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The Effects of Sleep Deprivation on College Students

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Abstract

The body requires adequate sleep in order to maintain proper physiological health, psychological health, and cognitive function. In the healthcare field, sufficient sleep is imperative to ensure optimal patient care. Sleep deprivation can result in greater procedural errors, which places the clients at risk. Insufficient sleep negatively affects the nervous system, resulting in poor brain function. Because of the cognitive decline that is associated with sleep deprivation, academic performance is often decreased. In order to combat the phenomenon of sleep deprivation, positive lifestyle behaviors and sleep hygiene should be maintained. For students, academic and financial demands can contribute to physiological stress, which may cause impaired sleep quality. In particular, poor sleep quality, insomnia, and daytime sleepiness are reportedly prevalent in college students. Therefore, it is crucial that the effects of sleep deprivation in university students be further studied and interventions to alleviate the problem be explored.

Through a thorough review of the research literature and a proposal for further research, this thesis investigates the questions:

- How will sleep deprivation affect college students, specifically their physiological health, psychological health, and cognitive function?
- How will ongoing sleep deprivation impact students' academic performance through their four years at university?

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Introduction

In order for human beings to function properly, sufficient sleep each night is vital. Adults need on average eight hours of sleep (Okano et al., 2019). Sleep deprivation occurs when an adequate amount of sleep is not being maintained. Focusing on the college student population, sleep deprivation is extremely prevalent. As nursing students, countless sleepless nights have been experienced due to work schedules, required coursework, and clinical rotations. It has been found that "up to 60% of all college students suffer from a poor sleep quality" (Schlarb et al., 2017, p. 1). Overtime, a lack of sleep can negatively affect a person's physiological health, psychological health, and cognitive function. Therefore, it is important to investigate how sleep impacts the human body and look into ways to combat the issue of sleep deprivation.

Problem Statement

Pertaining to the physiological effects of sleep deprivation on the body, the autonomic response and parasympathetic nervous system become altered when experiencing exceedingly high levels of distress and not acquiring sufficient hours of sleep. The sympathetic nerves overly activate while the parasympathetic nervous system becomes inhibited (Hasegawa et al., 2015). Stress is an influential factor that contributes to the activation of the autonomic nervous activity (Hasegawa et al., 2015). Hence, insufficient sleep and stress affect both psychological and physical functioning.

College students have a particularly high risk for impaired sleep quality. Academic demands contribute to stressors that impact the body and may play a role in sleep deprivation. Focusing on nursing students, exams, coursework, projects, and clinical rotations place tremendous stress on the body. As the individual progresses through their program, students are faced with additional

stressors (Hasegawa et al., 2015). These stressors may result in the college student experiencing an altered circadian rhythm (an individual's internal sleep-wake cycle), which can lead to inconsistent sleep schedules. Consistent sleep is important because "specific synaptic connections that were active during awake-periods are strengthened during sleep" (Okano et al., 2019, p. 1). These synaptic connections play a significant role in academic performance, specifically with regards to cognition, memory, and attention span. For an individual who has been awake for 17 hours, their cognitive function is equally comparable to someone who has a blood alcohol content of 0.05% (Okano et al., 2019). Furthermore, sleeping eight hours a night is necessary for a college student to have full cognitive function in order to adequately perform in their academic studies.

Research Questions

How will sleep deprivation affect college students, specifically their physiological health, psychological health, and cognitive function? How will ongoing sleep deprivation impact their academic performance throughout their four years at university?

Literature Review

Sleep deprivation commonly occurs amongst college students. Lack of sleep can impact one's overall health and performance both in the classroom and the workplace (post-graduation). If sleep is not properly maintained, it can have negative effects on the body physiologically, psychologically, and cognitively. Concerning the identified problem of sleep deprivation, it is important to understand why adequate sleep is required.

Through the Dominican University of California Library, the following articles for the research literature were acquired from PubMed, Iceberg, and UpToDate. Regarding the effects of

sleep deprivation, twelve articles were compiled from these databases. Keywords such as "sleep deprivation," "college students," "nursing," and "physiological, psychological, and cognitive" were input into the databases to identify articles that correlated to our specific topic.

This literature review will be divided into three categories related to sleep deprivation: 1) physiological health; 2) psychological health and sleep hygiene; and 3) cognitive health and academic performance. Three articles will focus on the topic of physiological health, three articles on psychological health and sleep hygiene, and six articles on cognitive health relating to academic performance.

Sleep Deprivation and Physiological Health

Articles in this category are based on sleep and how it affects physiological health. Autonomic nervous system function, sleep deprivation, napping in college students, and psychomotor performance amongst night-shift nurses were assessed. Within these three articles, they were all quantitatively designed with the addition of a quasi-experimental and non-experimental study. These quantitative studies assessed how sleep deprivation affected both university students and registered, night-shift nurses. Furthermore, the articles in this section are relevant because they take into account multiple aspects of sleep, as sleep deprivation can negatively affect one's health and performance.

In the "*Assessment of Autonomic Nervous System Function in Nursing Students Using an Autonomic Reflex Orthostatic Test by Heart Rate Spectral Analysis,"* Hasegawa et al. (2015) focused on the function of the autonomic nervous system in 121 nursing students at the Kyoto Prefectural University of Medicine. Participants standing load were assessed and evaluated using an autonomic reflex orthostatic tolerance test in which their heart rate variability was analyzed.

An electrocardiogram was administered to measure their autonomic reflex over the span of approximately five minutes. These measurements were obtained while the participant remained sitting for two minutes, standing for two minutes, and in a resting position for one minute. It was hypothesized that fourth-year students experience higher levels of demand in regard to academics (Hasegawa et al., 2015). Therefore, these participants would have an abnormal autonomic nervous system functioning.

Regarding fourth-year students, it was found that their resting state was low while their parasympathetic nervous system resulted in hypotension (Hasegawa et al., 2015). In comparison to first-year students, the fourth-year students presented with a high sympathetic nervous system function and a high standing state concerning autonomic nervous system function. Activation of the sympathetic nerves was induced from stress while it inhibited the parasympathetic nervous system. Meanwhile, the standing position resulted in a high autonomic nervous system response in regard to fatigue. Furthermore, stress is an influential factor on the autonomic nervous system, especially in fourth-year students. Additionally, it has been found that sympathetic nerve activity is decreased by sleep (Hasegawa et al., 2015). With this study, there were two limitations. One limitation was the small population, and another limitation was the isolated geographic location.

Focusing on college students, Schlarb et al. (2017), in "*Sleep Problems in University Students - an intervention,"* utilized a multicomponent sleep strategy to improve sleep amongst the 27 student participants. The combination of Cognitive Behavioral Therapy for insomnia and Hypnotherapy for insomnia were implemented for the refinement of insomnia symptoms and nightmares. In addition, Studieren wie im Schlaf (SWIS) was utilized as a sleep training tool for university students who suffered from irregular sleep-wake cycles. Students participated in the

study in which questionnaires were administered to measure the pre and post design of the study. Other measurement tools include the Pittsburgh Sleep Quality Index (PSQI), sleep logs, and actigraphy. Daytime sleepiness, sleep-related personality traits, and sleep cognition were assessed as well (Schlarb et al. (2017).

It was found that insomnia and insomnia related disorders were present in 27% of participants. According to the fifth edition of Diagnostic and Statistical Manual of Mental Disorders, it revealed that 51.9% of participants met the criteria for insomnia (Schlarb et al., 2017). Although students suffered from sleep problems, there were improvements in subjective sleep quality, sleep-related personality traits, and objective sleep measurements. There were several limitations within this study. One limitation was the small sample size, and another limitation was due to the missing control group. The positive effects that were obtained could potentially be the result of other factors and not attributable from SWIS. In addition, the absence of a follow-up measurement hindered the long-term effects of the investigation.

In *"Sleep Deprivation and Psychomotor Performance Among Night-Shift Nurses,"* Johnson et al. (2010) studied night-shift nurses and their sleeping habits. In order to better understand how sleep impacts psychomotor performance, the nurses were examined under normal work conditions. It is hypothesized that sleep deprived health care providers are at higher risk for making errors while at work.

