25.6 3.33 (1.39)



Sleeping on uncomfortable bed	63.8	17.3	9.8	3.5	3.5 1.63 (1.04)
Sleeping in uncomfortable bedroom	48.8	26.0	12.2	7.5	3.5 1.89 (1.12)
Doing important work before bedtime	8.3	7.9	20.1	30.3	30.7 3.69 (1.23)
Thinking, planning, worrying while in bed	5.5	13.4	16.9	30.7	31.5 3.71 (1.21)

*Note.* <sup>a</sup>Percentages of self-reported sleep hygiene behaviors. <sup>b</sup>Sub-total mean scores (with standard deviation)

### **Inferential results.**

#### ***Correlation analyses.***

##### *Research question 1.*

Pearson product-moment correlation was performed to analyze the relationship with the nursing students' year of study and their sleep quality and daytime sleepiness (research question 1). With  $\alpha = 0.05$ , the results indicated no significant relationships with the level of student and their sleep quality ( $p = .418$ ) and daytime sleepiness ( $p = .222$ ) (see Table 8).

Table 8

*Correlations with Nursing Student Year of Study and Sleep Quality and Daytime Sleepiness as Measured by the PSQI and ESS*

Student year level	PSQI	ESS
Pearson Correlation	.057	.078
Sig. (2-tailed)	.418	.222
N	201	245

The results indicated that it did not matter what year of study the nursing students were in with regard to their self-reported sleep quality and daytime sleepiness. Overall, this sample reported poor sleep quality and excessive daytime sleepiness regardless of their year of study.

*Research question 3.*

Behaviors were collected in the demographics section of the questionnaire and were analyzed as descriptive (Table 3) and inferential data. These included behaviors that would cause the participant to lose sleep on a daily or weekly basis. Behaviors were defined as drinking caffeine, energy drinks, coffee/tea, drinking alcohol, cigarette use, using street drugs, and technology or electronic devices into the night. Pearson product-moment correlation was performed to identify relationships between nursing students' self-reported behaviors and their sleep quality and daytime sleepiness.

Results indicated statistically significant relationships with the behaviors of drinking caffeine, energy drinks, coffee/tea ( $p = .001$ ,  $r = -.242$ ) and cigarette use ( $p = .015$ ,  $r = -.172$ ), and sleep quality. Both behaviors were inversely and weakly related to sleep quality; that is, as the participants consumed more caffeinated and energy drinks, their sleep quality decreased. Interestingly, the same behaviors were not statistically significant with daytime sleepiness (see Table 9). Further research could be conducted to better understand how nursing student behaviors affect sleep quality but not daytime sleepiness. Although the results revealed statistically nonsignificant findings with use of technology or electronic devices into the night and sleep quality, the relationship approached significance ( $p = .053$ ,  $r = -.137$ ), which is noteworthy (see Table 9).

Table 9

*Correlations Between Self-Reported Behaviors as Reasons for Sleeping Less on a Daily or Weekly Basis and Daytime Sleepiness (ESS) and Sleep Quality (PSQI)*

Behaviors	ESS	PSQI
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Drinking caffeine, energy drinks, coffee/tea	Pearson Correlation	-.003	-.242**
	Sig. (2-tailed)	.960	.001
	N	245	201
Drinking alcohol	Pearson Correlation	-.057	-.114
	Sig. (2-tailed)	.379	.110
	N	242	199
Cigarette use	Pearson Correlation	.053	-.172*
	Sig. (2-tailed)	.409	.015
	N	242	199
Street drug use	Pearson Correlation	-.014	.078
	Sig. (2-tailed)	.832	.278
	N	240	197
Use of technology or electronic devices into the night	Pearson Correlation	-.034	-.137
	Sig. (2-tailed)	.596	.053
	N	244	201

\* Correlation is significant with  $\alpha = .05$  level (2-tailed).

\*\* Correlation is significant with  $\alpha = .01$  level (2-tailed).

#### *Research question 5.*

Pearson product-moment correlation was performed to identify the relationship between nursing students' enrollment status and their sleep quality, daytime sleepiness, and sleep hygiene (research question 5). With  $\alpha = 0.05$ , the results were statistically nonsignificant (see Table 10).

Table 10

*Correlations Between Nursing Students' Enrollment Status and Daytime Sleepiness (ESS), Sleep Quality (PSQI) and Sleep Hygiene (SHI)*

Student status, full-time and part-time	ESS	PSQI	SHI
Pearson Correlation	-.049	.057	.008
Sig. (2-tailed)	.448	.421	.902
N	245	201	240

#### *Serendipitous Findings of Statistically Significant Correlations with the Study Variables*

This quantitative research using cross-sectional descriptive design yielded several statistically significant correlations when consideration was given to correlation analyses of all

the study variables (see Table 11). For example, the reported behaviors of drinking caffeine, energy drinks, coffee/tea ( $p < .001$ ,  $r = -.248$ ), drinking alcohol ( $p < .010$ ,  $r = -.166$ ), and use of technology or electronic devices into the night ( $p < .001$ ,  $r = -.364$ ) were inversely and statistically significant with sleep hygiene. Likewise, several of the reported obligations, such as work ( $p = .004$ ,  $r = -.185$ ), family ( $p = .027$ ,  $r = -.144$ ), class ( $p < .000$ ,  $r = -.295$ ), finances for food ( $p = .003$ ,  $r = -.193$ ), finances for housing ( $p = .016$ ,  $r = -.157$ ), and finances for college ( $p = .004$ ,  $r = -.185$ ) were inversely and statistically significant with sleep hygiene.

In addition, several of the reported obligations, such as work ( $p < .001$ ,  $r = -.263$ ), family ( $p < .001$ ,  $r = -.299$ ), class ( $p < .001$ ,  $r = -.307$ ), living arrangements ( $p = .020$ ,  $r = -.165$ ), finances for food ( $p < .001$ ,  $r = -.356$ ), finances for housing ( $p < .001$ ,  $r = -.300$ ), and finances for college ( $p < .001$ ,  $r = -.322$ ) were inversely and statistically correlated with sleep quality. The obligations class ( $p = .018$ ,  $r = -.151$ ) and finances for food ( $p = .041$ ,  $r = -.131$ ) were inversely and statistically correlated with daytime sleepiness. It is interesting to note that both the student obligations of class and finances for food were inversely and statistically correlated with all three outcomes of sleep hygiene, sleep quality and daytime sleepiness. This is important information when considering how to educate pre-licensure baccalaureate nursing students on sleep quality and sleep hygiene, especially given that this sample, as a whole, reported poor sleep quality and excessive daytime sleepiness.

The final serendipitous findings included the moderate correlation of daytime sleepiness with sleep quality ( $p < .000$ ,  $r = .316$ ) and with sleep hygiene ( $p < .000$ ,  $r = .313$ ) and the strong correlation of sleep hygiene ( $p < .000$ ,  $r = .521$ ) and sleep quality. The latter correlation is especially notable when considering the future need to study the effects sleep quality has on academic performance with pre-licensure baccalaureate nursing students.

Table 11

*Correlations between Nursing Students' Behaviors, Nursing Students' Obligations, and Daytime Sleepiness (ESS), Sleep Quality (PSQI) and Sleep Hygiene (SHI)*

	Caffeine	Alcohol	Technology	ESS Tot	PSQI Tot	SHI Tot
Caffeine	1	.234**	.188**	-.003	-.242**	-.248**
Sig. (2 tailed)		.000	.003	.960	.001	.000
N	249	246	248	245	201	240
Alcohol	.234**	1	.144*	-.057	-.114	-.166*
Sig. (2 tailed)	.000		.024	.379	.110	.010
N	246		246	242	199	237
Technology	.188**	.144*	1	-.034	-.137	-.364**
Sig. (2 tailed)	.003	.024		.596	.053	.000
N	248	246		244	201	239
ESS Tot	-.003	-.057	-.034	1	.316**	.313**
Sig. (2 tailed)	.960	.379	.596		.000	.000
N	245	242	244	245	198	236
PSQI Tot	-.242**	-.114	-.137	.316**	1	.521**
Sig. (2 tailed)	.001	.110	.053	.000		.000
N	201	199	201	198	201	197
SHI Tot	-.248**	-.166*	-.364**	.313**	.521**	1
Sig. (2 tailed)	.000	.010	.000	.000	.000	
N	240	237	239	236	197	240
Work	.062	.021	-.012	-.106	-.263**	-.185**
Sig. (2 tailed)	.333	.744	.855	.102	.000	.004
N	245	243	244	241	198	236
Family	.178**	-.113	.021	-.022	-.299**	-.144*
Sig. (2 tailed)	.005	.078	.742	.734	.000	.027
N	246	245	245	242	198	237
Activity	.121	.280**	.158*	.065	.138	-.062
Sig. (2 tailed)	.058	.000	.013	.312	.051	.342
N	248	246	247	244	200	239
Class	.244**	.042	.251**	-.151*	-.307**	-.295**
Sig. (2 tailed)	.000	.507	.000	.018	.000	.000
N	249	246	248	245	201	240
LiveArr	.211**	.176*	.084	.034	-.165*	-.103
Sig. (2 tailed)	.001	.006	.189	.593	.020	.112
N	246	246	246	242	199	237
FFood	.254**	-.016	.048	-.131*	-.356**	-.193**
Sig. (2 tailed)	.000	.802	.455	.041	.000	.003
N	246	246	246	242	199	237
FHouse	.234**	.022	-.033	-.049	-.300**	-.157*
Sig. (2 tailed)	.000	.733	.965	.451	.000	.016
N	245	245	245	241	198	236

