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Prevalence of Insomnia and Its Impact on Academic Performance Among Respiratory Therapy Students in Saudi Arabia (SA) and the United States of America (USA).

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ACCEPTANCE

This thesis, PREVELANCE OF INSOMNIA AND ITS IMPCAT ON ACADEMIC PEFROMANCE AMONG RESPIRATORY THERAPY STUDENTS IN SAUDI ARABIA (SA) AND THE UNITED STATES OF AMERICA (USA), by Ahmed Hameed Alasimi, BSRT, was prepared under the direction of the Master's Thesis Advisory Committee of the Respiratory Therapy department at Georgia State University. It is accepted by the committee in partial fulfillment of requirements for the Master's of Science degree in Respiratory Therapy at Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University.

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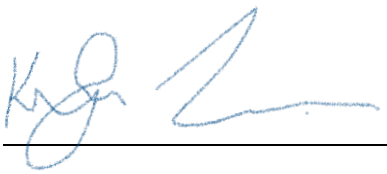

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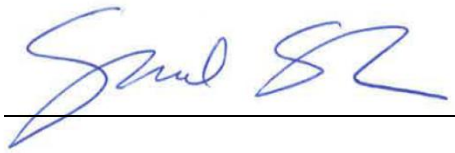

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DEDICATION

I would like to express my sincere gratitude to everyone who played a crucial role in my successful completion of this thesis. Firstly, I want to extend my profound thanks to God (Allah) for the unwavering guidance and grace that have been bestowed upon me during the challenges of this academic endeavor. Secondly, I would like to thank my family for their continuous support, understanding, and encouragement. Your belief in me provided the motivation to persevere through the obstacles and uncertainties that come with such a significant academic undertaking. I am also deeply thankful for my friends, whose camaraderie brought joy to this journey. Lastly, I extend my gratitude to all those who, in various ways, contributed to the realization of this endeavor. This achievement is not just mine; it is a testament to the collective strength of the wonderful individuals who surrounded me. Thank you for being a part of this milestone in my academic journey.

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Ahmed Hameed Alasimi

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PREVELANCE OF INSOMNIA AND ITS IMPCAT ON ACADEMIC PEFROMANCE AMONG RESPIRATORY THERAPY STUDENTS IN SAUDI ARABIA (SA) AND THE UNITED STATES OF AMERICA (USA).

By

Ahmed Hameed Alasimi

A Thesis

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the Degree of Master of Science in

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In

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Under the supervision of Dr. Kyle Jason Brandenberger

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By

Ahmed Hameed Alasimi

(Under the Advisement of Dr. Kyle Brandenberger)

ABSTRACT

Background: Insomnia is a common sleep disorder characterized by difficulties falling asleep, staying asleep, or waking up early in the morning, along with significant distress and impairments of daytime functioning. It is a prevalent sleep complaint among health science students, due to an overburdened academic load, protracted intensive study periods, and stressful lifestyles to maintain an outstanding grade point average (GPA). Therefore, insomnia can adversely affect students' health and academic performance. **Purpose:** This study aimed to assess the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia (SA) and the United States of America (USA). **Methods:** A cross-sectional study was conducted between June 9 and September 12, 2023. Insomnia Severity Index (ISI) was distributed electronically to students' email addresses through direct coordination with RT department directors. Data were collected from RT students in both countries by using a non-probability convenience sampling technique. Descriptive statistics of the participants were presented in frequencies, percentages, means, and standard deviations. A one-way ANOVA test wasused to measure the significant differences of ISI scores among categorical groups. **Results:** A total of 403 responses were received from both countries. The majority of them were from Saudi Arabia (79.9%) and (20.1%) from the United States. The study findings showed that the prevalence of insomnia among RT students in SA and the USAwas found to be 32% and 21%, respectively. In addition, ISI scores were significantly higher among Saudi RT students who were female, in their second academic year, current smokers, single, and those with a poor cumulative GPA. However, ISI scores were significantly higher only among current smoker RT students in the USA. **Conclusion:** Insomnia was a prevalent sleep disorder among respiratory therapystudents in both Saudi Arabia and the United States. Insomnia was negatively correlated with students' academic performance. Several demographic factors were significantly associated with a higher level of insomnia, including gender, academic year, smoking status, marital status, and GPA. Therefore, this study provides valuable insights for educational institutions and stakeholders to work collaboratively to implement tailored interventions and coping strategies that support students' healthy sleep habits, mental well-being, and academic achievement.

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CHAPTER I

Introduction

Sleep is an essential component of human physiology that enhances cognitive functions associated with academic achievement in the learning process [1]. The recommended amount of sleep for young adults is 7-9 hours per night [2]. Regular performance of brain functions will be negatively compromised due to lack of sleep, leading to impaired attention, memory, decision making, problem-solving, and critical thinking [3]. Insomnia is a serious sleep disorder characterized by insufficient or poor sleep quality due to difficulty initiating, staying asleep, or waking up in the morning [4]. It is closely correlated with daytime impairments and poor academic performance due to difficulty sleeping at night [3]. Statistically, one-third of the world's population suffers from insomnia which is highly correlated with low sleep quality or quantity [5].

Insomnia is categorized into two types based on its distinctive traits: short-term (acute) and long-term (chronic). Acute insomnia is associated with difficulty falling or staying asleep accompanied by concomitant daytime symptoms such as exhaustion and physical lethargy that lasts for less than three months at a rate of fewer than three times a week. Chronic insomnia is similar to acute insomnia concerning symptoms and difficulties. However, it persists three times a week for more than three monthsannually. According to statistics, up to 20% of people experience acute insomnia, while10% of adults worldwide have chronic insomnia [3].

The etiology of insomnia can be classified into primary or secondary causes based on the disorder triggers. The primary reasons are intimately connected to natural stimuli such as stress and unpleasant events that disturb a person's sleep pattern by engaging the mind with brainstorming at night. Moreover, alcohol consumption, cigarette smoking, and drinking coffee are stimulants that make it hard to fall asleep or

reach deeper sleep stages. The secondary causes of insomnia are linked with other medical conditions or medications that impede sleep. For example, insomnia is closely associated with several diseases, such as diabetes, asthma, GERD, and obstructive sleep apnea. In addition, using certain prescription pharmaceuticals to control blood pressure and depression can significantly interfere with sleep [6].

Insomnia can be recognized by realizing the symptoms that may appear in insomniacs, which can lead to daytime weariness, drowsiness, nervousness, restless mood, impaired concentration, inactive performance, and increased mistakes and accidents. These symptoms may substantially threaten insomniacs by sleeping while driving or walking, leading to pernicious effects. Insomnia may have critical complications on human health, increasing the likelihood of developing heart and mental diseases such as hypertension and anxiety, which are closely related to a decrease in the quality of life and well-being [7].

There are numerous available approaches for insomnia treatment. Cognitive behavioral therapy is the most frequently used initial remedy for persistent insomnia. The CPT-I program offers a variety of methods for improving sleep hygiene that assists insomniacs in changing unhealthy habits, enhancing sleep quality, and preventing sleeplessness. Additionally, prescribing sedative medications and natural supplements may effectively help relieve insomnia episodes. Moreover, a sleep hormone called melatonin is utilized to enhance daily functioning, promote sleep, and lessen anxiety related to sleep issues. Insomnia prevention can be achieved by establishing a regular bedtime schedule, avoiding morning naps, and avoiding gadgets (computers, cell phones, tablets, etc.) just before bed to minimize sleeplessness attacks [8].