This study used a non-experimental design. Pertaining to the participants, 289 people were recruited through flyers, announcements, and posters. Eligibility requirements for participants included being a full-time employee, having at least one year of experience in the hospital setting, and not having an existing sleep disorder diagnosis. Between midnight and four in the

morning, participants were given a packet of information. The packet contained a demographic data sheet and a d2 Test of attention (Johnson et al., 2010). The demographic data questions focused on the nurses' current shift, past years working as a nurse, and their experience with working the night-shift. Using a 48-hour sleep recall diary, participants wrote down how many hours of sleep they felt they needed, as well as how much sleep they actually got. The d2 Test of Attention, which measured psychomotor performance, was a timed test. This test was administered after a nurse had been on the floor for about five to nine hours, and it was proctored by an investigator. This test is one page long and lasted about eight minutes. In order to calculate the overall score and to determine the total number of errors, errors of commission and errors of omission were added together (Johnson et al., 2010). A high number of errors indicated poor performance. When the entire packet of information was completed, it was sealed into an envelope and secured in a locked file. To compare sleep deprivation and psychomotor performance, a general linear model was used.

A major finding of this study was that 56% of the nurses were sleep deprived, and they only received an average of 3.9 hours of sleep. In contrast, 43% of the nurses in the study received an adequate amount of sleep, as they slept on average 6.78 hours (Johnson et al., 2010). A higher performance score indicated inadequate psychomotor performance and was found to be associated with nurses who slept an insufficient number of hours. For both sleep deprived and non-sleep deprived participants, poor psychomotor performance scores were found. Physiological changes occurred amongst nurses working 24-hour shifts, and it resulted in their psychomotor performance being diminished. Sleep deprivation influences physiological changes, as a lack of sleep inhibits neuronal transfer of chemicals and impairs psychomotor performance.

This resulted in the poor d2 Test of Attention outcomes (Johnson et al., 2010). Psychomotor performance, in night-shift nurses, can be improved by implementing naps. Napping could enhance patient safety because it helps to maintain optimal psychomotor performance and brain function.

Limitations of this study include collecting data only one time and not over a period of time, as well as not taking into account other social factors that could impact sleep. In addition, when gathering information on sleep deprivation, a self-report was used. A physiologic measure would have been more accurate and provided more reliable information (Johnson et al., 2010). Furthermore, chronic sleep deprivation may have led to the underestimation of how much sleep is needed to be fully rested.

Sleep Deprivation, Psychological Health, and Sleep Hygiene

Articles in this category are based on sleep and how it affects psychological health and sleep hygiene (referring to creating an environment conducive to sleep). Quality of sleep, lifestyle behaviors, and sleep hygiene are further assessed in the following studies. A cross-sectional, quantitative, and experimental study were conducted among the three articles. All of these articles are relevant to our research question because they examine how sleep impacts overall health.

In *"Quality of Sleep and Anxiety are related to Circadian Preference in University Students,"* Silva et al (2020) studied university students to identify anxiety levels, quality of sleep, and different chronotypes. The relationship between these characteristics were assessed in 103 undergraduate student participants. This study was conducted in the city of Santo Antonio de Jesus, Bahia, Brazil. Although there were 103 volunteers, only 96 students participated in the

activities from seven in the morning to six in the evening. These participants are students, ranging from 18 to 25 years of age, enrolled in the courses of the Centro de Ciências da Sau´de (Silva et al., 2020). Additional criteria included having no prior history or diagnosis of a psychiatric disease and not taking controlled medications. Three questionnaires were completed by the participants to assess their preferred time to complete the activities, anxiety levels, and quality of sleep. These tools included the Morningness-Eveningness Questionnaire (MEQ), State-Trait Anxiety Inventory (STAI), and the Pittsburgh Sleep Quality Index (PSQI).

There were several findings in this study. Anxiety and sleep quality appeared to be worse in those with an evening chronotype. Alert levels were increased in evening students with a peak at ten hours rather than at seven hours. Approximately 90% of students reported partial sleep deprivation on workdays with daytime sleepiness occurring during the week. Because of this, the students later compensated for the lack of sleep over the weekend, which is also known as social jet lag (Silva et al., 2020). Compensation for sleep deprivation during the week was found to occur amongst those with an early work schedule. It was found that morning students had a lowered anxiety level and a better quality of sleep in comparison to the evening participants. Meanwhile, evening students had a more irregular sleep-wake cycle and anxious personality trait (Silva et al., 2020). A limitation within the study includes the small sample size that may limit the conclusion of this research. Additional factors needed to be controlled in regard to anxiety, such as anxiety the participant is encountering, academic stressors, social limitations, potential substance use, changes in living environment, and financial conditions.

In the article, *"Associations Between Sleep and Lifestyle Behaviours Among Australian Nursing Students: A Cross-Sectional Study,"* Binks et al. (2020) studied the association of

negative lifestyle behaviors and sleep. The examined lifestyle behaviors include poor diet, physical inactivity, and alcohol consumption. Focusing on Bachelor of Nursing students in Australia, it is believed that poor lifestyle behaviors are connected with poor sleep quality.

While 500 participants were recruited through the use of convenience and snowballing methods, only data from 470 students was analyzed (Binks et al., 2020). Various methods, such as email, flyers, university online learning platforms, and classroom presentations, were utilized. Eligibility requirements for participants include being at least eighteen years of age, enrolled at a Bachelor of Nursing program, and not pregnant or breastfeeding. This study collected data by sending out an online questionnaire via SurveyMonkey to the participants. In a total of 165 questions, participants were asked about socio-demographics, medical history, food and dietary habits, physical activity, alcohol consumption, cigarette smoking, and sleep.

It was found that approximately 77.8% of nursing students sleep poorly (Binks et al., 2020). Overall, students who frequently skipped meals, consumed non-nutrient foods, drank alcohol, and smoked experienced inadequate sleep quality. A significant relationship between physical activity and sleep was not found in this study. Based on the results of this study, preexisting health conditions and poor lifestyle behaviors negatively impacted sleep, which ultimately led to reduced academic and clinical performance (Binks et al., 2020). This is because sleep deprivation is known to reduce cognitive performance, daytime functioning, work productivity, and attention. Because data was collected via a survey and used self-reported measures, there is a chance of potential bias, specifically in recall and reporting. This is a limitation because bias can lead to distorted reports and wrong conclusions. Another limitation would be that this study did not study how stress impacts sleep quality. Moreover, the study did

not examine cause and effect. A longitudinal study would have also been beneficial to better understand how lifestyle behaviors and sleep are related overtime.

In the *"Effects of a Sleep Hygiene Text Message Intervention on Sleep in College Students,"* Gipson et al (2019) assessed sleep hygiene and sleep improvement in college students between the ages of 18 to 26 years old. It was hypothesized that the college students from a Southwestern University would report improved sleep knowledge, sleep hygiene, self-efficacy for sleep hygiene, and sleep quality following a text-message intervention.

The 96 participants were divided into two groups (pretest and posttest). Over the course of six weeks, students were assigned to receive text messages twice a week about sleep hygiene or healthy behaviors. Participants who received text messages about sleep hygiene were the intervention group while those who received text messages about healthy habits in general were a part of the control group. Survey questions were utilized to assess the baseline for the posttest results in regard to sleep knowledge, sleep hygiene, self-efficacy for sleep hygiene, and sleep quality (Gipson et al., 2019).

There was no significant improvement in scores for sleep knowledge, sleep hygiene, self-efficacy for sleep hygiene, and sleep quality in the experimental group. Therefore, the hypothesis was not supported. It was found that time management improved in those in the sleep intervention group and not in the attention control group (Gipson et al., 2019). However, the sleep intervention group showed an improvement in the disruptive subscale score while it remained the same for the attention control group. Although the experimental group received text messages related specifically to sleep, their sleep scores did not significantly improve. In regard to sleep hygiene, it was reportedly improved in those in the control group in comparison to the

intervention group. In contrast, there was no significant difference in improvement for the experimental group despite sleep quality improvement in both groups. There was no significant improvement in score for either group in regard to self-efficacy for sleep hygiene. Furthermore, time management was most related to sleep quality and significantly related to both sleep hygiene and knowledge. In this study, stress was found to impact quality of sleep, sleep hygiene, and time management (Gipson et al., 2019). Overall, sleep quality improved for both the control group and intervention group while the hours of sleep decreased from the baseline posttest.