FCloth	.185**	.016	-.003	-.047	-.213	-.128*
Sig. (2 tailed)	.004	.803	.957	.465	.003	.050
N	244	244	244	240	197	235
FColl	.075	-.123	.028	-.067	-.322**	-.185**
Sig. (2 tailed)	.241	.053	.664	.303	.000	.004
N	246	243	246	242	199	237
FTPPort	.141*	-.067	.064	-.131	-.247**	-.197**
Sig. (2 tailed)	.027	.295	.316	.042	.000	.002
N	246	246	246	242	199	237

Note. \* Correlation is significant at  $\alpha = 0.05$  (2 tailed); \*\*Correlation is significant at  $\alpha = 0.01$  (2 tailed)

### ANOVA analyses.

#### *Research question 2.*

ANOVA testing was performed to compare differences in the nursing students' year of study with their sleep quality and daytime sleepiness. With  $\alpha = 0.05$ , the results showed there were no differences between the year of study and self-reported sleep quality [ $F(3, 197) = .905, p = .440$ ] and daytime sleepiness [ $F(3, 241) = .517, p = .671$ ] (see Table 12).

Table 12

*Differences with Nursing Students' Year of Study and Daytime Sleepiness (ESS) and Sleep Quality (PSQI)*

	Sum of Squares	df	Mean Square	F	Significance <sup>a</sup>
ESS					
Between groups	28.546	3	9.515	.517	.671
Within groups	4432.164	241	18.391		
Total	4460.710	244			
PSQI					
Between groups	25.979	3	8.660	.905	.440
	1885.523	197	9.571		

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Within groups	1911.502	200
Total		

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*Note.*  $\alpha = 0.05$  to determine significance of  $p$  values.

### **Mediation Results.**

#### ***Research question 6.***

Mplus version 8.4 (Muthén & Muthén, 2017) was used to calculate the results. A mediation analysis was performed to see if student obligations mediated the relationships between sleep quality, daytime sleepiness, and sleep hygiene. A mediating variable is a link between two variables (e.g. the independent variable (IV) and dependent variable (DV)). In a descriptive study, like this one, a mediating variable is hypothesized to explain relationships (either partially or completely) between the IV and DV.

This study tested nursing students' behaviors (drinking caffeine, energy drinks, coffee/tea, drinking alcohol, and technology or electronic device use into the night) as the mediating variable to determine if they mediated the relationships between student obligations (IVs) and sleep quality, daytime sleepiness, and sleep hygiene (DVs). The IVs, or student obligations, included work, family, activities with friends, finances (including food, housing, clothing, college, and transportation), classes, and living arrangements. The DVs were sleep quality (as measured by the PSQI), daytime sleepiness (as measured by the ESS), and sleep hygiene (as measured by the SHI).

### **Mediation Variables.**

Due to the small percentage of self-reported cigarette (2.4%) and street drug (1.2%) use, these behaviors were not used as mediating variables. Instead, only the behaviors of drinking caffeine, alcohol, and technology or electronic devices use into the night were used in the mediation analyses. The model tested the mediators to determine if they indirectly affected the

relationship between student obligations, and sleep quality, daytime sleepiness, and sleep hygiene. Since the standard errors of the model results for mediation are biased, bootstrapping was performed to obtain confidence intervals for determining if the mediating behaviors were significant (Shrout & Bolger, 2002).

Bootstrapping relies on random sampling with replacement. With this analysis, Mplus used 1000 bootstrap random samples with replacement to estimate the standard error. (i.e. the three mediating variables were teased out with student obligations, and sleep quality, daytime sleepiness, and sleep hygiene. Mplus produced results as confidence intervals of total, total indirect, specific indirect and direct effects. The 95% confidence intervals (CIs) were analyzed to determine significance; 95% CIs are equivalent to setting  $\alpha = 0.05$ , and using a  $p$ -value of less than 0.05.

### **Model Results.**

The model examining each obligation as a mediator was just identified, meaning all the degrees of freedom were being used (Kline, 2015). Therefore, no model fit information was available. Unfortunately, just identified models are not ideal (Goodboy & Kline, 2016). They do not allow for comparison to other models in order to identify the “best” model. Instead, a just identified model can only be evaluated on the basis of variance explained in the endogenous outcome variables.

The first step in the analysis process was to run correlations with the behaviors, obligations and sleep quality, daytime sleepiness, and sleep hygiene (Table 11). Next, the variables student obligations and student behaviors were tested with sleep quality, daytime sleepiness, and sleep hygiene using linear regression. Overall, the model results indicated that work ( $p = .029$ ), classes ( $p = .023$ ), and technology or electronic device use into the night ( $p < .000$ ) significantly predicted sleep hygiene. Similar linear regression results indicated that work



( $p = .010$ ), family ( $p = .001$ ), activity with friends ( $p = .001$ ), and classes ( $p = .009$ ) significantly predicted sleep quality (see Table 13).

Table 13

*Model Results of Nursing Students' Self-Reported Obligations and Behaviors Predicting Sleep Hygiene (SHI), Sleep Quality (PSQI), and Daytime Sleepiness (ESS)*

<b>Sleep Hygiene</b>	<b>Estimate</b>	<b>S.E.</b>	<b>Est. / S.E.</b>	<b>Two-Tailed <i>p</i>-Value</b>
Work	-1.428	0.655	-2.181	0.029
Family	-1.021	0.699	-1.462	0.144
Activities with friends	0.217	0.979	0.221	0.825
Class	-1.748	0.771	-2.268	0.023
Living arrangements	-0.351	0.735	-0.478	0.633
Finances for food	-0.697	1.212	-0.575	0.565
Finances for housing	0.733	1.174	0.658	0.510
Finances for clothing	0.804	1.437	0.559	0.576
Finances for college	-0.696	0.809	-0.860	0.390
Finances for transportation	-1.551	1.065	-1.456	0.145
Drinking caffeine	-0.922	0.800	-1.153	0.249
Drinking alcohol	-1.408	0.882	-1.597	0.110
Technology or electronic device use	-3.418	0.704	-4.853	0.000
<b>Sleep Quality</b>	<b>Estimate</b>	<b>S.E.</b>	<b>Est. / S.E.</b>	<b>Two-Tailed <i>p</i>-Value</b>
Work	-0.646	0.250	-2.583	0.010
Family	-1.110	0.348	-3.193	0.001
Activities with friends	1.438	0.419	3.431	0.001
Class	-0.925	0.354	-2.610	0.009
Living arrangements	-0.419	0.332	-1.261	0.207
Finances for food	-0.870	0.551	-1.578	0.114
Finances for housing	-0.169	0.519	-0.326	0.745
Finances for clothing	0.585	0.781	0.748	0.454
Finances for college	-0.481	0.413	-1.162	0.245
Finances for transportation	0.034	0.530	0.065	0.948
Drinking caffeine	-0.085	0.335	-0.255	0.799
Drinking alcohol	-0.724	0.403	-1.796	0.072
Technology or electronic use	-0.314	0.294	-1.070	0.285
<b>Daytime Sleepiness</b>	<b>Estimate</b>	<b>S.E.</b>	<b>Est./S.E.</b>	<b>Two-Tailed <i>p</i>-Value</b>
Work	-0.268	0.495	-0.542	0.588
Family	0.149	0.503	0.296	0.768
Activities with friends	0.669	0.776	0.862	0.389
Class	-1.190	0.550	-2.163	0.031

Living arrangements	0.356	0.490	0.727	0.467
Finances for food	-1.070	0.970	-1.103	0.270
Finances for housing	0.702	0.754	0.931	0.352
Finances for clothing	0.828	1.036	0.800	0.424
Finances for college	0.301	0.559	0.540	0.590
Finances for transportation	-1.245	0.879	-1.417	0.156
Drinking caffeine	0.489	0.507	0.965	0.334
Drinking alcohol	-0.844	0.492	-1.714	0.086
Technology or electronic use	0.069	0.482	0.142	0.887

*Coefficient of determination.*

The coefficient of determination,  $r^2$ , is the measure of shared variance between the IV and DV being tested. The area of shared variance is determined by squaring the correlation coefficient  $r$ . In general, researchers are looking for the IV to account for a minimum of 9% of the variance in the DV (Cohen, 1988). In other words, the  $r^2$  informs the usefulness of the model in regard to explaining the IVs effect on the DV as a percentage. In this study, the model suggested that the observed variables, sleep quality, as measured by the PSQI total score, significantly explained 32.5% of the variance ( $p < .001$ ) and sleep hygiene, as measured by the SHI total score, significantly explained 26.5% of the variance. Therefore, suggesting the model did well with explaining variances of the variables that are not affected by the other variables not being predicted within the model.