Academic performance measures the student's educational success in the theoretical subjects, typically evaluated through traditional assessment tools, including exams, assignments, and homework. Furthermore, a student's GPA is the most widely used measurement instrument for assessing learning progress [9]. It is well known that medical curricula are overloaded with intensive content information, which can drive academic burnout [10]. Lack of sleep has detrimental health consequences related to learning capacity impairment, highly predisposing to poor productivity and delayed study progress [11].

Respiratory therapy (RT) is a health care specialty concerned with training students in the respiratory system to assess and treat patients experiencing diseases of the cardiopulmonary system. Graduated students must possess a comprehensive view of pathophysiology, pharmacology, microbiology, chemistry, and mechanical ventilation to be qualified practitioners in the medical field. In addition, an internship year is a mandatory requirement within the program to obtain enriching clinical experience that enables the graduate to work in the critical care units [12].

Statement of Problem

Insomnia can have physical and mental harmful side effects on the human condition. Students are more prone to have poor sleep quality throughout written exams and presentations. Despite the massive burden of insomnia among students, there is an inadequate amount of scientific research that addresses the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia and the United States of America. Therefore, I hypothesize that insomnia impairs academic performance, hindering educational success.

Purpose of Study

This quantitative study aims to assess the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia (SA) and the United States of America (USA). This study will investigate the following research questions:

1. What is the prevalence rate of insomnia among RT students in SA and the USA?
2. What is the insomnia severity among RT students in SA and the USA?
3. What is the impact of insomnia on academic performance among RT students in SA and the USA?
4. What is the association between demographic variables and insomnia prevalence among RT students in SA and the USA?

Significance of Study

This study will contribute to determining the consequences of insomnia on academic performance among respiratory therapy students in Saudi Arabia and the United States of America. Many researchers discussed the prevalence of insomnia among medical and nursing students, but no published study examines the prevalence of insomnia and its impact on academic performance in Saudi Arabia and the United States of America. The study outcomes will immensely increase the awareness of insomnia drawbacks on learning progress, motivating educational organizations to provide seminars and medical consultations that improve students' quality of life and academic advancement.

Definition of Terms

GERD: Gastroesophageal reflux disease.

CPT-I: Cognitive behavioral therapy for insomnia.

GPA: Grade point average.

RT: Respiratory therapy.

AARC: American Association for Respiratory Care.

Assumptions

It is highly assumed those study participants will respond honestly and truthfully to the research questions because this study focuses on addressing their academic issues. The data collection process will be meticulously implemented to maintain the confidentiality and anonymity of the participants and to ensure the study's credibility. Additionally, a high response rate to the research is expected because it uses a short and validated survey that can be quickly and easily answered.

Limitations

This study involves a target population from several regions in an effort to generalize the research results across Saudi Arabia. However, it will collect data from American respiratory therapy students at Georgia State University only to represent the entire population of RT students in the United States of America. Moreover, interns will be excluded from participating as they are not assigned numerical grades during their rotations. Furthermore, the study is limited due to a lack of studies that assess the prevalence of insomnia and its impact on academic performance among RT students. In addition, it is a self-reported study, which may allow students to provide inaccurate data.

Summary

In summary, insomnia is a prevalent sleep disorder that negatively affects students' cognitive abilities. Therefore, this research examines the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia and the United States of America. Moreover, the study will raise awareness about insomnia consequences and their effects on academic progress, motivating educational administrations to apply appropriate solutions to resolve this issue.

CHAPTER II
REVIEW OF THE LITREATURE

The current literature review mainly concerns providing comprehensive knowledge about other related published studies that were conducted on a variety of undergraduate disciplines. Also, it contributes significantly to understanding the extent of research progress on the association between insomnia and academic performance among university students in different countries globally. The primary objectives of this literature review are to demonstrate the research idea from distinct perspectives and to identify knowledge gaps that recommend for conducting the current research. In the literature review, databases including PubMed, EBSCOhost, CINAHL, ScienceDirect, and Google Scholar were used.

The following keywords were used during the search process, including insomnia, sleep disorder, sleep disturbance, sleep quality, academic performance, academic achievement, academic progress, respiratory care students, respiratory therapy students, physical therapy students, radiology students, medical students, nursing students, pharmacy students, dental students, health science students, and undergraduate students. The search results revealed additional published studies that were not looked

into by the simple search. This chapter is organized and separated into three sections based on relevant articles in the following categories:

- Insomnia and academic performance among medical students.
- Insomnia and academic performance among nursing students.
- Insomnia and academic performance among university students.

Background

Sleep is an essentially biological process for developing intellectual capabilities including memory consolidation, decision-making, and critical thinking which are linked to academic progress [13]. Optimal sleep duration is crucial for recovery, energy regeneration, and memory consolidation [14]. As such, it was recommended that adults should get between 7 to 9 hours of sleep per night on a regular basis [2]. Therefore, sleep accounts for one-third of our life span [15]. Good sleep quality and quantity are crucial variables for optimizing the quality of life by minimizing the incidence of work-related accidents and motor vehicle crashes that can be caused as a result of excessive daytime sleepiness and fatigue [7].

Inversely, an insufficient amount of sleep has been substantially correlated with emotional instability, poor concentration, and attention deficit during class [16]. Moreover, disturbed sleep patterns or inadequate overnight sleep are closely linked to a higher risk of daytime sleepiness and academic failure [17]. Numerous studies have indicated that short sleep duration, delayed sleep time, and late rising time significantly compromised learning capacity, neurobehavioral functions, and academic performance [18, 19]. Particularly, students are more likely to develop sleep disorders that adversely impact their educational achievement [20]. A previous study demonstrated that nearly

15% of college students have consistently poor sleep quality, while approximately 75% occasionally experience sleep disturbances [21].

Insomnia is a highly prevalent sleep disorder characterized by difficulties falling asleep, staying asleep, or waking up early in the morning, along with significant distress and impairments of daytime functioning [4]. In the US, nearly 25% of the population report complaints of insomnia]22[, and almost 10% of Americans meet the diagnostic criteria for persistent insomnia [23]. Acute insomnia symptoms may lead to various daytime consequences including increased tension, mood instability, irritability, weariness, proneness for errors or accidents, and impaired attention and memory which lowers life satisfaction and academic performance [4]. Persistent insomnia is substantially associated with serious physical and psychiatric comorbidities such as hypertension, diabetes, obesity, asthma, depression, and anxiety [24]. In comparison to good sleepers, insomniacs are more likely to have a poor quality of life with a greater rate of school absenteeism and utilization of medical services [4].

Respiratory therapy (RT) is an essential healthcare specialty that contributes significantly to evaluating and treating patients with cardiopulmonary diseases [12]. Similar to their counterparts in other health-related majors, undergraduate respiratory therapy students may be at risk of acquiring insomnia. Several published studies reported the prevalence of insomnia and its impact on academic performance among medical, paramedical [25], and nursing students [26]. Despite the massive burden of insomnia in students, studies on insomnia among RT students in Saudi Arabia are negligible. Therefore, the current study aimed to assess the prevalence of insomnia and its impact on academic performance among RT students in KSA.