Limitations of the study were the use of unreliable tools to assess the reliability of results amongst the target population. Potential controlling factors were not measured in the research that could have played a role in the effects of sleep quality, including extraneous activities and stressful coursework. Participants were enrolled in additional courses that could have predisposed them to information that influenced their sleep behaviors. Although the participants were divided into two separate groups, they could have discussed interventions with one another, altering the results (Gipson et al., 2019). Furthermore, the data from the posttest of participants who dropped out of the study were still included in the analysis, which could have provided a false high result. Students were not equally represented in regard to gender across university demographics. Regarding improved sleep scores rather than just the text message intervention, preexisting knowledge about sleep hygiene may have influenced scores over time (Gipson et al., 2019). Overall, the results are not applicable to the greater population of young adults because the study focused on students from one Southwestern University.

Sleep Deprivation, Cognitive Health, and Academic Performance

Articles in this category are based on sleep and how it affects cognitive function and academic performance. Sleep quality, sleep disruption, gender differences, and sleep deprivation are further assessed regarding how it affects academic performance. Amongst these articles, a systematic review and meta-analysis, a cross sectional, cohort, or case-control study, and cross-sectional study were conducted, respectively. These studies assessed how sleep deprivation affects academic performance in both college and medicine students along with nurses working shifts. In addition, gender is evaluated in its relationship between sleep disturbance and academic performance along with procedural errors as a result of sleep deprivation.

In the article, *"Sleep Quality, Duration, and Consistency are Associated with Better Academic Performance in College Students,"* Okano et al. (2019) performed a research study that focused on the effect sleep has on academic performance by tracking the sleep of 88 participants via a Fitbit. The Fitbit device is an accessory that can be utilized to trace activity such as steps, heart rate, and sleep duration. A second aim was focused on the difference between gender and its role in sleep and academic performance. The researchers hypothesized females showing an advantage in grades, which contributed to gender differences (Okano et al., 2019).

Participants were students from MIT who were enrolled in The Solid State Chemistry class during the fall semester. The 88 participants were provided with a Fitbit and were assigned to a specific section that fit their schedule. The participants were not allowed to participate in other sections. Participants were tested on content covered in the course by completing quizzes, midterms, and a final exam. Leading up to the quiz date, weekly quizzes were conducted to test the knowledge of the participants. Students were required to complete three midterms covering three to four weeks of content leading up to the exam date. A cumulative final exam was

administered that tested the content that was covered throughout the semester (Okano et al., 2019).

The study had several findings. Better performance and grades were correlated with improved quality of sleep that was longer in duration. Although better sleep consistency resulted in better grades, there was no relationship between sleep quality the night before an exam and test performance. However, sleep duration correlated with better grades when sleep quality was improved for the month and week before a test (Okano et al., 2019). Limitations involve the wearable activity device. A Fitbit device can estimate sleep stages, but there is no published evidence that the activity tracker can accurately predict sleep quality. The relationship between sleep and academic performance can also be limited by factors not taken into account, such as stress, anxiety, motivation, personality traits, and gender roles that can affect sleep.

In "*Napping in College Students and Its Relationship with Nighttime Sleep,*" Ye et al. (2017) examined how napping impacts one's sleep at night. When investigating the relationship between naps and nighttime sleep, it is important to know how frequently naps are taken, how long one naps, and when a nap usually takes place during the day. An understanding of these factors will help researchers to better determine the benefits and consequences that result from napping, specifically how napping affects overall health and academic performance. A known benefit is that short naps can improve alertness, as well as neurobehavioral performance. Moreover, longer naps are thought to promote grogginess and confusion, which in turn may lead to poor cognitive or academic performance (Ye et al., 2017) .

The study was conducted with 440 random, undergraduate college students in order to examine the relationship between napping and sleep quality. Participants were recruited using

email, and an anonymous survey was sent to the undergraduate students. The survey utilized both multiple choice and open-ended questions. Using a self-rating questionnaire called the Pittsburgh Sleep Quality Index (PSQI), sleep quality and disturbances were assessed in students over a period of one month. Questions that were asked focused on napping frequency, length, and timing. Other question topics include demographics, general health, sleep satisfaction, academic performance, weekday and weekend sleep schedules, and sleep routines.

Based on the Pittsburgh Sleep Quality Index, this study found that 59.7% of students in the sample suffered from poor sleep quality (Ye et al., 2017). The results of the study indicate that evening and long naps are actually harmful, as they can reduce cognitive performance and subjective alertness. Individuals who napped more than three times per week and for longer than two hours were reported to have the worst sleep quality. In addition, students slept for shorter periods of time at night when they took a nap between the hours of six to nine o'clock at night. Overall, participants who consistently napped for extended periods of time late in the day reported poor sleep quality at night, as well as symptoms of sleep deprivation. As a result, these participants demonstrated reduced daily function and cognitive performance, which in turn negatively impacted their academic performance (Ye et al., 2017). Some limitations of this study include the self-reports of napping and sleep patterns, omission of number of naps per day or description of the napping experience, and the utilization of unreliable and invalidated survey questions. Furthermore, as a result of the data collected from the cross-sectional survey, a causal relationship cannot be found between napping and nighttime sleep quality.

In the article, *"Sleep Disruption in Medicine Students and its Relationship with Impaired Academic Performance: A Systematic Review and Meta-Analysis,"* Seoane et al. (2020) focused

on the relationship between sleep deprivation and its association with academic performance. Twenty-nine studies were assessed in which 5,646 out of 14,170 students reported poor sleep quality. It was hypothesized that rapid-eye movement (REM) sleep would enhance long-term memory performance. Meanwhile, declarative memory such as recall of events and facts would be linked to non-REM sleep (Seoane et al., 2020).

The participants were a mixed sample of health-related careers such as medical, nursing, and kinesiology students. Students' sleep quality, sleep duration, or diurnal sleepiness were covered over the span of more than a single night. Participants' quality of sleep were assessed during the normal school time frame. Academic performance was measured through the use of questionnaires, standardized tests, and grade point average (Seoane et al., 2020).

The article compiled the results from several studies. In some studies, it was found that shorter sleep was associated with medical students performing better. Sleep-deprived participants could benefit from a periodic sleep assessment along with a psychiatric evaluation. As a result, quality of life and academic performance might be improved. Although poor sleep quality and excessive daytime sleepiness were mild, it was highly associated with impaired academic performance (Seoane et al., 2020).

Limitations of the study include an overrepresentation of female medical students. Sleep characteristics of objective measures were not included within any of the studies in this research. However, there is a correlation between sleep quality and academic performance. This correlation was found to be significantly higher in the Middle east and Asia/Oceania regions, in studies conducted in 2012 or after, and in those in which women comprised more than 50% of the sample (Seoane et al., 2020). Since insufficient data was extracted from demographics and

comorbidities, it cannot be concluded whether there is a relationship. In other words, there is no sufficient data to allow for moderator analyses.

Marta et al. (2020), in the article titled *"Gender Differences in the Relationship Between Sleep Disturbances and Academic Performance Among Nursing Students,"* studied how gender plays a role in sleep disturbances and academic performance. In nursing students, it is hypothesized that gender can affect both sleep and academic performance. Additionally, based on past studies, it has been found that females experience worse sleep quality than males (Marta et al., 2020).

Four hundred ninety-two students participated in this study that ran from July 1, 2018 to September 30, 2018. All of the participants were enrolled in an undergraduate program in Indonesia during the 2017 to 2018 academic school year, and they ranged from first-year to fourth-year students. Data on sleep was collected using bio demographic characteristics, the Pittsburgh Sleep Quality Index, the Insomnia Severity Index, the Epworth Sleepiness Scale, the Morningness-Eveningness Questionnaire, and the Beck's Depression Inventory (Marta et al., 2020). The instruments used to collect information on sleep consisted of questions that focused on factors that have been known to affect sleep, sleep quality and disturbances, insomnia in males and females, daytime sleepiness, circadian rhythm preferences, and severity of depression symptoms. Once the sleep surveys were completed, grade point averages during the 2017 to 2018 academic school year were used to gather data on academic performance. Data analyses were conducted using SPSS Version 23.0, independent T-Tests, chi-square tests, and the odds ratio. A logistic regression model and multivariate logistic regression model were utilized in

order to determine the relationship between a certain event, such as poor or good academic performance, and two different groups (Marta et al., 2020).