*Confidence intervals.*

Confidence intervals (95%) were used to determine if the three behaviors as mediating variables explain the relationship between student obligations (IVs) and sleep hygiene, sleep quality and daytime sleepiness (DVs). The model indicated that overall, the three behaviors indirectly explained a significant relationship between activities with friends and sleep hygiene. However, individually, none of the three behaviors could partially explain the relationship. The model also indicated that overall, the three behaviors indirectly explained a significant relationship between classes and sleep hygiene. In addition, use of technology or electronic

devices into the night partially explained the significant relationship between classes and sleep hygiene. Last, the model indicated that overall, the three behaviors indirectly explained a significant relationship between activities with friends and sleep quality. When considering daytime sleepiness, the model did not indicate that the three behaviors indirectly explained relationships between student obligations and the outcomes (see Table 14). Due to purposely correlating the mediating variables, the overall indirect effects and the subsequent partially explained effects by the individual behaviors were unclear. The nuance of each specific, indirect effect on the individual behaviors was lost due to the purposeful correlation of the mediators.

Table 14

*Confidence Intervals of Behaviors as Mediating Variables Explaining Significant Indirect Effects between the IVs and DVs using Mplus*

	95% CI
Behaviors indirectly explained significant relationship between activities with friends and sleep hygiene	[-2.014, -0.155]*
Nonsignificant individual findings:	
Tech between Activities and Sleep Hygiene	[-1.307, 0.099]
Alcohol between Activities and Sleep Hygiene	[-0.929, 0.041]
Caffeine between Activities and Sleep Hygiene	[-0.402, 0.108]
Behaviors indirectly explained significant relationship between classes and sleep hygiene	[-1.691, -0.369] *
Significant individual findings:	
Technology and Classes with Sleep Hygiene	[-1.545, -0.349]**
Nonsignificant individual findings:	
Alcohol and Classes with Sleep Hygiene	[-0.206, 0.205]
Caffeine and Classes with Sleep Hygiene	[-0.424, 0.120]
Behaviors indirectly explained significant relationship between activities with friends and sleep quality	[-0.537, -0.023]*
Nonsignificant individual findings:	
Technology and Activities with Sleep Quality	[-0.197, 0.062]
Alcohol and Activities with Sleep Quality	[-0.425, 0.003]

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*Note.* \* Confidence Interval (CI) of behavior mediating variables is indirectly significant at  $\alpha = 0.05$  (2 tailed). \*\* CI partially of behavior mediating variables partially explains indirect significance at  $\alpha = 0.05$  (2 tailed). <sup>a</sup>Technology use = use of technology or electronic devices into the night

### **Results Summary**

Results indicated that this sample of pre-licensure baccalaureate nursing students had overall poor sleep quality, excessive daytime sleepiness, and maladaptive sleep hygiene with no regards to the year of study nor student enrollment status. Behaviors of drinking caffeine, energy drinks, coffee/tea, drinking alcohol, and use of technology or electronic devices into the night were inversely and statistically significant with sleep hygiene. Obligations of work, family, classes, finances for food, housing, and college were inversely and statistically significant with sleep hygiene and sleep quality. Also, classes and finances for food were inversely and statistically correlated with daytime sleepiness. Both the student obligations of classes and finances for food were inversely and statistically correlated with all three outcomes of sleep hygiene, sleep quality and daytime sleepiness.

Mediation analysis indicated that the behaviors of drinking caffeine and alcohol, and using technology or electronic devices into the night, as mediating variables, indirectly explained the relationship between activities with friends and sleep hygiene and sleep quality, as well as classes and sleep hygiene. Results also indicated that work, classes, and technology or electronic device use into the night significantly predicted sleep hygiene; whereas work, family, activity with friends, and classes significantly predicted sleep quality.

## **CHAPTER V: DISCUSSION AND SUMMARY**

The purpose of this research study was to further investigate sleep in pre-licensure baccalaureate nursing students, and describe factors that impact their sleep quality and daytime sleepiness. A cross-sectional descriptive design using mediation analysis was conducted. At the present time, this study provides more descriptive evidence on sleep quality, daytime sleepiness, and sleep hygiene of pre-licensure baccalaureate nursing students. In addition, the study's results provide evidence for correlations with sleep quality, daytime sleepiness, and sleep hygiene in pre-licensure baccalaureate nursing students.

Results from this research study concluded that pre-licensure baccalaureate nursing students in a Midwest region of the United States have poor sleep quality and excessive daytime sleepiness. Self-reported factors that always impacted sleep in this sample included daily obligations and behaviors. For example, the results showed classes were overwhelmingly the main reason for sleep loss on a daily or weekly basis, followed by work and finances for college. Overwhelmingly, the greatest self-reported behaviors that impacted sleep the most was use of technology or electronic devices into the night. Drinking caffeine, energy drinks, coffee/tea was a distant second reported behavior of always losing sleep. Chapter 5 will provide an explanation of the findings for each research question.

### **Research Questions**

Research questions 1 and 2 were similarly worded, but used different statistical tests to analyze the data. Therefore, the two questions will be explained together.

1. What is the relationship with freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?
2. Are there differences in freshman, sophomore, junior, and senior nursing students and their quality of sleep and daytime sleepiness?

The results indicated that the vast majority of the participants reported poor sleep quality and excessive daytime sleepiness regardless of the year of study. These findings support prior research which has shown poor sleep quality in undergraduate nursing students (Hsiu-Chin et al., 2014; Mattos Moraes dos Santos et al., 2016), as well as undergraduate college students in general (Buboltz et al., 2009; Lund et al., 2010), and excessive daytime sleepiness in undergraduate nursing students (Demir, 2017; Huang et al., 2014). Demir (2017) found second year nursing students who reported poor sleep hygiene, difficulty falling asleep, and awakening in the night correlated with excessive daytime sleepiness. Similarly, Huang et al. (2014) found first year nursing students who had poor sleep quality, perceived symptoms (i.e. changes in body weight, headache, stomachache, menstrual cycle changes, and worrying about poor liver function), and were involved in student clubs had significant correlations with daytime sleepiness. Researchers have reported nursing students' sleep latency significantly correlates with daytime sleepiness (Demir, 2017; Huang et al., 2014). A sleep latency of over 30 minutes in this study, as well as some participants needing medication to help them sleep, shows that undergraduate nursing students have difficulty falling asleep and supports the need for educational sessions.

The results from this study indicated that year of study was not a significant factor associated with sleep quality. This finding coupled with the overall findings of poor sleep quality and excessive daytime sleepiness support the need to educate all levels of pre-licensure baccalaureate nursing students on sleep health, including factors associated with poor sleep quality and daytime sleepiness.

When considering sleep deprivation and daytime functioning, the participants reported an overall lack of enthusiasm with getting things done once or twice a week, closely followed by being unenthusiastic more than three times a week. Consistently, lack of enthusiasm for getting

things done, such as daily tasks, or maintaining a school schedule, can be problematic when trying to maintain the rigor demanded of pre-licensure baccalaureate nursing students in regard to their academic studies and clinical preparation. The combination of theoretical studies and clinical requirements is demanding. Nursing students begin their clinical experiences at different points within the curriculum depending upon the nursing program. When clinical hours do begin, daytime sleepiness may occur given the time required to adequately prepare for the scheduled clinical day. Prior research has reported an association of higher stress and clinical preparation in undergraduate nursing students (Demir, 2017) therefore, making sleep health education early in the curriculum a necessity.