Insomnia and academic performance among medical students

Insomnia is a popular sleep complaint among medical students, due to the nature of their highly competitive study environment [25]. Medical students are considered to be a more vulnerable population to poor sleep quality and sleep-related issues due to an overburdened academic load, protracted intensive study periods, and stressful lifestyles to maintain an outstanding grade point average (GPA) [25, 27, 28]. A cross-sectional study conducted in 2018 by Alqudah et al., among 977 Jordanian medical and paramedical students, found that the prevalence rate of insomnia was estimated to be 26.0% [25]. Moreover, there was a significant effect of insomnia on students' academic performance as indicated by their cumulative grade point average (CGPA) [25]. As such, students with good sleep quality, who slept more than 7 hours, and had a CGPA of 3 or higher had significantly fewer scores on Insomnia Severity Index (ISI) compared to their peers who had poor sleep quality, slept less than 6 hours, and had a CGPA of less than 2.5 [25].

Another cross-sectional study was carried out in 2012 on 305 Saudi medical students to assess sleep habits during the clinical year in Jeddah, Saudi Arabia [27]. It was reported that the incidence rate of insomnia was present in approximately 33%, poor sleep quality in 30%, and excessive daytime sleepiness (EDS) in 40%. Students who were at higher risk of sleep disorder symptoms had poor academic performance as the majority of students slept an average of 5.8 hours per night, with an average bedtime of 01:53 [27]. Also, the study pointed out that around 8% of the total respondents had a reversed sleep cycle, where they sleep during the daytime period [27]. Moreover, a pertinent study conducted in 2019 on 150 medical students in their fourth and fifth years at the University of Benghazi in Libya to evaluate the quality of sleep revealed that roughly 77% of the participants had poor sleep quality, with an increased incidence of

females and young students due to academic pressure and stress that resulted in circadian rhythm disturbances [29]. In addition, a related study among medical students at Majmaah University in Saudi Arabia indicated that students suffer from sub-threshold, moderate, and severe clinical insomnia, 48.9%, 17.4%, and 3.7%, respectively [30].

Besides, Shakeel et al. found that 41% (55 out of 135) of medical students in Pakistan were insomniacs with a higher prevalence and severity of symptoms among female students. Also, senior students were more susceptible to insomnia and experienced more severe symptoms than junior students [31]. According to Alrashed et al., insomnia was the predominant sleep complaint among medical students by approximately 35% during the COVID-19 pandemic, with a greater prevalence proportion among female students and third-year students compared to interns due to perceived stress [32]. In accordance with a recent study, 37% of Pole medical students reported insomnia episodes, with a greater incidence rate among cigarette smokers [33]. Likewise, several related studies on medical students showed an estimated prevalence of insomnia at 18.3% in Jordan, 25% in Iraq, 28% in China, and 37% in India. As such, it reported a significant association between insomnia and poor academic achievement [34-37].

On the contrary, these findings were inconsistent with a large study carried out at the University of North Texas with 1,074 students, which found no significant association between persistent insomnia and academic success. Despite that students with chronic insomnia significantly reported having poor sleep quality, experiencing psychological disorders, and using sleeping pills to relieve symptoms of insomnia [38]. As well as, a cross-sectional study of 388 university students in Ethiopia revealed that

62% of the students had insomnia, as every three out of five students were insomniac, although there was no significant effect on students' academic performance [39].

Medical students resort to sleep restriction to obtain a longer period of time for studying, particularly prior to exams, in order to adapt the workload and the stressful environment [28]. Medical students' test scores were substantially correlated with the number of hours they slept the night before the exam [38, 40]. Similarly, a bad sleep quality prior to exam period leads to subpar academic achievement [41]. Alsaggaf et al. discovered that late wake-up time worsens the student's grades, as outstanding students with superior academic progress had an earlier rise time compared to their peers [27]. Bahammam et al. pointed out that a reduced nocturnal sleep duration among medical students had adverse effects on their academic success [42]. Conversely, a cross-sectional study performed in 2019 on 367 medical students in Riyadh, Saudi Arabia, by Qasim et al. revealed that the percentage of insomnia was estimated to be 32.9% two weeks prior to the test, compared to 27.1% two weeks after the test [43]. Furthermore, it reported that there was no statistically significant correlation between insomnia and test performance [43].

The incidence of sleep disruptions and insomnia among medical students can be ascribed to major contributing factors, including a high degree of stress and extreme emotional weariness [25, 27]. As such, a high-stress level and academic failure were closely related to poor sleep quality as it increased the likelihood of frequent nocturnal awakenings and excessive daytime sleepiness [27]. In addition, insomnia and poor quality of sleep were remarkably linked to profound negative consequences on physical and mental health, which were associated with a variety of detrimental daytime complications, including fatigue, impaired memory, decision-making, low concentration level, moodiness, and lack of energy [43-45]. Furthermore, inadequate

sleep was significantly correlated with daytime drowsiness, decreased productivity at work, learning difficulty, and academic failure [46].

A recent meta-analysis study among undergraduate medical students from 13 different countries, indicated that around 55% of the entire respondents had poor sleep quality with regional disparities being found [47]. Variations in the occurrence of insomnia among medical students can be related to socioeconomic status and other psychosocial factors impacting sleep quality [48]. Riemann et al. reported that depressed individuals manifest alterations in their sleep architecture, accompanied by a decrease in slow wave sleep (SWS), which led to a significant reduction in sleep efficiency and complaints of insomnia [49]. Several studies in South Korea, Taiwan, and the USA demonstrated that lower socioeconomic status was found to be significantly associated with a higher prevalence rate of self-reported sleep complaints, resulting in poorer sleep quality and shorter sleep duration [50, 51].

The academic level can be significantly associated with insomnia, as early academic year students were more likely to encounter insomnia episodes versus their counterparts in the clinical year due to intense study pressure [25, 52]. Additionally, it indicated that clinical pharmacy students were at a higher proportion of exposure to insomnia attacks than the rest of other health science students, and they were the most resorting to using sleeping pills to relax and fall asleep [25]. Furthermore, 18% of the students who consumed hypnotic pharmaceuticals such as melatonin and antihistamines are daytime sleepers [27]. Johnson and Valsa claimed that taking a nap afternoon may significantly improve cognitive functions, facilitating the learning process and leading to greater academic achievements during the class period [53].

Summary of insomnia and academic performance among medical students

Insomnia is a common sleep issue among medical students due to an extensive academic burden and extended periods of studying [25]. Numerous studies conducted on medical students from several nations indicated that the prevalence rate of insomnia ranged from 17% to 41%, with a significant correlation between insomnia and poor academic progress [25, 27, 31-37, 54]. In contrast, relevant studies revealed that there was no significant association between insomnia and academic success, with the incidence of insomnia ranging from 27% to 62% among medical students [38, 39, 43]. The prevalence of insomnia was closely related to the sociodemographic variables of participants, with insomnia being shown to be significantly higher in junior students [25, 52], female students [29, 32], and smoker students [33]. Several studies demonstrated that superior academic performance was significantly associated with good sleep quality [41], early awakening [27], and afternoon naps [53], while decreased nocturnal sleep may hinder academic success [42]. Insomnia and poor sleep quality were substantially associated with excessive daytime sleepiness affecting productivity, concentration, memory, and cognitive functions, leading to academic failure [43-46].