The study found that poor sleep quality, insomnia, and daytime sleepiness were prevalent among both male and female nursing students. Approximately a quarter of the participants reported experiencing daytime sleepiness (Marta et al., 2020). This finding was commonly observed in students who suffered from insomnia and poor sleep quality. Moreover, the results of the study indicate that nursing students in general often suffer from poor sleep quality and insomnia. Additionally, female nursing students, who had insomnia, were more likely to perform poorly in academics. However, no correlation between insomnia and academic performance was found in male nursing students (Marta et al., 2020). Three limitations of this study include the subjective self-administered questionnaires, the sample population being from a single nursing school, and the cross-sectional design. Another longitudinal, prospective study needs to be conducted in order to further validate the results.

It is believed that sleep deprivation is a major cause of errors, especially in healthcare. In *"Effects of Sleep Deprivation on the Cognitive Performance of Nursing Working in Shift,"* Kaliyaperumal et al. (2017) studied how sleep deprivation impacts cognition in night-shift nurses. This study took place between August 2016 and September 2016. The participants, ranging from 20 years old to 50 years old, were staff nurses who had been on a rotating schedule for at least one year. They would work the day shift for one month and then night-shift for the next one. These nurses worked at Peelamedu Samanaidu Govindasamy Hospitals, Tamil, Nadu, India (Kaliyaperumal et al., 2017). In order to participate in this study, the nurses had to work six days a week and do eight-hour shifts. In addition, all of the nurses in the study did not have any

existing medical or mental illnesses, did not work overtime, and did not work another job. After

weaning out the participants who did not meet the eligibility requirements, there were 97 female

and 3 male participants. Cognition and executive function were measured using the Montreal

Cognitive Assessment (MoCA) Version 7.3, the Stroop test, and Memoryze. Mobile applications,

such as the Vigilance Test, simple reaction time test, and a timed math test, were used to measure

attention, reaction time, photographic memory, and numerical cognition or mental speed. SPSS

Version 19.0 was used to analyze data, and non-parametrical values were compared using the

Wilcox Signed Ranktest (Kaliyaperumal et al., 2017). Throughout the study, sleep deprivation

prevalence is indicated by percentage values, and it was assessed by the Epworth Sleepiness

Scale (ESS).

Using the Epworth Sleepiness Scale, Kaliyaperumal et al. (2017) found that 69% of the

nurses in this study were experiencing sleep deprivation. General intellect and attention were

found to be worse at night than during the day. In contrast, mental speed and reaction time were

found to be better at night. Based on the Montreal Cognitive Assessment (MoCA) Version 7.3,

cognition was better in nurses who worked the day shift. Moreover, as a result of sleep

deprivation, this study found that execution, memory, response time, and mental speed relating to

numerical cognition were also increased during the day shift and decreased during the night-shift

(Kaliyaperumal et al., 2017). Therefore, sleep deprivation does impair cognitive performance.

One limitation is the small sample population, which may increase the margin of error

and affect the reliability and variability of this study. In addition, this study did not explore all of

the domains of cognition. Regarding limitations with the data measurements, the Epworth

Sleepiness Scale was used to measure sleep quality and sleep deprivation. An actigraph or

actimetry sensor would have provided more accurate measurement and detection (Kaliyaperumal et al., 2017). Furthermore, the mobile application software was unable to measure its claim due to resource restraints.

Concentrating on the role of memory maintenance, in the article, *"Effects of Sleep Deprivation on Procedural Errors. Journal of Experimental Psychology: General,"* Stepan et al. (2019) studied how sleep deprivation affects error rates in procedural tasks. This study examined sleep deprivation and procedural errors in 234 Michigan State University students, ranging from 18 to 25 years of age. These students were undergraduates and native English speakers. Additionally, all of the participants did not have any existing memory or sleep disorders, were not color blind, did not have any major sleep disturbances, and did not have a strong preference for either the morning or the evening. As compensation, the participants received course credit (Stepan et al., 2019).

Stepan et al. (2019) conducted the study in groups of up to eleven people and in two testing rooms. The night before the study the participants were told to get at least six hours of sleep and to wake up at nine o'clock in the morning. Before coming to the laboratory and during the 24 hours before the study, these students were not allowed to nap or consume caffeine, alcohol, or drugs. The study commenced at ten o'clock at night. Everyone completed sleepiness and mood assessments, the UNRAVEL task (performance of a series of tasks in a looped, specific order in response to a stimulus), and various cognitive and personality measures when they arrived (Stepan et al., 2019). After these tasks were completed, the group was randomly divided under double blind conditions into two groups (a sleep and sleep deprivation group). One group was given a Fitbit to monitor sleep activity and told to go home and sleep, and the other

group was required to stay awake overnight in the laboratory. Every two hours, the sleep deprived participants were asked to complete sleepiness and mood assessments. The students who slept at home arrived at the laboratory the next day at eight-forty-five o'clock in the morning. Both groups then completed sleepiness and mood assessments, the UNRAVEL test, and cognitive tasks. Relating to the UNRAVEL test, results of the experiment were measured by looking at sequence errors and non-sequence errors (Stepan et al., 2019).

This study found that individuals who are sleep deprived should not perform procedural tasks, especially when associated with interruptions and costly errors. Sleep deprived participants were less willing or unable to perform the same tasks that they completed the night before. With the sleep deprived individuals who were able to complete the tasks, higher rates of error were observed. The errors were mainly due to memory failures, especially when tasks were timed (Stepan et al., 2019). This study had one limitation, as it did not explore the need for accommodations among the sleep-deprived individuals as they performed procedural tasks.

Overall Discussion of Literature Review

The evidence from twelve different research articles reveals that sleep deprivation can negatively impact multiple health domains. Pertaining to physiological health, stress affects the autonomic nervous system, the sympathetic nervous system, and the parasympathetic nervous system. Lack of sleep resulted in inadequate psychomotor performance and poor brain function. In order to combat the effects of sleep deprivation on one's physiological health, napping for a short period of time and early in the day can be used to maintain optimal brain function. In regard to psychological health, individuals who experience daytime sleepiness tend to compensate by excessively sleeping on the weekends. Management of sleep is important, as it

improves sleep quality. Therefore, poor lifestyle behaviors can influence sleep quality and ultimately reduce academic performance. Concerning cognitive function, a lack of sleep is known to reduce academic performance and contribute to more procedural errors. It is more important to maintain a consistent and adequate sleeping schedule than to receive sufficient sleep solely on the day before an exam. Furthermore, because cognition was found to be reduced at night in sleep deprived individuals, lack of sleep leads to more procedural errors. Overall, quality of life and academic performance can be improved with adequate sleep.

In general, limitations found amongst the articles were the small sample size, bias when conducting self-administered surveys, and not taking into account controlling factors that may affect sleep. Common themes found for strengths were a large sample size, randomization of participants, and the research being the first to study a topic or intervention.

Several tools and materials were utilized within the study to assess and measure results. Reliable instruments, such as the Cognitive Behavior Therapy, were used to assess for insomnia. Studieren wie im Schlaf (SWIS) was used as a sleep training tool to assess irregular sleep patterns. Other measurement tools include the Pittsburgh Sleep Quality Index (PSQI), the Diagnostic and Statistical Manual of Mental Disorders, and a d2 Test of Attention for psychomotor performance. Additional tools include the Morningness-Eveningness Questionnaire (MEQ), the State-Trait Anxiety Inventory (STAI), Epworth Sleepiness Scale and the Beck's Depression Inventory, Montreal Cognitive Assessment (MoCA) Version 7.3, and the Stroop test.

Studies utilized within the research provided evidence on the importance of sleep; however, there are additional topics that can be further explored. For example, how does sleep affect the body over a span of several years rather than just a semester or the length of a short experiment?