Researchers have also found associations with physical and mental health, and poor sleep quality that is significantly influenced by sleep latency (Augner, 2011). Learning about sleep health early in the nursing curriculum can be one approach to teach nursing students how to manage their stress. Future research could study the effects of rigorous academic and clinical demands have on nursing students' levels of stress and academic performance over time. Studies may include anxiety and depression scales with lack of enthusiasm for getting things done, along with understanding sleep latency onset.

### 3. What are the relationships with nursing students' behaviors and their quality of sleep and daytime sleepiness?

While prior research has shown that college students engaged in risky behaviors, such as using drugs, smoking tobacco, and drinking alcohol (Kaur & Singh, 2017), this sample of pre-licensure baccalaureate nursing students may avoid such behaviors due to understanding the importance of practicing healthy behaviors. For example, only two participants (1.2%) reported using street drugs that caused them to sometimes lose sleep on a daily or weekly basis. Furthermore, smoking cigarettes was reported by only one participant as always (0.4%) causing

them to lose sleep on a daily or weekly basis. The sample may have had already completed health and nutrition classes making them aware of healthy behavior choices, especially since the majority of the responses were from junior nursing students (29.1%), and senior nursing students (33.1%).

Although this sample might have been aware of healthy behavior choices, they still reported poor sleep quality and excessive daytime sleepiness. The overall poor sleep quality and excessive daytime sleepiness reported may be attributed to the inverse relationship their reported behaviors had with sleep hygiene. For example, the findings indicated that the more the nursing students engaged in drinking caffeine, energy drinks, coffee/tea, drinking alcohol, and using technology or electronic devices into the night, the less they practiced sleep hygiene. Similar findings have been reported in the literature with studies conducted on college students in general (Kaur & Singh, 2017). This study's findings add to the evidence of sleep hygiene in pre-licensure baccalaureate nursing students.

Researchers recommend education on sleep hygiene practices be offered to college students as educational sessions and workshops (Kaur & Singh, 2017), targeting behaviors aiming to improve sleep (Felix et al., 2017; Kloss et al., 2016). Examples include caffeine management, limiting the exposure to light prior to bed, and practicing routine healthy bedtime habits. Additional research suggests beginning sleep health education early in the students' college careers, such as during freshman orientation and during freshman courses. In doing so, students could learn to utilize strategies early to prevent health problems associated with sleep deprivation (Huang et al., 2014). This may include addressing sleep quality to improve academic performance and quality of life (Valerio et al., 2016). Benn and Lanier (2016) recommended developing workshops for stress and time management as strategies to promote sleep health. Prior research has shown that undergraduate nursing students are interested in improving their



health, but need support from educators to accomplish goals related to improving their health, including sleep health (Nevins & Sherman, 2016).

With the increasing use of technology as a medium for academic and clinical preparation, future research is needed to better understand the effects of using technology or electronic devices late into the night has on nursing students' sleep, physical, and mental health. Prior research has found that late night technology use may cause sleep deprivation by interrupting the sleep cycle (Benn & Lanier, 2016; Whipps et al., 2018) and negatively impact learning and memory of college students (Hershner & Chervin, 2014). Understanding how technology use into the night affects nursing students may assist nursing faculty with teaching nursing students about the complications of sleep deprivation.

4. How do nursing students describe their routine obligations outside of school to (a) family, (b) work, (c) activities, (d) finances, and (e) living arrangements that cause them to sleep less on a daily or weekly basis?

Prior research has shown that obligations are reasons reported to explain why college students have sleep deprivation. Examples of reasons why college students lose sleep included spending time with friends, and lifestyle choices (i.e. engaging in risky behaviors, staying up late into the night, and having trouble managing their time) (Benn & Lanier, 2016). Other obligations reported by college students that impacted their sleep included living arrangements, such as bedroom settings, roommates, bed partners, and physiological conditions, such as illnesses, sleeping disorders, inconsistent sleeping patterns, or using the bedroom for other things than sleep (Buboltz et al., 2009; Demir, 2017; Gellis et al., 2014; Hershner & Chervin, 2014; Huang et al., 2014; Khalil, 2017). Phillips et al. (2017) reported undergraduate students who had irregular sleep cycles experienced a later release of melatonin, which disturbed their circadian

rhythm. Similarly, Selvi et al. (2017) and Soares et al. (2012) reported that sleep may be influenced by internal and external factors such as work schedules, academics, and social commitments that disrupt melatonin secretion. Environment and physical conditions that impact sleep may be due to routine obligations beyond nursing students' control.

Students' obligations to work, academics, family, finances, and socializing were commonly reported research findings in samples of college students (AASM, 2008; Benavente et al., 2014; Buboltz et al., 2009; Demir, 2017; Gellis et al., 2014; Hershner & Chervin, 2014; Huang et al., 2014; Khalil, 2017; Soares et al., 2012). The participants in this study reported similar obligations that were inversely related to sleep quality (i.e. work, family, classes, living arrangements, and finances for food, housing, and college). Classes and finances for food were also inversely related to daytime sleepiness. These are pertinent findings that add to the science of pre-licensure baccalaureate nursing students. The findings support the need to develop sleep health content as a thread through nursing curriculum or may be used as content discussed at educational sessions teaching about poor sleep quality and excessive daytime sleepiness. Educational sessions like these could include nursing students collaborating on strategies to lessen the effects common student obligations have on their sleep health. Introducing nursing students to the educational sessions early in their programs could equip them with good sleep hygiene practices they carry into their professional nursing practice.

Results from this study indicated that nearly 50% of the sample lost sleep always or sometimes related to finances for college. Similarly, 72% and 82% reported losing sleep related to work and activities with friends always or sometimes, respectively. Finances for college and work as student obligations were inversely and significantly correlated with sleep quality and sleep hygiene. Therefore, it might be that nursing students work odd hours to accommodate their theory and clinical schedules. Nursing students who work during the evening or night hours

might be at higher risk for experiencing sleep deprivation. Future research could investigate the effect work schedules have on nursing students' sleep quality (Soares et al., 2012), sleep hygiene, and homeostatic sleep drive and circadian rhythm to better understand how to educate students entering nursing programs on time management and sleep hygiene as a way to optimize their health.

More than half of the participants reported family obligations as another reason for losing sleep on a daily or weekly basis. The results inversely and significantly correlated with sleep quality, daytime sleepiness and sleep hygiene. When considering adults may have family or other personal obligations that impact their sleep (AASM, 2018; CDC, 2018), future research could study nontraditional students enrolled in nursing programs part-time or full-time to better understand the effects family obligations have on holistic wellbeing. Additionally, future research is warranted on nontraditional nursing students, their family obligations, and academic performance. Findings from like studies could be used to inform nurse educators on the need to incorporate students' self-care, including sleep health as a thread through nursing curriculum.

Although participants reported living arrangements as an unlikely reason to lose sleep on a daily or weekly basis, the results did indicate that living arrangements were inversely and statistically correlated with sleep quality. Prior research has shown an association between living arrangements and students having less control over conditions such as room temperature or loud noises, leading to uncomfortable sleeping environments and poorer sleep quality (Gellis et al., 2014). The majority of the participants in this sample lived in off-campus housing (e.g. apartments) so they might have had more control of their living conditions, such as regulating noise level, temperature, and interaction with their roommates.

5. Is there an association with nursing students' enrollment status as full-time and part-time, and their quality of sleep and correlates?

The results from this study indicated there was not a significant association with pre-licensure baccalaureate nursing students' enrollment status and their self-reported sleep quality, daytime sleepiness, and sleep hygiene. This study found that both part-time and full-time students had maladaptive sleep hygiene, indicating that both part-time and full-time students are in need of improving sleep hygiene to improve their sleep quality. These findings align with prior research by Nevins and Sherman (2016) who found self-care practices, such as diet and hydration, exercise, stress reduction, and sleep lacking among pre-licensure baccalaureate nursing students. The findings from this study, coupled with prior research findings (Nevins & Sherman, 2016) support the need for educating nursing students on their own self-care practices as a means for promoting healthy behaviors.

Self-care practices and good sleep hygiene may be a strategy to eliminate daytime sleepiness. Practices may include a regular sleep-wake schedule, routine physical activity, maintaining comfortable sleeping environments, avoiding stimulating activities before bed, and avoiding alcohol and cigarettes (Hershner & Chervin, 2014, National Sleep Foundation, 2019). Good sleep hygiene is important for physical and mental health, as well as career performance (Kaur & Singh, 2017; National Sleep Foundation, 2019). Threading self-care practices throughout undergraduate nursing curriculum might be a way to foster good sleep hygiene practices. Future research could study the influence of nursing students' self-care practices, including sleep health on academic and clinical performance.