Insomnia and academic performance among nursing students

Nursing students are at a higher probability of experiencing insomnia symptoms due to rigorous academic demands and clinical practices [55]. In a cross-sectional study of nursing students in Italy to assess the prevalence of sleep disorders and their corresponding impacts on academic performance [56]. It was found that nursing students were influenced by various sleep disturbances that were significantly associated with poor academic achievement and low quality of life, with an incidence of insomnia symptoms reaching up to 19% [56]. Besides, late afternoon coffee

consumption can be linked to disruptive effects on sleep architecture [56]. Drake et al. discovered that moderate dosages of caffeine ingested 6 hours prior to habitual bedtime reduced the quality of sleep [57]. Likewise, a relevant study was carried out in 2018 on 492 nursing students in Indonesia to determine the prevalence of sleep disturbances and their associations with academic performance in terms of gender difference [26]. It was revealed that female nursing students were more prone to have poor educational progress, as the incidence of poor sleep, insomnia, and excessive daytime sleepiness reached 66.0%, 45.6%, and 24.3%, for males and 71.5%, 52.4%, and 28.8%, for females, respectively [26].

Furthermore, a study of 401 Spanish nursing students demonstrated that bad sleep habits and a short sleep pattern were substantially linked to a higher likelihood of inferior academic performance among young students under the age of 25 [58]. As a result of that, an estimated 30% of nursing students had poor sleep habits and 48% reported poor academic progress [58]. A systematic review investigated the consequences of sleep loss on nursing students by Shochat et al., who found that disrupted sleep patterns and inadequate sleep duration were substantially associated with negative outcomes on academic performance [59]. Scientific evidence has proven that sleep has an essential role in the learning process, since it restores brain activity, leading to better cognitive abilities and memory consolidation [60]. Therefore, Gallego-Gómez et al. suggested that promoting sleep hygiene by regulating the sleep-wake cycle, minimizing overstimulating activities, and using technology prior to habitual bedtime may enhance the sleep pattern [58].

Inadequate sleep quantity and daytime sleepiness were predominant sleep complaints among nursing students, influencing their academic performance and daytime functioning [61]. Furthermore, it indicated that there was a statistically

significant effect of daytime naps and daily sleep duration on students' GPA [61]. As students with sleep disorders had higher probability of acquiring bad grades in class, and correspondingly poor academic results [61]. Angelone et al. found an overall prevalence of insomnia around 27% among 364 nursing students in Italy, with a relativity high proportion of insomnia rising with age [62]. As the percentage of insomnia among students under the age of 20 is equivalent to 10%, versus 46% for those over the age of 40 [62]. In addition, poor sleep quality was significantly correlated with unsatisfactory academic progress among study subjects [62].

Similarly, numerous published studies had shown that disrupted sleep patterns and poor sleep quality were widespread phenomena among nursing students in Malaysia, Saudi Arabia, and Nepal, which were closely associated with poorer grade point averages (CGPA) and consequently affects academic achievement [63-65]. On the contrary, Zimmerman and Eliasson et al. stated that there was no remarkable effect on academic performance in terms of students' sleeping hours; however, demographic variables of students may have a substantial association with academic outcomes [66, 67]. A student who resides with his family tends to work hard to obtain greater academic results [66, 67].

Summary of insomnia and academic performance among nursing students

Nursing students are highly susceptible to insomnia episodes as a result of their hectic lifestyle in the academic environment and clinical setting [55]. Various studies showed that the prevalence rate of insomnia among nursing students was found to be 19-27% in Italy [56, 62], 30% in Spain [58], and 52% in Indonesia [26], with significant impacts on academic achievement. On the contrary, a relevant study indicated that there was no significant effect of sleep duration on the academic success [66, 67]. It was

reported that the incidence rate of insomnia was significantly higher in females nursing students [26] and junior students [58]; however, a pertinent study illustrated that the risk of developing insomnia increases with age, as the elderly are more susceptible to insomnia compared to the young [62]. Disrupted sleep patterns and coffee consumption prior to bedtime were substantially linked to poor sleep quality, which had adverse impacts on students' GPAs [57, 59]. Consequently, sleep hygiene is a fundamental aspect to regulate the sleep-wake cycle, and reducing stimulants before the usual bedtime may improve sleep patterns and quality [58].

Insomnia and academic performance among university students

Insomnia is highly correlated with unhealthy behaviors and implications for university students' daily functioning and academic performance [68]. A systematic review of 7 articles conducted by Jiang et al. indicated that risk of insomnia symptoms was significantly higher odds among university students than in the general population, with an estimated prevalence ranging from 9.4% to 38.2% [69]. Additionally, a recent systematic review demonstrated that insomnia is a universal sleep complaint closely associated with adverse effects on students' concentration impairing academic performance. Besides, 35% to 70% of university students in South Asian regions reported having insomnia [70].

Insomnia and insufficient sleep duration have serious consequences on the academic success of higher education students [71]. In 2018, a national survey from Norway, including a large sample size of more than 50,000 university students showed that insomniac students were significantly associated with delayed study progress and failed examinations [71]. Moreover, there was a statistically significant effect between sleep duration and academic failure, as those who slept for less than 5 hours or more

than 10 hours had greater odds of failing exams compared to those who typically slept for 7 to 9 hours [71]. In this study, it was pointed out that the proportion of students reporting difficulties initiating or maintaining sleep had increased dramatically from 23% in 2010 to 31% in 2018 [71].

It is well reported that sleep deficit and disturbed sleep quality are negatively affects students' learning ability and academic performance, which is consequently impaired neurocognitive functioning and educational success [72]. Gaultney found that American college students with insomnia had six-fold odds more to fail academically with a GPA of less than 2.0 compared to healthy students [73]. A recently published cross-sectional study conducted on 582 university students in Spain revealed that the percentage of students suffering from insomnia was around 40% [74]. Furthermore, it illustrated that stress, depression and anxiety were major contributors to insomnia symptoms and consequently academic failure [74]. Phillips et al. concluded that irregular sleep patterns were substantially linked to delayed circadian rhythms and lower academic achievement [75]. In addition, numerous studies had documented clinically significant effect of insomnia symptoms on academic achievement among university students where it was found that insomnia was prevalent at a rate of approximately 11% in Lebanon, 12% in Turkey, and 26% in the United States [52, 76, 77].

Summary of insomnia and academic performance among university students

Insomnia is significantly linked to critical behaviors that negatively affect the quality of life and academic performance of university students (59). Numerous studies demonstrated that the prevalence rate of insomnia among university students ranged

from 9% to 70%, and found a significant impact on their neurocognitive functioning and, subsequently, their academic achievement (60,61,65, 44, 67, 68). A related study found that over the course of eight years, the proportion of students reporting symptoms of insomnia significantly increased from 23% to 31% (62). Irregular sleep patterns, stress, and psychological disorders, including depression and anxiety were highly correlated with delayed circadian rhythms and academic failure (65,66). A typical sleep duration of seven to nine hours is a prerequisite for academic success, as it revealed that sleep for less than five hours or more than ten hours was closely related to the deterioration of student grades in exams.