A longitudinal study could be conducted to assess how sleep deprivation during young adulthood affects performance later in life. In addition, factors contributing to poor sleep quality need to be further investigated and included within the research.

Research Proposal

Patient safety is critical for healthcare providers to maintain. The literature review examined the effects of sleep deprivation on the body in the clinical and academic setting. In the clinical setting, insufficient sleep contributes to medical errors and reduces brain function. Most of the studies in the literature review resulted in a similar outcome: adequate sleep is necessary in order to provide optimal care for patients. Sleep was found to affect performance among undergraduate university students and professional medical workers. Therefore, the primary aim of the study is to determine how sleep deprivation will impact university students, specifically their physiological, psychological, and cognitive health, over the course of four years during their undergraduate studies. A second aim is to study the effect of continuous sleep deprivation on specifically academic and clinical performance. The third aim will be to compare the sleep quality and performance of nursing students with students who are studying other disciplines.

Theoretical Framework

Sister Callista Roy created a model known as Roy's Adaptation Model (RAM). She theorized that all individuals are biopsychosocial beings who constantly adapt to various stimuli (Akinsanya, 1994). These three stimuli include focal, contextual, and residual stimuli. In order to cope with a changing environment, this theory utilizes a problem-solving approach. The goal is for the individual to adaptively respond to environmental changes. Adaptive responses and level of stimuli both influence one another.

Pertaining to the three categories of stimuli, this theory describes the manner in which an individual responds to changes in their environment. Focal stimuli occur rapidly and require the individual to respond immediately. Contextual stimuli and focal stimuli work together, and they influence the overall response of the individual. Residual stimuli refer to past experiences, beliefs, or attitudes rather than immediate ones. Together these types of stimuli allow the individual to create the skills and reflexes needed to adapt to their environment (Akinsanya, 1994).

Concerning sleep deprivation and environmental examples of stimuli, sleep deprivation would be considered a focal stimulus. Sleep deprivation can immediately impact responses to an individual's environment, as it can affect quality of life and overall health. Contextual stimuli would contribute to lack of sleep. Examples of this type of stimuli are related to sleep hygiene, such as loud noises, bright rooms, consumption of caffeine, and use of electronic devices. Residual stimuli are additional stressors that result from personal conditions or events. With an understanding of Roy's Adaptation Model (RAM), researchers can focus on how to combat sleep deprivation by targeting the three types of environmental stimuli that impact sleep.

Research Design

The design of this study will be mixed methods, using both quantitative and qualitative questions in an online survey. First demographic information will be obtained. Questions will include age, gender, grade level (Freshman, Sophomore, Junior, or Senior), and major area of study. Additionally, participants will be asked to provide their most up to date grade point average (GPA).

A Likert Scale and the Pittsburgh Quality Sleep Index (PQSI) will be utilized, and an online survey with approximately ten questions will be asked (Buysse et al., 1989). Questions such as "Do you feel like you perform better after eight hours of sleep?" will be answered with a five point scale. The scale includes the following options: strongly disagree, disagree, neutral, agree, and strongly agree. Regarding academic performance, an open-ended questionnaire will be conducted via the same online platform. For example, participants will be asked to respond to "How do you feel your sleep quality has affected your academic and clinical performance?".

Population of Study

The proposed convenience sample size will be at least 100 undergraduate university students. Participants will be recruited through email and social media (Facebook and Instagram). Inclusion criteria incorporate the need to be 18 years or older to participate and to have no pre-existing health conditions or sleep disorders.

Data Analyses

Descriptive statistics will be used to assess the demographic data. First, the data will be analyzed to determine any correlation between sleep deprivation and physiological, psychological, and cognitive health over four years during their undergraduate studies, using a Multiple Logistic Regression. The correlation between sleep and academic performance will also be examined through the use of a multiple logistic regression model. A t-test will be used to compare differences between groups, such as nursing majors and non-nursing majors.

Moreover, in order to evaluate the open-ended responses, a content analysis will be conducted. The analysis will look for common words and phrases, which will then be organized into categories. Themes will be derived from the categories.

Ethical Considerations

Potential ethical issues include the need for consent. Students can be considered a vulnerable population due to the risk of coercion. Therefore, students will be assured that participation will be strictly confidential. Their choice to participate or refrain from the study will not affect their grades or progress in any university program. Furthermore, students will be advised that they can skip any question and discontinue their participation at any time. Because the survey will be conducted online, a statement will be included stating that the submission of the survey will be considered as consent.

Another ethical consideration would be the potential of self-reporting bias. This study has been presented to the Dominican University of California ethical review board. Data collection will not begin until the study has been approved by the Internal Review Board (IRB).

Conclusion

The evidence shows that sufficient sleep quantity is necessary to function adequately as an undergraduate college student and as an individual in the hospital workplace. Our review of the literature reveals that lack of sleep can negatively affect academic and clinical performance, as well as generate problems, such as an increase in medication and procedural errors. Sleep deprivation can have a profound impact on brain function, mental health, and psychomotor performances.

Our proposal for further study has the potential to add to our body of knowledge and aims to help nurses and university students sleep better. The proposed research can lay the groundwork for future studies on the topic of sleep deprivation. Once our proposed study has been completed, we hope the findings will serve to improve the quality of sleep for healthcare

workers and students, resulting in improvement in patient care and performance in both the

academic and clinical setting. By studying quality of sleep and its effects, researchers can

examine ways to ensure university students and healthcare professionals get adequate sleep each

night. Interventional studies can be conducted to analyze how specific sleep measures can

enhance one's sleep quality. Sleep quality is critical for optimal health, mental acuity, and

performance; therefore, it is essential that further research be conducted in order to mitigate the

impact of sleep deprivation and promote healthful, restful sleep.

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Binks, H., Vincent, G. E., Irwin, C., Heidke, P., Vandelanotte, C., Williams, S. L., & Khalesi, S.

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Gipson, C. S., Chilton, J. M., Dickerson, S. S., Alfred, D., & Haas, B. K. (2019). Effects of a

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Johnson AL, Brown K, & Weaver MT. (2010). Sleep deprivation and psychomotor performance

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Kana Okano, Jakub R. Kaczmarzyk, Neha Dave, John D. E. Gabrieli, & Jeffrey C. Grossman. (2019). Sleep quality, duration, and consistency are associated with better academic performance in college students. *Npj Science of Learning*, *4*(1), 1–5. https://doi-org.dominican.idm.oclc.org/10.1038/s41539-019-0055-z.

Mao Hasegawa, Azusa Hayano, Atsushi Kawaguchi, & Ryuya Yamanaka. (2015). Assessment of autonomic nervous system function in nursing students using an autonomic reflex orthostatic test by heart rate spectral analysis. *Biomedical Reports*, *3*(6), 831–834. https://doi.org/10.3892/br.2015.512.

Marta, O. F. D., Kuo, S.-Y., Bloomfield, J., Lee, H.-C., Ruhyanudin, F., Poynor, M. Y., Brahmadhi, A., Pratiwi, I. D., Aini, N., Mashfufa, E. W., Hasan, F., & Chiu, H.-Y. (2020). Gender differences in the relationships between sleep disturbances and academic performance among nursing students: A cross-sectional study. *Nurse Education Today*, *85*. https://doi-org.dominican.idm.oclc.org/10.1016/j.nedt.2019.104270.

Schlarb, A. A., Friedrich, A., & Claßen, M. (2017). Sleep problems in university students - an intervention. *Neuropsychiatric disease and treatment*, *13*, 1989–2001. https://doi.org/10.2147/NDT.S142067.