Prior research has shown that college students who have sleep deprivation may miss out on the last few hours of REM sleep, which may influence how new information is integrated, therefore affecting academics and daily accomplishments (Benn and Lanier, 2016; Buboltz et al.,

2001). Being less sleepy during the day may positively affect nursing students' overall academic performance in the classroom and clinical settings (Demir, 2017; Huang et al., 2014; Khalil, 2017; Postma et al., 2017), promoting critical thinking and skill acquisition to clinical experiences with patient care. Without proper support and education in the undergraduate nursing curriculum, researchers have suggested poor self-care practices and poor sleep hygiene may carry over into the nursing career, impacting patients' care and health (Postma et al., 2017; Ye & Smith, 2015).

Sleep deprivation can lead to medical errors, patient safety concerns, and sentinel events. Therefore, pre-licensure baccalaureate nursing students should use self-care practices to assist in optimal daytime functioning. Improving sleep hygiene in undergraduate nursing students may aid in better sleep quality and daytime functioning (Huang et al., 2014; Thomas et al., 2017). Undergraduate nursing students who have knowledge about healthy sleep may have a successful transition to professional practice, delivering high quality care to their patients (Thomas et al., 2017).

6. Do student obligations mediate the relationships between sleep quality and correlates?

The data indicated the results for research question #6 a priori were null. In further communications with the statistician, post priori discussion included testing student behaviors (drinking caffeine, alcohol, and technology use into the night) as the mediating variables between student obligations (IVs) and sleep quality, daytime sleepiness, and sleep hygiene (DVs).

Results indicated that self-reported technology use into the night was most frequently associated with class, and correlated with poor sleep quality and sleep hygiene. These findings correlate with prior research suggesting that using technology into the night may impact sleep, as well as prolong sleep latency. This is important information for nursing students and nursing

faculty to know given the potential effect staying up late might have on awakening early the next morning for clinical. Researchers have found that late night technology may cause sleep deprivation by interrupting the sleep cycle (Benn & Lanier, 2016; Whipps et al., 2018), therefore, making early morning clinical days even more stressful. This information is important for nursing faculty to know when considering approaches they may teach nursing students as part of their clinical preparation. For example, resources used for researching disease processes, medications, nursing interventions and patient care outcomes. Time management and stress reduction techniques may aid in better sleep quality, as sleep quality results from this study did show that stress, anxiety, wondering thoughts, and inability to shut their minds off impacted sleep for these undergraduate nursing students. Participants self-reported that attending theory class, along with getting up early for clinical, impacted their sleep. Interestingly though, the results from this study indicated technology as a mediating variable between class and sleep hygiene. Further research is needed to understand how technology is being used by nursing students into the night. It may be that nursing students were using technology for both class preparation and for social use.

This research sample had poor sleep quality, excessive daytime sleepiness, and poor sleep hygiene. Unal (2018) studied undergraduate nursing students and found poor sleep hygiene was a precursor to excessive daytime sleepiness. Mediation analysis results in this study supports prior research that indicated sleep and academic performance are affected by technology (Li et al., 2015). Furthermore, other researchers have found correlations with high use of technology, poor sleep quality, and sleep deprivation (Mohammadbeigi et al., 2016; Towne Jr et al., 2017; Whipps et al., 2018). Educating undergraduate nursing students on good sleep hygiene practices, such as eliminating late night technology use, may improve their sleep quality. Future research

could test the effect of good sleep quality on academic performance in the classroom and clinical settings.

### **Limitations of the Study**

There are many limitations to consider when deciphering the findings and implications for nursing education. One limitation of the study was the small sample size  $N = 254$ . A power analysis was conducted using the triangular model (Schoemann et al., 2017) and yielded, and indicated, 256 participants were needed to be 80% powered. Although 297 participants completed the surveys, 43 identified as 18 years old, and therefore did not meet the inclusion criteria of 19 years old. Their completed surveys were not included in the analysis. The participants may not have read the directions thoroughly for inclusion criteria, or they may have wanted to take the survey in order to calculate their own personal sleep scores. Deans of the colleges were requested to forward the Invitation to Participate to their students. It is possible that not all of the Deans were able to do so. Additionally, several nursing programs required approval from their IRB to be able to forward the Invitation to Participate to their nursing students; time constraints prohibited their participation. Some Deans of nursing programs (31%) did not respond to the original query email inquiring about the Deans' interest in their students' participation in this research study. Therefore, it is unknown how many potential participants received the Invitation to Participate and elected not to participate.

Second, this study included different levels of nursing students. Colleges may define freshman, or first year nursing student, sophomore or second year nursing student, junior or third year nursing student, and senior year or fourth year nursing student differently at the nursing programs that participated. It is possible that the participants were not be able to recognize where they were in the program at the time they completed the questionnaires. For example, if a student transferred in or completed pre-requisite course work at a different college, or the same college,

the level of student may be defined in a different way. The college may have also defined students as a nursing student only in the last two years of their program of study.

Third, the questionnaires required the participants to self-report their responses related to their sleep quality, daytime sleepiness, and sleep hygiene practices. Self-reported data is always considered a limitation. Additionally, the questionnaires were distributed during the fall semester only, and for five weeks only. Limiting to this area, sample, and at one given time, may not be representative of the population in the Midwest region of the United States.

Fourth, a convenience sample was used to recruit the participants; the participants decided if they met the inclusion and exclusion criteria on their own. Consent to participate was implied by completing the questionnaires. The participants were a voluntary sample from thirteen colleges in a Midwest region of the United States. This geographic limitation may not be representative of the entire population of nursing students nationwide. Additionally, limiting the study to pre-licensure baccalaureate nursing students does not represent all levels of nursing school programs in the study area.

Fifth, since the questionnaire was administered electronically, there was no way of tracking who completed the questionnaires; the same participant may have completed the questionnaires multiple times, not allowing for proper sample representation.

Sixth, there was no way to exclude participants from completing the questionnaires who may have been previously diagnosed with a sleep disorder or taking medications that affected their sleep.

And finally, and quite possibly the most important limitation is that no definite conclusion can be drawn from a cross-sectional design. Data were collected at one point in time, using data from different groups of subjects in various stages of a process. Descriptive research designs determine relationships between and among variable, not cause and effect (Gray et al.,



2017). That said, the findings from this descriptive design do support the need for future research using experimental design to better understand the cause and effect of student behaviors and obligations and sleep quality.

### **Implications/Recommendations for Education**

The findings from this study provide evidence that pre-licensure baccalaureate nursing students have poor sleep quality, excessive daytime sleepiness, and maladaptive sleep hygiene. The findings may be used to inform nurse educators about the need for sleep education.

This sample, comprised of full-time and part-time nursing students across all years in their nursing programs, reported that classes, work, and activities with friends impacted their sleep. This information is important for nursing program administrators and faculty to know in order to inform nursing students of the factors associated with poor sleep health. It is essential for nursing students to understand that poor sleep quality and excessive daytime sleepiness may affect their daytime functioning, and has the potential to affect their academic performance.

#### **Neuman Systems Model.**

Prior research has shown that college students who report poor sleep quality have an increase in daytime sleepiness, physical, and psychological complaints (Buboltz et al., 2009; Khalil, 2017; Nagane et al., 2016). Ideally, all variables in the Neuman Systems model function fluidly and harmoniously throughout, and are stable in relation to internal and external stressors (Neuman & Fawcett, 2011). Understanding factors that impact sleep, identifying stressors, obligations, behaviors, and targeting primary prevention strategies, may avoid a health system breakdown of the pre-licensure baccalaureate nursing student. Under the guidance of the Neuman Systems Model, the findings from

this research will add to the science on the association with pre-licensure baccalaureate nursing students' behaviors, obligations, and their sleep health.

In the Neuman Systems Model, health promotion is included in the area of primary prevention and is a goal to avoid system breakdown, for example, education and supportive actions toward achieving optimal wellness (Neuman & Fawcett, 2011). Primary prevention strategies in colleges may include health promotion, support services, peer support groups, sleep education, and cognitive behavioral therapy. Researchers reported that undergraduate nursing students have a desire to improve their well-being in the area of sleep, need for sleep education, and improve knowledge in self-care activities, including sleep hygiene (Nevins & Sherman, 2016; Postma et al., 2017). This study's findings support the need for educational offerings on sleep hygiene practices and reinforce strategies tailored to nursing students and the multiple stressors they encounter (i.e. rigorous classes, work and family responsibilities, and finances needed for college).