CHAPTER III

Methodology

This chapter provides an overview of the methods and procedures that will be utilized to conduct this study. It will be a cross-sectional study to investigate the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia and the United States of America. It will be a self-report study using a validated questionnaire which is Insomnia Severity Index (ISI) to assess insomnia prevalence and severity, while academic performance will be evaluated through students' Cumulative Grade Point Average (CGPA). The study design was chosen for its ability to answer the research questions conveniently, saving time and resources.

Research Questions

This study will explore the following research questions:

1. What is the prevalence rate of insomnia among RT students in SA and the USA?
2. What is the insomnia severity among RT students in SA and the USA?

3. What is the impact of insomnia on academic performance among RT students in SA and the USA?
4. What is the association between demographic variables and insomnia prevalence among RT students in SA and the USA?

Study instrument

This study will be conducted by using a self-report questionnaire that focuses mainly on collecting data about sociodemographic variables, insomnia severity, and the student's academic progress. Insomnia Severity Index (ISI) is a valid and reliable instrument that measures the person's impression of the severity of their insomnia symptoms during the previous 30 days. It comprises seven questions that evaluate the severity of sleep initiation, sleep maintenance, early morning awakening, sleep dissatisfaction, and sleep interference with daily activities. The overall score ranges from 0 to 28, with each item being scored on a five-point Likert scale from 0 (none) to 4 (very severe). The following categories of results are used to interpret the data: no clinically significant insomnia (0-7), subthreshold insomnia (8-14), moderately severe insomnia (15-21), and severe insomnia (22-28) [78, 79]. Academic performance will be evaluated through the student's Cumulative Grade Point Average (CGPA). It will be classified into good, average, poor, and very poor academic performance. For Saudi Arabia RT students, Good is 4.50-5.00, average is 3.50-4.49, poor is 2.5-3.49, and very poor is below 2.5. For American RT students, Good is 3.50-4.00, average is 2.50-3.49, poor is 1.5-2.49, and very poor is below 1.5.

Study Design and Setting

The study will be carried out through a cross-sectional design to assess the prevalence of insomnia and its impacts on academic performance among respiratory

therapy students in Saudi Arabia and the United States of America. According to Almeshari et al. (2022), twenty-three departments of respiratory therapy were detected in Saudi Arabia, four of which claimed to be inactive [80]. The first and second years are pre-medical years, which entail the study of basic sciences. The third to fourth year involves studying respiratory therapy courses. The fifth year in Saudi Arabia only is the internship year, where the student is entirely immersed in clinical training without receiving theoretical classes. Therefore, the study will be carried out on 19 educational institutions that offer a five-year bachelor's degree program in Saudi Arabia, and Georgia State University which has a four-year bachelor's degree program and a two-year master's degree program.

Study Population and Sampling Technique

The study seeks to include a convenient sample of respiratory therapy students in Saudi Arabia's universities and at Georgia State University in the United States of America. A recent study established by Al-Mashari et al. found that 1297 students were enrolled in respiratory care programs [80]. However, the proportion of internship students out of the overall study population is unknown. Thus, assuming that 1,000 students between the second and fourth academic years. As such, this study is expected to reach 278 participants with a confidence interval of 95% and a margin of error of 5%. Internship-year students will be excluded from the study because their academic performance will not be affected.

Data Collection

The data collection process will initiate after obtaining Institutional Review Board (IRB) approval. A validated questionnaire will be distributed electronically to the students' e-mail addresses through direct coordination with the directors of

respiratory therapy departments. It will be administered in English as it is the approved language of teaching in the College of Applied Medical Sciences. As such, a cover page with the survey's goal will be included with the survey. Moreover, informed consent will be obtained from the students, indicating that participation in the study is voluntary while maintaining the candidate's confidentiality, as participants' identities will not be requested. Furthermore, contact information for the principal investigator of the study will be provided for any additional inquiries regarding the study.

Data Analysis

In this study, data were entered using a Microsoft Excel Sheet and will be coded and organized for statistical analysis. For data analysis, the Statistical Package for Social Sciences (SPSS) software version 28 will be utilized. Descriptive statistics of the participants will be presented in frequencies, percentages, means, and standard deviations for categorical variables. An Independent t-test will be used to measure differences in insomnia with different demographic variables. A one-way ANOVA test will be utilized to analyze the comparison of ISI scores between and among categorical groups. A p-value >0.05 is considered to represent a statistically significant correlation.

CHAPTER IV

Results

This chapter provides an overview of the results and statistical analysis procedures that will be used to conduct this study. This study aimed to assess the prevalence of insomnia and its impact on academic performance among respiratory therapy (RT) students in Saudi Arabia (SA) and the United States of America (USA). Data collection was conducted by distributing an electronically validated questionnaire to students'

email addresses through direct coordination with RT department directors. A total of 403 responses were received using a non-probability convenience sampling technique. Additionally, this chapter will offer a clear presentation of the study findings to answer the research questions.

Research Questions

This study aimed to investigate the following research questions:

1. What is the prevalence rate of insomnia among RT students in SA and the USA?
2. What is the insomnia severity among RT students in SA and the USA?
3. What is the impact of insomnia on academic performance among RT students in SA and the USA?
4. What is the association between sociodemographic variables and insomnia prevalence among RT students in SA and the USA?

Demographic characteristics of the study participants

A total of 403 responses were received from RT students between June 9 and September 12, 2023. More than half of the study participants were male 230 (57.1%) with a mean age of 22.75 years old (SD ±3.8). Responses were collected from two countries: 322 (79.9%) from Saudi Arabia (SA) and 81 (20.1%) from the United States of America (USA). The majority of the study respondents were bachelor's degree students 354 (87.8%), in the fourth academic year 171 (42.4%), and never smoked 267 (66.3%). Most of the RT students were single 342 (84.9%) and had a cumulative GPA between (4.50 – 5.00 in SA) or (3.50 – 4.00 in the USA) 223 (55.3%). Almost one-third of RT students 139 (34.5%) reported moderate levels of difficulty falling asleep, mild levels of difficulty staying asleep, and a higher proportion experienced mild to moderate levels of difficulty waking up too early in the morning 120 (29.8%) and 128 (31.8%),

respectively. Approximately one-third of study participants were moderately satisfied about their current sleep pattern 132 (32.8%), while 143 (35.5%) reported that their current sleep pattern a little impaired their quality of life. Most of the RT students 123 (30.5%) were a little worried about their current sleep pattern and reported that their current sleep pattern interferes with daily functioning. The full sociodemographic, academic, and sleep pattern characteristics of the study population are presented in Table 1.

Table 1: Demographic, academic and sleep patterns characteristics of the study participants (n= 403).