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Appendix

Authors/Citation	Purpose/ Objective of Study	Sample - Population of interest, sample size	Study Design	Study Methods	Major Finding(s)	Strengths	Limitations
Authors: Binks, H., Vincent, G. E., Irwin, C., Heidke, P., Vandelanotte, C., Williams, S. L., & Khalesi, S. **Citation:** Binks, H., Vincent, G. E., Irwin, C., Heidke, P., Vandelanotte, C., Williams, S. L., & Khalesi, S. (2020). Associations between sleep and lifestyle behaviours among Australian nursing students: A cross-sectional study. *Collegian*. https://doi-org.dominican.idm.oclc.org/10.1016/j.colegn.2020.02.013	To determine whether inadequate sleep was associated with poor diet, physical inactivity, alcohol consumption, and smoking in Australian nursing students.	N= 470	- Cross-sectional design	- A questionnaire assessing sleep and lifestyle behaviors was completed by 470 nursing students. -To determine the relationship between variables several regression testing were utilized such as a one-way ANOVA, t-tests, and a Pearson's bivariate correlation.	- Inadequate sleep was experienced by 78% of nursing students. - Indicators of inadequate sleep include irregular eating patterns and smoking, as well as excess consumption of discretionary foods and alcohol. - A lower global sleep quality score was associated with a lunch consumption that occurred between four to seven times per week. - Poor sleep quality was associated with an alcohol score with a high global sleep quality despite adjusting for confounding variables. -A significant association between sleep and physical activity level were not found.	- The large sample size of 470 nursing students was a strength of the study.	- The nursing students utilized an online self-reported questionnaire. This has the potential for self-reporting bias in recall and reporting. - The influence stress has on sleep quality was not evaluated and cannot be determined if it affects the severity of sleep deprivation within this sample. - The impact psychological stress can have on sleep quality should be considered for future research. -To further understand the relationship between sleep and lifestyle, a longitudinal study needed to be utilized for the sample population along with interventions on an as needed basis.

Authors: Gipson, C. S., Chilton, J. M., Dickerson, S. S., Alfred, D., & Haas, B. K. **Citation:** Gipson, C. S., Chilton, J. M., Dickerson, S. S., Alfred, D., & Haas, B. K. (2019). Effects of a sleep hygiene text message intervention on sleep in college students. *Journal of American College Health, 67*(1), 32–41. https://doi-org.dominican.idm.oclc.org/10.1080/07448481.2018.1462816.	To test the effectiveness of a text-message intervention to promote sleep hygiene to improve sleep in young adult college students.	N=96	- Experimental design	-Participants were a part of a two-group pretest-posttest design. Biweekly text messages were received by the participants for six weeks. The messages contained information about sleep hygiene or healthy behaviors. - The experimental design compared an intervention group and an attention control group. - Text messages containing information about sleep hygiene were sent out to the intervention group. - The text messages that were sent to the control group were about healthy habits. - At baseline and posttest, participants were asked to complete a survey with questions on sleep quality, sleep hygiene, sleep hygiene self-efficiency, and sleep knowledge.	-In comparison to the intervention group the experimental group did not have a higher score for sleep knowledge, sleep hygiene, self-efficacy for sleep hygiene, and sleep quality. Therefore, the hypothesis was not supported. - Scales are influenced by the improvement of sleep knowledge, sleep hygiene, sleep quality, and sleep. - The intervention group improved their time management but the attention control group did not improve on time management. - The sleep intervention group showed an improvement in the disruptive influences scale while no changes occurred among the attention control group. - Although text messages were sent to experimental group about sleep, there were no significant improvements in sleep scores. - The control group reported an improved sleep hygiene in comparison to the intervention group. -The quality of	- Strengths within the study include its experimental design, randomization of participants, and the utilization of an attention control group. -The use of text messages is commonly used among young adults, is widely used, and is low in cost to implement within the study. - The attrition rate of 20% was acceptable in this study.	Several instruments used within the study did not demonstrate reliability because it was not specifically aimed at the young adult population. - Factors that could have had an impact on the quality of sleep were not considered in the current study. This includes extraneous activities, school related assignments/ exams/ coursework, and other interactions. - The students may have had access to additional information via enrollment of other courses throughout the university. This may have influenced their knowledge on sleep beyond the information provided in the study. - The participants that were recruited consisted of undergraduate students. These students are a part of the treatment group and could contaminate the results by discussing the interventions with the control group. - The posttests of the students who dropped out of the study were still incorporated which could

| Authors:
Johnson AL, Brown K, & Weaver MT.

Citation:
Johnson AL, Brown K, & Weaver MT. (2010). Sleep deprivation and psychomotor performance among night-shift nurses. *AAOHN Journal*, *58*(4), 147–154. https://doi-org.dominican.idm.oclc.org/10.3928/08910162-20100316-02 | To examine the sleep habits of nurses who consistently worked night shifts and to quantify their psychomotor performance in the workplace under usual work conditions. | N=289 | -Nonexperimental correlational design | -Nurses who were recruited worked in the hospital. They worked 40 hours per week; eight, ten-, or twelve hour shifts in the hospital setting.
-A minimum of one year experience in the hospital setting was required from participants with not existing sleep disorder diagnosis.
- The analysis included 289 total surveys from qualified participants. - Hospital and participants were identified by a given number. A case/code number was assigned to all the data that was collected.
- Participants received a packet of information from midnight to four in the morning, five to nine hours into the assigned shift. The information provided contained a demographic data sheet and a d2 Test of Attention.
- The d2 Test of Attention was administered before other instruments because it is a timed test. The investigators monitor the time.
- Instruments were returned in an envelope to be placed in a locked file by the investigator | - Among the sample of nurses, approximately 56% were deprived of sleep.
- Sleep-deprived nurses slept a mean of 3.9 hours.
- Among the sample of nurses, approximately 43% were not deprived of sleep.
- Non-sleep deprived nurses slept a mean of 6.78 hours.
- Regarding psychomotor performance, both sleep-deprived and non-sleep deprived nurses performed similarly.
- A high performance score is an indication of poor psychomotor performance. Nurses who slept very few hours had a higher performance score.
- The sample of nurses slept less than the optimal hours of sleep in order to maintain adequate psychomotor performance.
- The findings of the study supported hypothesis number two.
- Poor performance was indicated by the inverse relationship that was found between hours of sleep and psychomotor performance | - Strengths of the study include the large sample size of 289 nurses.
- The d2 Test of Attention was used to measure attention, concentration, processing speed, and performance quality of psychomotor performance. | - Psychomotor performance was measured only once in the field setting because of the nurses' time constraints and work responsibilities.
-The sample nurses' had time constraints and work responsibilities which only allowed for one measurement of psychomotor performance.
-Factors that may affect sleep were not assessed.
-Since self-reporting was used, there is the potential for bias because a physiologic measure was not used.
-The hours of sleep needed to feel rested may have been underestimated if the nurses were chronically sleep deprived. |

| Authors: KALIYAPERUMAL, D., ELANGO, Y., ALAGESAN, M., & SANTHANAKRISHANAN, I.

Citation: KALIYAPERUMAL, D., ELANGO, Y., ALAGESAN, M., & SANTHANAKRISHANAN, I. (2017). Effects of Sleep Deprivation on the Cognitive Performance of Nurses Working in Shift. *Journal of Clinical & Diagnostic Research*, *11*(8), 1–3. https://doi-org.dominican.idm.oclc.org/10.7860/JCDR/2017/26029.10324 | To find out the prevalence of sleep deprivation and its impact on cognition among shift working nurses. | N = 96 | - Cross-sectional study | - The study took place between August 2016 to September 2016.
- The participants of the study were all staff nurses, who work on a rotating schedule at Peelamedu Samanaidu Govindasamy Hospitals, Coimbatore, Tamil, Nadu, India.
- The staff worked the night shift for one month. The same staff worked the day shift the following month.
- SPSS (version 19.0)was used to analyze the data.
- Sleep deprivation was conveyed as a percentage.
- Non-parametrical values were compared with the use of a Wilcox Signed Rankstest. | - Disturbed sleep patterns were found among 69% of the nurses due to shift work based on the scores obtained from ESS.
-The ESS score resulted in an average of 9.37.
-Amongst 42% of the nurses, they were found to have mild SD. A mild SD is considered with an ESS score of eight to eleven.
-General intellect and attention mean scores decreased during the night. Meanwhile, the mean scores for mental speed and reaction time increased during night hours.
-In comparison to night shift hours, day shift hours had both a higher MoCA test score and higher execution/ memory test. | - The study included staff nurses from Medicine Surgery, OBG, Paediatrics, etc. These nurses worked eight hour shifts per day for six days a week, did not suffer from any known medical or mental illness, and had a previous work experience of at least one year in rotating shift work. | - ESS can reliably measure the quality of sleep however, it is not equally as accurate as an actigraph or actimetry in regards to the detection of SD.
- Within this study, all domains of cognition were not tested.
- The mobile application software used to test cognition was subjected to internal face validation because of asset restrictions.
- The small sample population of 96 participants. |

| Authors:
Kana Okano, Jakub R. Kaczmarzyk, Neha Dave, John D. E. Gabrieli, & Jeffrey C. Grossman.