Pre-licensure baccalaureate nursing students have multiple factors that impact their sleep which include classes, work, finances for college, and using technology or electronic devices into the night. Class times are often scheduled without consideration to the college students' delayed circadian rhythm. Colleges need to understand, acknowledge, and publicize that class schedules may have an impact on sleep and learning. Offering later class times may assist in total sleep duration, attention, and academic performance (Hershner & Chervin, 2014).

### **Future Research**

Future research is needed to test the effects of educating undergraduate nursing students on sleep hygiene early in their nursing programs. Additional consideration should be given to the effects of sleep hygiene as a thread through nursing curriculum as a means for addressing

academic performance overall, including clinical performance, safe patient care, and students' physical and mental health.

This research study did not examine stress in regards to daily obligations. Reasons that impacted sleep in the content analysis from the PSQI included stress and anxiety about classes. It would be beneficial to explore stress levels on clinical days and compare this to general college students, with regards to daily obligations and other variables such as student enrollment status, gender, age, and other demographics. Also, research is needed to understand how technology or electronic devices are being used by nursing students into the night. It may be that nursing students were using technology for both class preparation and for social use. Further study of late night technology use with social media in regards to sleep quantity and quality would be beneficial, across all age levels.

There is lack of research in undergraduate nursing students that associates sleep quality to successful academic performance (Benavente et al., 2014). Successful academic performance may be a predictor of professional success (Valladares et al., 2018), affecting patient care. After sleep education occurs, researchers could compare GPA and retention rates across different levels of nursing students at different colleges. Research may continue into nursing practice, assessing sentinel events, job performance, job turnover rates, and career satisfaction.

Outcome goals of the Neuman System Model include health retention, restoration, and maintenance; therefore, primary prevention strategies are crucial to optimize nursing students' health. Longitudinal studies on nursing students recognizing risk factors, health promotion strategies, and education about sleep hygiene practices would be valuable. Studies of how nursing students make use of resource staff such as mental health counselors, support groups, and student success centers would be beneficial. Teaching

nursing students how to effectively manage sleep may improve their physical and mental well-being to enhance their professional practice. Longitudinal studies on nursing students who continue into professional practice could yield essential findings that tie learned behaviors or sleep curriculum in undergraduate nursing programs with professional practice, career performance, satisfaction, and retention.

### **Summary**

Research has shown poor sleep quality may lead to sleep deprivation, causing daytime sleepiness. Good sleep hygiene and healthy self-care practices may eliminate physical and mental health issues that affect pre-licensure baccalaureate nursing students. Learning self-care practices will assist the pre-licensure baccalaureate nursing student to achieve optimal daytime functioning. College curriculum should support students in areas of healthy behaviors to achieve academic success, leading to successful careers, and safe patient care.

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students: Associations with stress, coping, sleep, and mental disorders. *Teaching & Learning in Nursing*, 12(4), 246–252. doi:10.1016/j.teln.2017.06.005

Zhang, Y., Peters, A., & Bradstreet, J. (2018). Relationships among sleep quality, coping styles, and depressive symptoms among college nursing students: A multiple mediator model. *Journal of Professional Nursing*, 34(4), 320–325.  
doi:10.1016/j.profnurs.2017.12.004

Zhang, Y., Peters, A., & Chen, G. (2018). Perceived stress mediates the associations between sleep quality and symptoms of anxiety and depression among college nursing students. *International Journal of Nursing Education Scholarship*, 15(1), 1–1.  
doi:10.1515/ijnes-2017-0020

## Appendix A

## Invitation to Participate

Dear Dean (Personalized name),

I am a doctoral student from Bryan College of Health Sciences in Lincoln, Nebraska working on my dissertation study. I am researching sleep quality and daytime sleepiness in undergraduate nursing students who are pursuing the pre-licensure baccalaureate degree. I am writing to request your assistance with disseminating my Invitation to Participate.

The purpose of this study is to describe the factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students. I will use a demographic sheet and three questionnaires, with established validity and reliability, to collect the data. Although demographic information will be collected, such as age, race/ethnicity, gender identity, type of housing, etc., I will not ask for the students' names, nor their contact information. All demographic information will be analyzed as aggregated data. This is a measure which will be taken to protect confidentiality of participants' responses. The risks to participating in this study are minimal. I have received IRB approval from Bryan College of Health Sciences. If further IRB approval is indicated through your institution, I would appreciate a contact name and number.

I have written an Invitation to Participate (see attachment) for undergraduate nursing students. If you are willing, I am requesting that you send it to the pre-licensure nursing students in your BSN program. Please consider sending the email starting September 3, 2019. The survey will be available to students until October 1, 2019. I will send an email reminder at one week and three weeks after sending the initial Invitation to Participate email.

If you have questions related to this study, please contact me or my dissertation chair, Michelle Johnson PhD RN, at 402-481-8762 or [michelle.johnson@bryanhealthcollege.edu](mailto:michelle.johnson@bryanhealthcollege.edu). You may also contact the Bryan College of Health Sciences IRB at 402-481-3967.

Thank you for your consideration of disseminating the Invitation to Participate.

Regards,  
Melissa Blome, EdD-C, RN  
[melissa.blome@bryanhealthcollege.edu](mailto:melissa.blome@bryanhealthcollege.edu)  
402-481-8092

## Appendix B

### Invitation to Participate for pre-licensure baccalaureate nursing students

Dear nursing student,

You are invited to participate in my dissertation study titled “Sleep Quality and Daytime Sleepiness in Pre-licensure Baccalaureate Nursing Students”. The purpose of this study is to describe the factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students. In order to better understand the factors that impact your sleep, I am requesting that you answer the questions in the Google Forms link below.

You are eligible to participate in this study if you are a nursing student in a pre-licensure Baccalaureate of Science Nursing program (BSN), age 19 or older, have access to an electronic device with internet capabilities in order to access the survey questions online, and are able to read and understand the English language. Students in a nursing program that offers an associate, diploma, or vocational degree are excluded from this study. Students who have already obtained a nursing license (e.g. RN-BSN), or in an accelerated program are also excluded from this study.

Participation in this study is voluntary. You may withdraw from the study at any time without any consequences to you, the relationship with college/university, Bryan College of Health Sciences, the PI, or your grades. It is your choice to participate by accessing the questions in Google Forms and providing your responses. You may benefit from better understanding your own quality of sleep and sleep hygiene practices after receiving your scores from the questionnaires. The results may assist nursing education on how to better support pre-licensure baccalaureate nursing students, and inform them of healthy lifetime sleep habits.

The risks to participating in this study are minimal and include loss of time given to completing the questions, a perceived burden with answering the questions, and possible breach of confidentiality. By participating in the study, you are agreeing to consent. You provide your consent to participate by completing the questions and demographic information accessed through the Google Forms link. The survey should take approximately 10-15 minutes of your time. The survey will be available for one month between September 3, 2019 through October 1, 2019. You will be asked to provide some demographic information, such as your age, identified gender, etc. You will not be asked to provide your name or contact information, so your responses will remain anonymous. All demographic information will be presented as aggregated data, as a way to maintain confidentiality.

In order to protect your privacy, there is no IP address associated with the data in Google Forms. I will prepare the spreadsheet for data analysis using Mplus software. The data will be housed in a personalized folder, on a password protected computer, of which only I have access. Printed Excel spreadsheets and outputs will be kept in a locked drawer in a locked office.

You will not be compensated for your time, though your responses to the questionnaires will be used to better understand the factors impacting sleep quality in nursing students pursuing the BSN degree. This study has been approved by Bryan College of Health Sciences Research Review Board.

Your dean will resend the Invitation to Participate one week and three weeks after the survey has been launched. Everyone will receive the reminder because I will not know who has completed the survey. Please disregard the reminder if you have completed the survey.

If you have questions related to my study or accessing the Google Forms link, please contact me, Melissa Blome, at 402-481-8092 or [melissa.blome@bryanhealthcollege.edu](mailto:melissa.blome@bryanhealthcollege.edu) and/or my dissertation chair, Michelle Johnson PhD RN, at 402-481-8762 or [michelle.johnson@bryanhealthcollege.edu](mailto:michelle.johnson@bryanhealthcollege.edu). If you have any questions about your rights as a research participant, you may call the IRB 402-481-3967.

Please click or copy and paste the link to begin the survey:

<https://forms.gle/aivT5FzBxEo3A18c8>

Thank you for participating in my study!