Variables	**Frequency (%), m (±SD)**
Gender n (%)	
Male	230 (57.1%)
Female	173 (42.9%)
Age (mean, ±SD)	22.75 ±3.8
Geographical **location n (%)**	
Saudi Arabia (SA)	322 (79.9%)
United States (USA)	81 (20.1%)
Academic degree n (%)	
Bachelor's degree	354 (87.8%)
Master's degree	49 (12.2%)
Academic year n (%)	
First year	27 (6.7%)
Second year	69 (17.1%)
Third year	136 (33.7%)
Fourth year	171 (42.4%)
Smoking status n (%)	
Non-smoker	267 (66.3%)
Former-smoker	55 (13.6%)
Current-smoker	81 (20.1%)
Marital status n (%)	
Single	342 (84.9%)
Married	61 (15.1%)
Cumulative GPA n (%)	
4.50 – 5.00 in SA or 3.50 – 4.00 in USA	223 (55.3%)
3.50 – 4.49 in SA or 2.50 – 3.49 in USA	156 (38.7%)
2.50 – 3.49 in SA or 1.50 – 2.49 in USA	24 (6.0%)
Difficulty falling asleep n (%)	

None	68 (16.9%)
Mild	137 (34.0%)
Moderate	139 (34.5%)
Severe	47 (11.7%)
Very severe	12 (3.0%)
Difficulty staying asleep n (%)	
None	105 (26.1%)
Mild	139 (34.5%)
Moderate	115 (28.5%)
Severe	33 (8.2%)
Very severe	11 (2.7%)
Difficulty waking up too early in the morning n (%)	
None	48 (11.9%)
Mild	120 (29.8%)
Moderate	128 (31.8%)
Severe	83 (20.6%)
Very severe	24 (6.0%)
Satisfaction of current sleep pattern n (%)	
Very satisfied	37 (9.2%)
Satisfied	89 (22.1%)
Moderately satisfied	132 (32.8%)
Dissatisfied	111 (27.5%)
Very dissatisfied	34 (8.4%)
Current sleep pattern impairs quality of life n (%)	
Not at all Noticeable	61 (15.1%)
A Little	143 (35.5%)
Somewhat	138 (34.2%)
Much	42 (10.4%)
Very Much Noticeable	19 (4.7%)
Worry/Distress about current sleep pattern n (%)	
Not at all Worried	88 (21.8%)
A Little	123 (30.5%)
Somewhat	122 (30.3%)
Much	57 (14.1%)
Very Much Worried	13 (3.2%)
Current sleep pattern interferes with daily functioning n (%)	
Not at all Interfering	48 (11.9%)
A Little	114 (28.3%)
Somewhat	123 (30.5%)
Much	87 (21.6%)
Very Much Interfering	31 (7.7%)

Data are presented as frequency and percentage or mean ± standard deviation.

The prevalence of insomnia among RT students in Saudi Arabia

The prevalence of insomnia among RT students in Saudi Arabia was 32.3%. The mean score for the ISI was 11.7 (± 5.2), indicating subthreshold level of insomnia. Data from the ISI questionnaire indicated that 151 (46.9%) were at the subthreshold level of clinical insomnia, while 98 (30.4%) experienced moderate level of insomnia, and 6 (1.9%) suffered from severe clinical insomnia. The full data interpretation of prevalence and severity of insomnia among RT students in SA are presented in Table 2.

Table 2: Prevalence and severity of insomnia among RT students in Saudi Arabia (n= 322).

Severity of insomnia	Frequency (%)
No clinically significant insomnia	67 (20.8%)
Subthreshold insomnia	151 (46.9%)
Clinical insomnia (moderate severity)	98 (30.4%)
Clinical insomnia (severe)	6 (1.9%)

Data are presented as frequency and percentage.

The prevalence of insomnia among RT students in the United States of America

The prevalence of insomnia among RT students in the United States of America was 21%. The mean score for the ISI was 10.6 (± 4.6), indicating subthreshold level of insomnia. Data from the ISI questionnaire indicated that 44 (54.3%) were at the subthreshold level of clinical insomnia, while 15 (18.5%) experienced moderate level of insomnia, and 2 (2.5%) suffered from severe clinical insomnia. The full data interpretation of prevalence and severity of insomnia among RT students in the USA are presented in Table 3.

Table 3: Prevalence and severity of insomnia among RT students in United States of America (n= 81).

Severity of insomnia	Frequency (%)
No clinically significant insomnia	20 (24.7%)
Subthreshold insomnia	44 (54.3%)
Clinical insomnia (moderate severity)	15 (18.5%)
Clinical insomnia (severe)	2 (2.5%)

Data are presented as frequency and percentage.

Association between insomnia and demographic characteristics of RT students in Saudi Arabia (SA).

A one-way ANOVA test analysis revealed that female RT students had significantly higher insomnia scores than male students (12.7 vs. 10.9) ($p = 0.003$). RT students who were in the second academic year had significantly higher insomnia scores compared to their counterparts in all academic years (second year: 13.8, third year: 11.8, fourth year: 10.8) ($p = 0.003$). RT students who were current smokers had significantly higher insomnia scores than those who were former smokers or who never smoked (current smokers: 15.1, former smokers: 12.1, never smoked: 10.6) ($p > 0.001$). Single RT students had significantly higher insomnia scores than married RT students (12.0 vs. 8.2) ($p > 0.001$). RT students with a cumulative GPA of 2.50–3.49 in SA or 1.50–2.49 in USA had significantly higher insomnia scores compared to other students (GPA of 2.50–3.49 in SA or 1.50–2.49 in USA: (14.4), GPA of 3.50–4.49 in SA or 2.50–3.49 in USA: (13.9), GPA of 4.50–5.00 in SA or 3.50–4.00 in USA: (9.5), $p > 0.001$). The full results of the one-way ANOVA analysis are presented in Table 4.

Table 4: Comparison of ISI score with different sociodemographic variables among RT students in Saudi Arabis (SA).

Variables	N	Mean	SD	P value
Overall ISI	322	11.7	5.2	-
Gender				
Male	188	10.9	5.1	**0.003**
Female	134	12.7	5.2	
Academic year				
Second year	45	13.8	4.8	**0.003**
Third year	130	11.8	5.4	
Fourth year	147	10.8	5.0	
Smoking status				
Never smoke	222	10.6	5.1	**>0.001**
Former smoker	37	12.1	4.6	
Current smoker	63	15.1	4.4	
Marital status				
Single	292	12.0	5.0	**>0.001**
Married	30	8.2	6.0	
Cumulative GPA				
4.50 – 5.00 in SA or 3.50 – 4.00 in USA	167	9.5	4.4	**>0.001**
3.50 – 4.49 in SA or 2.50 – 3.49 in USA	137	13.9	5.0	
2.50 – 3.49 in SA or 1.50 – 2.49 in USA	18	14.4	5.0	

Abbreviations: ISI: Insomnia Severity Index. SD: Standard Deviation. GPA: Grade Point Average.

Association between insomnia and demographic characteristics of RT students in the United States (USA).

A one-way ANOVA test analysis found that RT students who were current smokers had significantly higher insomnia scores than those who were former smokers or who never smoked (current smokers: 13.7, former smokers: 11.0, never smoked: 9.2) ($p >$ 0.001). However, no significant associations were found between insomnia and gender

(p = 0.861), academic degree (p = 0.608), academic year (p = 0.531), marital status (p = 0.587), or cumulative GPA (p = 0.193). The full results of the one-way ANOVA analysis are presented in Table 5.

Table 5: Comparison of ISI score with different sociodemographic variables among RT students in the United States (USA).