Citation:
Kana Okano, Jakub R. Kaczmarzyk, Neha Dave, John D. E. Gabrieli, & Jeffrey C. Grossman. (2019). Sleep quality, duration, and consistency are associated with better academic performance in college students. *Npj Science of Learning*, *4*(1), 1–5. https://doi-org.dominican.idm.oclc.org/10.1038/s41539-019-0055-z. | To explore how sleep affects university students' academic performance by objectively and ecologically tracking their sleep throughout an entire semester using a Fitbit - a wearable activity tracker. A second aim was to understand gender differences in sleep and academic performance.

To measure the correlation between multiple sleep measures with in-class performance on quizzes and midterm examinations. | N=88 | - Qualitative
- Quantitative Study | - A total of 88 participants were chosen from an MIT class offered in the fall semester. They were chosen from The Solid State Chemistry class.
- A wearable activity tracker was provided to each student. The students were assigned a specified section to attend and were not allowed to attend other sections. This ensures the same TA was used throughout the semester.
- The students took a weekly quiz, three midterms approximately three to four weeks before the exam date, and a final exam covering content from the entire semester. | - Poorer grades were associated with worse quality, shorter duration, and less consistency of sleep.
- Improved sleep quality prior to taking a test did not correlate to better test performance.
-However, improving both the length and quality of sleep for a month and a week before a test did correlate to better grades.
- Approximately 25% of the academic variances were a result from sleep measures. | - Gender differences is a mediating factor taken into consideration in regards to grades
- Gives new knowledge about the circumstance of the connection among sleep and academic performance. | - Sleep quality measures were made with proprietary algorithms. Fitbit gadgets can precisely determine sleep stages however, there is no proof that Fitbit's 1~10 rest quality scores speak to a valid evaluation of sleep quality.
- There are several factors that can affect the relationship between sleep and academic performance. This may include stress, anxiety, motivation, personality traits, and gender roles.
- The findings from this sample are only applicable to the student population enrolled in a specified course at MIT. It cannot be applied to the generalized population or to other courses at MIT. |

Authors: Mao Hasegawa, Azusa Hayano, Atsushi Kawaguchi, & Ryuya Yamanaka. **Citation:** Mao Hasegawa, Azusa Hayano, Atsushi Kawaguchi, & Ryuya Yamanaka. (2015). Assessment of autonomic nervous system function in nursing students using an autonomic reflex orthostatic test by heart rate spectral analysis. *Biomedical Reports*, *3*(6), 831–834. https://doi.org/10.3892/br.2015.512.	To examine the functioning of the autonomic nervous system in nursing students by assessing active standing load using autonomic reflex orthostatic tolerance test that enables quantitative analysis of dynamic autonomic nervous system function.	N=121	- Quantitative Study	- Participants consisted of 121 nursing students who were enrolled at the Kyoto Prefectural University of Medicine. - The autonomic reflex orthostatic tolerance test was used to assess the active standing load of the student participants. This analyzed their autonomic nervous function. - The variability of the participants' heart rate were measured and analyzed for the autonomic nervous system. - The participants had to remain sitting for two minutes, standing for 2 minutes, and remain in a resting position for 1 minute. This was done in order to obtain electrocardiogram measurements for the autonomic reflex orthostatic tolerance test.	Resting rates: - In comparison to first-year students, fourth-year students have a lower activity of the autonomic nervous system (CVRR). -Fourth-year students tended to have a higher sympathetic nervous system activity (LF/HF) in comparison to other students from different grade levels. - In comparison to third-year students, fourth-year students had a lower parasympathetic nervous system activity (CCVHF). Standing rates: -Fourth-year students had a higher autonomic nervous system (CVRR) in comparison to other students from different grade levels. - Fourth-year students had a lower nervous system response (LF/HF) in comparison to other students from different grade levels. Autonomic nervous system functions: - Compared with first- to third-year students, fourth-year students had a lower activity of the autonomic nervous system (CVRR) of	- Valuable information is provided among nursing students concerning the autonomic nervous system dysfunction.	- Limitations of the study include the relatively small number of 121 participants. - The study was tailored toward a specified geographic location.

Authors: Marta, O. F. D., Kuo, S.-Y., Bloomfield, J., Lee, H.-C., Ruhyanudin, F., Poynor, M. Y., Brahmadhi, A., Pratiwi, I. D., Aini, N., Mashfufa, E. W., Hasan, F., & Chiu, H.-Y. **Citation:** Marta, O. F. D., Kuo, S.-Y., Bloomfield, J., Lee, H.-C., Ruhyanudin, F., Poynor, M. Y., Brahmadhi, A., Pratiwi, I. D., Aini, N., Mashfufa, E. W., Hasan, F., & Chiu, H.-Y. (2020). Gender differences in the relationships between sleep disturbances and academic performance among nursing students: A cross-sectional study. *Nurse Education Today*, *85*. https://doi-org.dominican.idm.oclc.org/10.1016/j.nedt.2019.104270.	To examine the prevalence of sleep disturbances and academic performances in male and female nursing students and to determine gender-specific effects on the relationship between sleep disturbances and academic performance.	N=492	- Cross-sectional study design	- Data was collected from July 1, 2018 to September 30, 2018. - Biosociodemographic characteristic data was collected. - Using the Pittsburgh Sleep Quality Index (PSQI), the Insomnia Severity Index, the Epworth Sleepiness Scale, and the Morningness-Eveningness Questionnaire, sleep was assessed. - Depression was measured using the Beck Depression Inventory. - Based on grade point averages from the 2017-2018 academic year, academic performance was measured. - In order to analyze the data collected, a multivariate logistic regression model was utilized.	- Both male and female nursing students suffered from poor sleep quality and insomnia, which resulted in daytime sleepiness. - In comparison with female nursing students with insomnia, female nursing students without insomnia had a lower risk of poor academic performance. - In male students with insomnia and without insomnia, there was no difference in academic performance. - Regarding the male nursing students, more than 60% had intermediate and morning chronotypes. - Pertaining to the female nursing students, more than 50% had intermediate and morning chronotypes.	- Taking into consideration gender differences, this study is the first to examine the relationship between sleep disturbances and academic performance in nursing students.	- A prospective study is needed to confirm results. - In order to measure sleep disturbances, questionnaires were self-administered and subjective. - The participants were from one nursing school in Indonesia, which may have limited the external generalizability of the study.

Authors: Schlarb, A. A., Friedrich, A., & Claßen, M. **Citation:** Schlarb, A. A., Friedrich, A., & Claßen, M. (2017). Sleep problems in university students - an intervention. *Neuropsychiatric disease and treatment, 13*, 1989–2001. https://doi.org/10.2147/NDT.S142067.	To examine the feasibility of the "Studieren wie im Schlaf" (SWIS; (studying in your sleep)) sleep training, which is a specialized treatment for college/university students that combines Cognitive Behavioral Therapy for insomnia and Hypnotherapy for insomnia to improve students' sleep, insomnia symptoms, and nightmares. To evaluate acceptance, feasibility, and the first effects of studying in your sleep.	N=27	- Quasi-experimental study	- In this study (pre-post design), there were 27 students that participated. - Questionnaires were used to measure acceptance and feasibility. - Sleep was measured using the Pittsburgh Sleep Quality Index (PSQUI), sleep logs, and actigraphy. - Further factors incorporated daytime drowsiness, personality traits associated with sleep, and sleep cognitions.	- 27% of the participants reported experiencing symptoms of insomnia, as well as insomnia disorder. - Based on the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* 51.9% of the participants in the study met the criteria for insomnia disorder. - The Pittsburgh Sleep Quality Index (PSQI) identified that the participants were experiencing clinically relevant sleep problems. - Regarding subjective sleep quality, objective sleep measures, and sleep-related personality traits, this study found clinically significant improvements.	- In this study, acceptance assessments were anonymous, and sleep was also measured objectively.	- There were 27 participants in this study, which is considered a small sample size. - This is a feasibility study. - The goal of the study was to test the acceptance of the program, as well as its effectiveness. - This is a quasi-experimental design study. - Because a control group was missing, SWIS may not be solely responsible for causing the positive effects seen in the study. - There was no follow-up measurement.