Melissa Blome, EdD-C, RN

## Appendix C

### Invitation to Participate electronic mail reminder

Please note: The reminder will be sent at one week and three weeks after sending the initial Invitation to Participate email.

Dear nursing student:

You previously received an invitation to participate in my dissertation study titled “Sleep Quality and Daytime Sleepiness in Pre-licensure Baccalaureate Nursing Students”. The purpose of this study is to describe the factors that impact sleep quality and daytime sleepiness in pre-licensure baccalaureate nursing students. In order to better understand the factors that impact your sleep, I am requesting that you answer the questions in the Google Forms link below.

This questionnaire will be available in Google Forms until October 1, 2019. Please consider completing the questionnaire at this time. It will take you approximately 10-15 minutes to complete.

Your participation in this study is voluntary and you may quit at any time without any consequences to you, the relationship with college/university, Bryan College of Health Sciences, the PI, or your grades. Completing the questionnaire acts as your consent to participate. You will not be asked to provide your name or contact information. In order to protect your privacy, there is no IP address associated with the data in Google Forms. I will prepare the spreadsheet for data analysis using Mplus software. The data will be housed in a personalized folder, on a password protected computer, of which only I have access. Printed Excel spreadsheets and outputs will be kept in a locked drawer in a locked office.

This study has been approved by Bryan College of Health Sciences Research Review Board.

If you have questions related to my study or accessing the Google Forms link, please contact me, Melissa Blome, at 402-481-8092 or [melissa.blome@bryanhealthcollege.edu](mailto:melissa.blome@bryanhealthcollege.edu) and/or my dissertation chair, Michelle Johnson PhD RN, at 402-481-8762 or [michelle.johnson@bryanhealthcollege.edu](mailto:michelle.johnson@bryanhealthcollege.edu). If you have any questions about your rights as a research participant, you may call the IRB 402-481-3967. A copy of your rights as a research participant is attached.

Please click or copy and paste the link to begin the survey:

<https://forms.gle/aivT5FzBxEo3A18c8>

Thank you for participating in my study!

Melissa Blome, EdD-C, RN

## Appendix D

## Demographic information

## Age

- ☐ Age \_\_\_\_\_

## Identify gender as (select all that apply)

- ☐ Male
- ☐ Female
- ☐ If neither above, please identify your gender\_\_\_\_\_

## Student status

- ☐ Full-time student (enrolled in 12 credit hours or more)
- ☐ Part-time student (enrolled in 11 credit hours or less)

## Select the student year level that best describes you

- ☐ Freshman or first year nursing student
- ☐ Sophomore or second year nursing student
- ☐ Junior or third year nursing student
- ☐ Senior or fourth year nursing student

## Select the race/ethnicity that best describes you

- ☐ White
- ☐ Hispanic or Latino
- ☐ Black or African American
- ☐ Native American or American Indian
- ☐ Asian/Pacific Islander
- ☐ Other – please indicate your race/ethnicity\_\_\_\_\_

## Select the housing that best describes you



- On-campus (dormitory)
- On-campus (fraternity or sorority)
- Off-campus – select one
  - Parent's home
  - Own or rent a home
  - Apartment
  - Other- please specify \_\_\_\_\_

Select the relationship status that best describes you

- Single, not currently in a relationship
- Not married but in a relationship
- Married
- Divorced

What items listed below cause you to sleep less on a daily or weekly basis? Select all that apply.

- Work (always, sometimes, or never) [select one]
- Family (always, sometimes, or never) [select one]
- Activities with friends (always, sometimes, or never) [select one]
- Classes (always, sometimes, or never) [select one]
- Living arrangements (always, sometimes, or never) [select one]
- Drinking caffeine, energy drinks, coffee/tea (always, sometimes, or never) [select one]
- Drinking alcohol (always, sometimes, or never) [select one]
- Cigarette use (always, sometimes, or never) [select one]
- Using street drugs (always, sometimes, or never) [select one]
- Technology or electronic devices into the night (always, sometimes, or never) [select one]

- Finances for the following (select all that apply)
  - Food (always, sometimes, or never) [select one]
  - Housing (always, sometimes, or never) [select one]
  - Clothing (always, sometimes, or never) [select one]
  - College (always, sometimes, or never) [select one]
  - Transportation (always, sometimes, or never) [select one]

## Appendix E

## The Pittsburgh Sleep Quality Index (PSQI)\*

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

1. When have you usually gone to bed? \_\_\_\_\_
2. How long (in minutes) has it taken you to fall asleep each night? \_\_\_\_\_
3. When have you usually gotten up in the morning? \_\_\_\_\_
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) \_\_\_\_\_

5. During the past month, how often have you had trouble sleeping because you...	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
6. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
9. During the past month, how would you rate your sleep quality overall?				

Component 1                      #9 Score.....C1\_\_\_\_\_

Component 2                      #2 Score ( $\leq 15 \text{ min}=0$ ;  $16-30 \text{ min}=1$ ;  $31-60 \text{ min}=2$ ;  $>60 \text{ min}=3$ ) + #5a Score  
(if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3).....C2\_\_\_\_\_

Component 3                      #4 Score ( $>7=0$ ;  $6-7=1$ ;  $5-6=2$ ;  $<5=3$ ).....C3\_\_\_\_\_

Component 4                      (total # of hours asleep)/(total # of hours in bed) x 100

	>85%=0, 75%-84%=1, 65%-74%=2, <65%=3.....	C4_____
Component 5	Sum of Scores #5b to #5j (0=0; 1-9=1; 10-18=2; 19-27=3).....	C5_____
Component 6	#6 Score.....	C6_____
Component 7	#7 Score + #8 Score (0=0; 1-2=1; 3-4=2; 5-6=3).....	C7_____

Add these seven component scores together \_\_\_\_\_

**Global PSQI Score** \_\_\_\_\_

Smyth, C. (2012). The Pittsburgh Sleep Quality Index (PSQI). Retrieved from

<https://consultgeri.org/try-this/general-assessment/issue-6.1.pdf>

\*Permission to use tool

Hi again Melissa,

Thanks for your interest in the PSQI.

I am pleased to inform you that the English version can be sent to you upon completion of the attached “request translation form“ and send it back to me. Please make sure to put the country of interest together with the language needed.

Looking forward to hearing from you.

Kind regards,

Hoissila

**Hoissila Talhi**

**Project Coordinator**


[Hoissila.Talhi@mapi-trust.org](mailto:Hoissila.Talhi@mapi-trust.org)

[www.mapi-trust.org](http://www.mapi-trust.org), <https://eprovide.mapi-trust.org/>



### REQUEST FOR TRANSLATIONS

1. Date of Request:	03/13/2019
2. References:	MRT's reference: [182163] User's study reference/ protocol number (if any): [REF]

3. User:	<p><u>User Name</u> (hereinafter referred to as " User"): Melissa Blome</p> <p>Legal form : [individual or company's legal form]</p> <p>Address : [personal address or address of registered office]</p> <p>Melissa Blome, EdD-C, RN</p> <p>Assistant Professor</p> <p>Bryan College of Health Sciences</p> <p>1535 S. 52nd St.</p> <p>Lincoln, NE 68506-1398</p> <p>Work: ( 402)-481-8092</p> <p>Fax: ( 402)-481-842 1</p> <p><a href="mailto:melissa.blome@bryanhealthcollege.edu">melissa.blome@bryanhealthcollege.edu</a></p>  <p>Country : USA</p> <p>Name of the contact in charge of this request : Melissa Blome</p> <p>Telephone number: _____ Fax: _____</p> <p>Email address: _____</p> <p>Billing address: _____</p> <p>VAT number ( if applicable): _____</p> <p>Addressee: _____</p> <p>PO number or internal reference (if applicable): _____</p>
----------	--