Variables	N	Mean	SD	P value
Overall ISI	81	10.6	4.6	-
Gender				
Male	42	10.7	4.2	**0.861**
Female	39	10.5	5.0	
Academic degree				
Bachelor's degree	32	10.9	4.9	**0.608**
Master's degree	49	10.4	4.4	
Academic year				
First year	27	9.5	4.1	**0.531**
Second year	24	11.1	4.5	
Third year	6	10.7	2.4	
Fourth year	24	11.2	5.5	
Smoking status				
Never smoke	45	9.2	3.8	**>0.001**
Former smoker	18	11.0	4.1	
Current smoker	18	13.7	5.3	
Marital status				
Single	50	10.8	4.8	**0.587**
Married	31	10.2	4.2	
Cumulative GPA				
4.50 – 5.00 in SA or 3.50 – 4.00 in USA	56	10.	4.2	**0.193**
3.50 – 4.49 in SA or 2.50 – 3.49 in USA	19	11.7	5.3	

2.50 – 3.49 in SA or 1.50 – 2.49 in USA	6	12.7	5.2

Abbreviations: ISI: Insomnia Severity Index. SD: Standard Deviation. GPA: Grade Point Average.

CHAPTER V

Discussion

This chapter intends to discuss the study findings that were presented in Chapter IV. Also, it will provide a brief overview of the study results, a discussion of the main findings of the study, the strengths and limitations of the study, and a conclusion.

Overview of the study results

To the best of my knowledge, this is the first study that aimed to assess the prevalence of insomnia and its impact on the academic performance of respiratory therapy students in the Kingdom of Saudi Arabia (SA) and the United States of America (USA). This study found that insomnia was a common sleep disorder among RT students in both SA (32%) and the USA (21%), despite the fact that the majority (48%) reported a sub-threshold level of insomnia on the Insomnia Severity Index (ISI). In addition, insomnia scores were significantly higher among Saudi RT students who were female, in their second academic year, current smokers, single, and those with a poor cumulative GPA. In contrast, insomnia scores were significantly higher only among current smoker RT students in the USA.

Discussion of the main findings of the study

Insomnia is a prominent sleep disorder among health sciences students, compromising both their well-being and academic performance [25]. In this study, the prevalence of insomnia among respiratory therapy students in the Kingdom of Saudi Arabia and the United States of America was found to be 32% and 21%, respectively.

These findings are consistent with previous research conducted on medical students in Saudi Arabia, which showed a relatively similar incidence rate of insomnia ranging from 31% to 35% [27, 32, 81]. Notwithstanding, the prevalence of insomnia in the United States was slightly low compared to a recent study of US college students, where nearly a quarter (26%) were at greater risk of experiencing insomnia [77]. Numerous studies have demonstrated significant discrepancies in the prevalence of insomnia among medical students around the world, including Jordan (18%) [34], China (28%) [37], Poland (37%) [33], and Pakistan (41%) [31]. Similarly, a worldwide survey-based study on a sizable sample (n=1115) of dental students reported that insomnia was a common sleep disorder at a rate of 25%, with one in every four students exhibiting insomnia symptoms [82]. Likewise, a cross-sectional study of 364 nursing students in Italy revealed that over a quarter of the students (27%) suffered from insomnia [62]. In comparison to our study findings, the prevalence of clinical insomnia was slightly higher among the general population in Saudi Arabia (37%) [83] and the United States (23%) [84]. The observed heterogeneity in prevalence rates across studies can be attributed to several factors, including significant variations in sociocultural norms among different populations, which may influence sleep patterns and the manifestation of insomnia symptoms. Additionally, methodological differences in study design, sampling techniques, assessment tools, and diagnostic criteria for insomnia could contribute to the disparities in prevalence rates.

Interestingly, gender had a significant impact on the insomnia phenotype in Saudi Arabia, as it was observed that Saudi female RT students were more likely to have insomnia symptoms compared to their male counterparts. Our study findings align with previous relevant studies on medical students in Saudi Arabia that reported similar gender differences, with female students exhibiting higher rates of insomnia symptoms

[32, 81]. Moreover, clinical research carried out in the USA has shown that women tend to have poorer sleep quality and a higher risk of developing insomnia [85, 86]. Additionally, a recent systematic review of seven articles emphasized the vulnerability of females to insomnia disorder [70]. Other relevant studies demonstrated similar outcomes, where females had higher odds of experiencing insomnia [31, 87-89]. Nonetheless, only limited studies reported that males were more prone to suffer from insomnia than females [36, 90]. These results highlight the consistent gender disparity in insomnia prevalence, which could be due to certain psychological disorders affecting women's health. Previous evidence pointed out that females were more prone to anxiety, depression, and stress, which are common contributors to insomnia [91-92]. Specifically, individuals experiencing these mental health conditions often exhibit heightened arousal and hyperactivity in the central nervous system, making it challenging for the mind and body to transition into a relaxed state conducive to sleep [93-95].

Regarding the academic year, our study found that Saudi RT students in their second academic year reported higher rates of insomnia than their colleagues in all other academic years. In accordance with this, a cross-sectional study carried out among medical students in Saudi Arabia showed that second-year students were more affected by insomnia symptoms [81]. Similarly, numerous studies have found a significant association between insomnia and the academic year, with students in the earlier academic years, i.e., the first and second years, being more likely to experience insomnia compared to their senior counterparts [25, 52]. In addition, a recent global survey-based study with a large sample of college students from various countries revealed that clinical insomnia accompanied by excessive daytime sleepiness was frequently observed among first-year students, resulting in a low quality of life [96]. These findings could be due to overburdened academic obligations, protracted study periods, or an emotionally stressful lifestyle [29, 97]. Furthermore, previous literature

has pointed out that academic workload, transitional challenges, and stress associated with progressing in the program may all contribute to greater levels of insomnia among junior students [87, 98].

In the current study, it was observed that current smoker RT students in both Saudi Arabia and the United States were at greater risk of developing insomnia than those who had never smoked. In line with this, a survey of US adults showed that smoking is significantly associated with increased severity of insomnia and decreased sleep duration, especially nightly smoking [99]. Previous research had indicated that smoking was a contributing factor to insomnia incidents, as it affected an individual's sleep pattern, leading to decreased sleep efficiency [100, 101]. Accordingly, a related study on nursing students demonstrated that nicotine's stimulating effects were substantially correlated with poor sleep hygiene, prolonged sleep latency, and increased insomnia severity among smokers [102]. It is well established that nicotine addiction and the nightly withdrawal impacts of smoking have been found to disrupt sleep architecture and contribute to the development of insomnia [103, 104]. Specifically, cigarette smoking can potentially interrupt the circadian rhythm of sleep by disrupting the release of specific neurotransmitters involved in regulating the sleep-wake cycle, thus increasing the likelihood of insomnia [105, 106].

In terms of marital status, our study found that single Saudi RT students were more susceptible to having insomnia than their married peers. Corroborating our findings, previous relevant studies in Saudi Arabia have indicated that being single, divorced, or widowed was a major risk factor that increased the probability of getting insomnia-related symptoms due to social strain [83, 87]. In addition, a recent epidemiological study in the USA showed that married individuals tend to have better overall sleep health, specifically normal sleep duration, decreased insomnia symptoms, and increased sleep efficiency [16]. Likewise, subsequent literature demonstrated that

married students were less likely to experience insomnia symptoms, indicating that the lack of a spouse or social support can alter sleep patterns, leading to greater levels of insomnia among single students [39, 107, 108]. As such, a meta-analysis of 84 articles found a significant medium association between insomnia and loneliness, which negatively worsened insomnia symptoms, while perceived social support improved sleep quality [109].