Authors: Seoane, H. A., Moschetto, L., Orliacq, F., Orliacq, J., Serrano, E., Cazenave, M. I., Vigo, D. E., & Perez-Lloret, S. **Citation:** Seoane, H. A., Moschetto, L., Orliacq, F., Orliacq, J., Serrano, E., Cazenave, M. I., Vigo, D. E., & Perez-Lloret, S. (2020). *Sleep Medicine Reviews, 53.* https://doi-org.dominican.idm.oclc.org/10.1016/j.smrv.2020.101333.	Aimed at assessing the prevalence of sleep disruption in medical students and its relationship with academic performance.	N = 14, 170	- Systematic review and meta-analysis - Cross sectional, cohort or case - control studies were accepted	- In this study, there was a mixed sample of participants with various medical related careers, such as medical, kinesiology, and nursing students. - During the regular school period, the participating students were assessed. - At any rate unvalidated or validated, subjective or objective, sleep quality measurement, duration of sleep, or sleepiness during the day, covering more than one evening. - Questionnaire, standardized tests, and grade point averages were used to assess academic performance.	- In some studies, it was found that medical students who slept for shorter periods of time performed better. - In sleep deprived students, academic performance and quality of life can be improved with occasional sleep assessments and psychiatric evaluations. - Impaired academic performance was associated with poor sleep quality, as well as excessive daytime sleepiness.	- The study consisted of 14,170 medical students, which is considered a large sample size.	- There may have been an overrepresentation of female medical students. - This study did not measure sleep characteristics objectively. - In studies with half of the sample population being females and in studies conducted after 2011 in Asia/ Oceania regions, there was a stronger correlation between sleep quality and academic performance. - Moderator analyses were not allowed because a sufficient enough amount of data was not able to be collected in terms of demographics and comorbidities.

| Authors: Silva, V. M., Magalhaes, J. E. de M., & Duarte, L. L. Citation: Silva, V. M., Magalhaes, J. E. de M., & Duarte, L. L. (2020). Quality of sleep and anxiety are related to circadian preference in university students. *PLoS ONE, 15*(9), 1. | To identify anxiety levels, quality of sleep and different chronotypes of university students and investigate their relationship. | N=96 | - Cross-sectional study with a quantitative approach | - The study was conducted at the Centro de Ciências da Saúde of the Universidade Federal do Recôncavo da Bahia, in the city of Santo Antônio de Jesus, Bahia, Brazil. - Activities stated at seven in morning and ended at six in the evening. There were no night classes. - While there were 103 volunteers, there were only 96 participants. - Participants consisted of 57 females and 39 males with the mean ages being 22 years and 23.15, respectively. - Participants in this study were students who are enrolled in courses at Centro de Ciências da Saúde, between the ages 18 and 25 years old, do not have a diagnosis of psychiatric diseases, and do not take controlled medications. | - Individuals with an evening chronotype are more likely to have higher trait and anxiety states, as well as have poorer sleep quality. - Evening individuals have three times as high of alert levels at the tenth hour than at seventh hour. - On work days, approximately 90% of the participants suffered from partial sleep deprivation because they went to bed late and had to wake up early in the morning. - Late chronotypes who have early work schedules often do not sleep enough during the week, which results in having to compensate by increasing sleep on the weekends. This is known as social jet lag. - Compared to morning students, evening students have higher levels of anxiety and have poorer sleep quality. - In comparison with other chronotypes. evening chronotypes have sleep-wake cycles that are more irregular because of their higher levels of anxiety in relation to | - This study was the first to find an association between anxiety and evening people in a non-clinical setting. - The study brings needed attention to the conduction of specific studies, such as ones that examine how modification of class start times in universities can reduce anxiety in students. | - The scope of conclusions might be limited because this study collected data using a cross-sectional design and had a small sample population. - All contributing factors to anxiety were not controlled, such as living environments, economic conditions, social restrictions, academic rigor, and substance use. |

| Authors: Stepan, M. E., Fenn, K. M., & Altmann, E. M. Citation: Stepan, M. E., Fenn, K. M., & Altmann, E. M. (2019). Effects of sleep deprivation on procedural errors. *Journal of Experimental Psychology: General, 148*(10), 1828–1833. https://doi-org.dominican.idm.oclc.org/10.1037/xge0000495.supp (Supplemental). | To study the effects of sleep deprivation on error rates in a procedural task, focusing on the role of memory maintenance. | N=234 | - Cross-sectional study | - Groups were made up of a maximum of eleven students.
- This study placed the groups in two different testing rooms.
- As compensation, participants received course credit.
- Requirements for participants in this study include being a native English speaker and an undergraduate at Michigan State University.
- Participants who have been diagnosed with a memory or sleep disorder, have major sleep disturbances, are color blind, or have a strong preference for either the morning or the evening were not included in this study.
- Participants were asked to get at least six hours of sleep and to wake up by nine in the morning the night before the study.
- Before the study, participants were not allowed to nap.
- For the 24 hours prior to the study, participants were not allowed to consume caffeine, alcohol, or drugs. | - Individuals who are sleep deprived should refrain from undertaking procedural tasks, especially those that have interruptions and costly errors.
- If an individual who is sleep deprived cannot avoid performing procedural errors, it would be beneficial to only do the tasks for a limited amount of time.
- Individuals who are sleep deprived have a higher chance of having a general breakdown in ability, as well as they are more unwilling to complete tasks.
- With participants who were sleep deprived, there was an increased rate of errors.
- With tasks that required memory and took more time, sleep-deprived participants made more errors. | - This is the largest study that examined the effect of sleep deprivation on higher-order cognition.
- There were two groups in the study (the sleep and the deprivation group).
- Group assignments were random. | - In order to design a system that can accommodate operators who are sleep-deprived, the empirical pattern needs to be better understood and theoretically detailed. |

Authors: Ye, L., Hutton Johnson, S., Keane, K., Manasia, M., & Gregas, M. **Citation:** Ye, L., Hutton Johnson, S., Keane, K., Manasia, M., & Gregas, M. (2015). Napping in College Students and Its Relationship With Nighttime Sleep. *Journal of American College Health*, *63*(2), 88–97. https://doi-org.dominican.idm.oclc.org/10.1080/07448481.2014.983926.	To examine the habit of napping and its relationship with nighttime sleep in college students.	N = 440	- Cross-sectional study	- Students were asked three questions. - The questions were based on frequency, length, and timing of napping. - The study focused on students' napping during the past month. - In order to measure sleep quality, the Pittsburgh Sleep Quality Index (PSQI) was used.	- The participants in this study self-reported their napping habits. - Among the nap-frequency group and the nap-length group, there was a significant difference between PSQI scores. - It was found that poorest sleep quality is associated with individuals who nap for longer than two hours and for those who take naps more than three times a week. - Nap time played a role in the duration of sleep. On school nights, students slept for shorter periods if they took a nap between six and nine in the evening. - Frequent, long, and late napping is associated with an increased risk of poor sleep quality during the night, as well as sleep deprivation that is more severe.	- The sample size is large (440 students). - Regarding future investigations, this study can be used for reference when developing a valid and reliable questionnaire on napping habits and behavior. - The study used an anonymous, online survey. - This study consisted of a random sample of participants in regard to sex, race, and school enrollment. - The participants were all undergraduate students.	- A cross-sectional study was conducted, but a causal relationship cannot be deduced based on the collected data. - The study used retrospective subjective reports in order to analyze napping and sleep patterns. - The study did not examine all aspects of napping. It would be beneficial to study the number of naps taken per day, as well as the napping experience, in future studies. - Females scores were higher because females answered the survey questions more than the males. - The questions on napping habits, sleep habits, mood/ energy level, and overall health were not tested for reliability or validity. - As confirmation of the findings, the findings in this study need to be further examined.