4. Provider:	<p>Mapi Research Trust (hereinafter referred to as "MRT")</p> <p>PROVIDE</p> <p>27 rue de la Villette</p> <p>69003 Lyon</p> <p>France</p> <p>Telephone: +33 (0)4 72 13 65 75</p> <p>Fax : +33 (0)4 72 13 66 82</p>
5. Questionnaire needed:	Pittsburg Sleep Quality Index (PSQI) (hereinafter referred to as "the Questionnaire" or "the PSQI")
6. Bibliographic reference:	<p>Buyse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice research. <i>Psychiatry Res.</i> 1989 May;28(2):193-213</p>
7. Service:	Delivery of translations
8. Language version(s) needed:	<ul style="list-style-type: none"> <li>English</li> </ul> <p>Translations may not have undergone a full linguistic validation methodology. The level of translation for each scale should be verified.</p>
9. Copyright ownership and conditions of use of the Questionnaire:	<p>a. Copyright ownership and distribution of the translations:</p> <p>The copyright on the Questionnaire is owned by the University of Pittsburgh.</p> <p>The use of the Questionnaire <u>for commercial purposes or for commercially sponsored research</u> is licensed by the University of Pittsburgh. If you would like to use this instrument for commercial purposes or for commercially sponsored research, please contact the Office of Technology Management at the University of Pittsburgh at 412-648-2206 for licensing information.</p> <p>The Questionnaire can be used <u>for non-commercial research and educational purposes</u> without specific permission from the University of Pittsburgh.</p>

	<p>The University of Pittsburgh has granted to MRT the right to distribute the translations of the Questionnaire.</p> <p>User is not allowed to modify the translations provided by MRT.</p> <p>In case of publication, User shall acknowledge the source bibliographic reference and is not authorized to include a copy of the Questionnaire in the publication.</p> <p>b. Conditions of use:</p> <p>Upon reception by MRT of the fully executed license agreement between User and the University of Pittsburgh (if applicable) and upon receipt of the payment of MRT's access fees (if applicable), MRT will provide the needed translation(s) to User.</p> <p>User is not allowed to modify the translations provided by MRT.</p> <p>All publications, presentations, reports, or developments resulting from or relative to the use of the Questionnaire shall be referenced as follows:</p> <p>PSQI developed by Buysse,D.J., Reynolds,C.F., Monk,T.H., Berman,S.R., and Kupfer,D.J . of the University of Pittsburgh using National Institute of Mental Health Funding.</p> <p><i>Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ: <u>Psychiatry Research</u>, 28: 193-213, 1989.</i></p> <p>User is not authorized to include a copy of the Questionnaire in the publication</p>
10. Responsibilities:	<p>Mapi Research Trust may not be held liable for the consequences resulting from the use of the translations provided by Mapi Research Trust.</p>
11. MRT's Access fees:	<p>Distribution fees are administrative fees requested to cover the time spent by our team to provide the translations. These are not royalty or copyright fees.</p> <p>Please select appropriate category:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Commercial users (<i>Industry, CRO, any for-profit companies and academic research receiving funding from commercial companies</i>): 900 Euros excluding VAT per available translation</li> <li><input type="checkbox"/> Healthcare organizations (<i>healthcare system (including hospital), private research organization, sport &amp;</i></li> </ul>

	<p><i>rehabilitation center</i>):</p> <p>700 Euros excluding VAT per available translation</p> <p><input type="checkbox"/> <i>Funded Academic users (Projects receiving funding from non-commercial organizations, government, EU or registered charity):</i></p> <p>150 Euros excluding VAT per available translation</p> <p><input type="checkbox"/> <i>Academic Users (Projects not explicitly funded, but funding comes from overall departmental funds or from the University or individual funds): free</i></p> <p>Total amount: [total amount to be indicated] Euros</p>
12. Payment Schedule and Terms of Payment:	<p>The User may pay the price by bank transfer, cheque or bank card.</p> <p>The User undertakes to pay the amounts due within a period of thirty (30) days from the date of the invoice.</p>
13. Timeline:	<p>The translations will be provided upon receipt of the payment by MRT and the University of Pittsburgh license agreement (if applicable).</p>

**Agreed and accepted at the date of execution hereof by:**

User: Melissa Blome

Name:

Date: 03/13/2019

Signature: Melissa Blome 



## Appendix F

## Epworth Sleepiness Scale (ESS)\*

How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

**0** = would *never* doze

**1** = *slight* chance of dozing

**2** = *moderate* chance of dozing

**3** = *high* chance of dozing

SITUATION	CHANCE OF DOZING
Sitting and reading	
Watching television	
Sitting inactive in a public place ( <i>e.g. a theater or meeting</i> )	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after a lunch without alcohol	
In a car, while stopped for a few minutes in the traffic	
<b>TOTAL SCORE</b>	

## SCORE RESULTS:

**1-6**            Congratulations, you are getting enough sleep!

**7-8**            Your score is average

**9 and up**      Very sleepy and should seek medical advice

Johns, M. (2019, March 18). *The Epworth Sleepiness Scale*. Retrieved from

<https://epworthsleepinessscale.com/about-the-ess/>

\*Permission to use tool

Dear Melissa,

Thanks for your interest in the ESS. The English versions can be downloaded directly from the ESS's page on the ePROVIDE™ platform using our online distribution service, please select the needed language/country.

Here is a link to guide you for the online distribution:

[Instructions to download a questionnaire](#)

**This service is restricted to academic users:**

- Who do not receive specific funding for the study
- Who intend to use the questionnaire in individual clinical practice or research study

For any further help, please consult our [FAQ](#), or contact us at [eprovidetechnicalsupport@mapi-trust.org](mailto:eprovidetechnicalsupport@mapi-trust.org).

Best regards,

Hoissila

**Hoissila Talhi**

**Project Coordinator**

[Hoissila.Talhi@mapi-trust.org](mailto:Hoissila.Talhi@mapi-trust.org)

[www.mapi-trust.org](http://www.mapi-trust.org), <https://eprovide.mapi-trust.org/>

## Appendix G

## Sleep Hygiene Index (SHI)\*

Sleep Hygiene Index						
Please rate all of the following statements using the scale below.						
<b>5 Always</b> <b>4 Frequently</b> <b>3 Sometimes</b> <b>2 Rarely</b> <b>1 Never</b>						
					<b>1=Never</b>	
					<b>2=Rarely</b>	
					<b>3=Sometimes</b>	
					<b>4=Frequently</b>	
					<b>5=Always</b>	
<b>Sleep Hygiene Index</b>						
Please circle the letters or blacken the box by using the scale above.						
1.	I take daytime naps lasting two or more hours.	5	4	3	2	1
2.	I go to bed at different times from day to day.	5	4	3	2	1
3.	I get out of bed at different times from day to day.	5	4	3	2	1
4.	I exercise to the point of sweating within one hour of going to bed.	5	4	3	2	1
5.	I stay in bed longer than I should two or three times a week.	5	4	3	2	1
6.	I use alcohol, tobacco, or caffeine within four hours of going to bed or after going to bed.	5	4	3	2	1

7.	I do something that may wake me up before bedtime (for example: play video games, use the internet, or clean).	5	4	3	2	1
8.	I go to bed feeling stressed, angry, upset, or nervous.	5	4	3	2	1
9.	I use my bed for things other than sleeping or sex (for example: watch television, read, eat, or study).	5	4	3	2	1
10.	I sleep on an uncomfortable bed (for example: poor mattress or pillow, too much or not enough blankets).	5	4	3	2	1
11.	I sleep in an uncomfortable bedroom (for example: too bright, too stuffy, too hot, too cold, or too noisy).	5	4	3	2	1
12.	I do important work before bedtime (for example: pay bills, schedule, or study).	5	4	3	2	1
13.	I think, plan, or worry when I am in bed.	5	4	3	2	1

Mastin, D. F., Bryson, J. & Corwyn, R. (2006). Assessment of sleep hygiene using the Sleep Hygiene Index. *Journal of Behavioral Medicine*, 29(3). doi: 10.1007/s10865-006-9047-6

\*Permission to use tool

Dr. Mastin,

I am a doctoral student from Bryan College of Health Sciences in Lincoln, Nebraska working on my dissertation research. I am interested in the relationship between year of study, sleep quality, and daytime sleepiness in undergraduate nursing students enrolled in four-year baccalaureate nursing programs.

I have researched the tool Sleep Hygiene Index and I am writing to seek permission to use the tool for my dissertation research. I think that the data collected from using the Sleep Hygiene Index will assist me with better understanding the factors that impact sleep quality and daytime

sleepiness in undergraduate nursing students. All proper citations will be referenced when using the Sleep Hygiene Index.

Thank you for your consideration. I look forward to learning of your decision.

Regards,

Melissa Blome, EdD-C, RN

Response from Dr. Mastin:

Dear Melissa,

Yes you may use the Sleep Hygiene index in your research.

No special permissions are required other than a reference to the original publication (Journal of Behavioral Medicine).

Please let me know if I can help.

Please see attached.

Dr. David

## Appendix H

**Certificate of Completion**

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Michelle Johnson** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 12/27/2017.  
Certification Number: 2584743.

**Certificate of Completion**

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Melissa Blome** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 05/23/2017.

Certification Number: 2401241.