Lack of sleep, poor sleep quality, irregular sleep/wake rhythms, and insomnia are all contributing factors to poor academic performance in students [106, 107]. Our study found that Saudi RT students with a low cumulative GPA had significantly greater insomnia scores than other students. Analogously, a cross-sectional study of medical students in Saudi Arabia reported that insomnia and low quantity and quality of sleep were significantly associated with an increased risk of academic jeopardy [27]. Additionally, several relevant studies in the USA have indicated that irregular sleep patterns induce delayed circadian rhythms and consequently increase the risk of insomnia and lower academic performance [75, 110]. Furthermore, previous literature has revealed that medical students with good sleep quality have an excellent GPA and a lower risk of developing insomnia [25, 112]. Moreover, a national survey of Norwegian college students reported that insomnia and short sleep duration were considerably linked with higher odds of failing exams and delayed academic progress [71]. This negative association can be explained by the detrimental implications of insomnia, which can impede students' academic performance due to impairments in memory consolidation, learning ability, and cognitive functioning [113].

Strengths and limitations:

This study is noteworthy since it is the first to assess the prevalence of insomnia and its impact on academic performance among respiratory therapy students in the Kingdom of Saudi Arabia (SA) and the United States of America (USA). Nevertheless, certain characteristics of the study limit its scope. The study used a cross-sectional design, which limits the ability to determine causality and temporary relationships between variables. In addition, the assessment of insomnia relied on self-report measures, resulting in subjective data that could potentially introduce recall bias. Moreover, the study may be subject to selection bias, which hampers the generalizability of the results across the USA because the participants were recruited from a single educational institution compared to the Saudi respondents, who were from several educational programs across the country. Furthermore, insomnia can arise from many causes other than academic load, including socioeconomic status and comorbid medical or psychiatric conditions, so investigating these confounding factors may alter interpretations of study results. In light of these limitations, further research using well-representative samples, longitudinal designs, and objective measures of sleep such as polysomnography or actigraphy is warranted to improve understanding of these associations and provide more robust evidence for effective interventions and coping strategies that promote healthy sleep habits among RT students.

Conclusion

Insomnia was a prevalent sleep disorder among respiratory therapy students in both Saudi Arabia and the United States. Insomnia was negatively correlated with students' academic performance. Several demographic factors were significantly associated with a higher level of insomnia, including females in their second academic year, current smokers, singles, and those with a poor GPA. Therefore, this study

provides valuable insights for educational institutions and stakeholders to work collaboratively to implement tailored interventions and coping strategies that support students' healthy sleep habits, mental well-being, and academic achievement.

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Appendix A: Informed Consent and Study Questionnaire

Prevalence of Insomnia and Its Impact on Academic Performance Among Respiratory Therapy Students in Saudi Arabia (SA) and the United States of America (USA).

You are invited to participate in a research study entitled "Prevalence of Insomnia and Its Impact on Academic Performance Among Respiratory Therapy Students in Saudi Arabia (SA) and the United States of America (USA)." Insomnia is defined as a sleep disorder where the person may have difficulties falling asleep, staying asleep, or getting good sleep quality. The aim of this study is to assess the prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia and the United States of America.

The questionnaire will take 3 minutes to complete, and it is completely voluntary to take part and participate in the study. The data will be used confidentially and for research purposes only.

By answering the first question, you voluntarily agree to participate in this study and give your consent to use your anonymous data for research purposes.

"You do not have to be in this study. You may skip questions or stop participating at any time".

For any additional inquiries regarding the study:

Principal investigator
Dr. Brandenberger, Kyle
Georgia State University
Email: kbrandenberger1@gsu.edu.

Demographic Data

1- Your gender:

- Male
- Female

2- Your age:

3- Your university's geographical location:

- Saudi Arabia
- United States

4- Your academic degree:

- Bachelor's degree
- Master's degree

5- Your academic year:

- First year
- Second year
- Third year
- Fourth year

6- Your smoking status:

- Never smoke
- Former smoker
- Current smoker

7- Your marital status:

- Single
- Married

8- Your cumulative GPA: Please choose the appropriate option for your GPA in Saudi Arabia (SA) or United States (USA)

- 4.50 - 5.00 in SA or 3.50 - 4.00 in USA
- 3.50 - 4.49 in SA or 2.50 - 3.49 in USA
- 2.50 - 3.49 in SA or 1.50 - 2.49 in USA
- < 2.50 in SA or < 1.50 in USA

Insomnia Severity Index:

For each question, please **CIRCLE** the number that best describes your answer.

Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

Insomnia Problem	None	Mild	Moderate	Severe	Very Severe
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

Very Satisfied	Satisfied	Moderately Satisfied	Dissatisfied	Very Dissatisfied
0	1	2	3	4

5. How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life? Not at all Noticeable

A Little	Somewhat	Much	Very Much Noticeable
1	2	3	4

6. How WORRIED/DISTRESSED are you about your current sleep problem? Not at all Worried

A Little	Somewhat	Much	Very Much Worried
1	2	3	4

7. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY? Not at all Interfering

A Little	Somewhat	Much	Very Much Interfering
1	2	3	4

Appendix B: IRB Approval

INSTITUTIONAL REVIEW BOARD

Mail: P.O. Box 3999
Atlanta, Georgia 30302-3999
Phone: 404/413-3500

In Person: 3rd Floor
58 Edgewood
FWA: 00000129

June 05, 2023

Principal Investigator: Kyle Brandenberger

Key Personnel: Alasimi, Ahmed H; Brandenberger, Kyle

Study Department: Respiratory Therapy

Study Title: The prevalence of insomnia and its impact on academic performance among respiratory therapy students in Saudi Arabia (SA) and the United States of America (USA).

Submission Type: Exempt Protocol Category 2

IRB Number: H23621

Reference Number: 374753

Determination Date: 06/05/2023

Status Check Due By: 06/04/2026

The above-referenced study has been determined by the Institutional Review Board (IRB) to be exempt from federal regulations as defined in 45 CFR 46 and has evaluated for the following:

1. Determination that it falls within one or more of the eight exempt categories allowed by the institution; and
2. Determination that the research meets the organization's ethical standards

If there is a change to your study, you should notify the IRB through an Amendment Application before the change is implemented. The IRB will determine whether your research continues to qualify for exemption or if a new submission of an expedited or full board application is required.

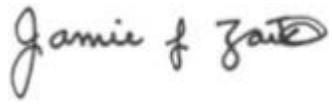
A Status Check must be submitted three years from the determination date indicated above. When the study is complete, a Study Closure Form must be submitted to the IRB.

This determination applies only to research activities engaged in by the personnel listed on this document.

It is the Principal Investigator's responsibility to ensure that the IRB's requirements as detailedin the Institutional Review Board Policies and Procedures For Faculty, Staff, and Student Researchers (available at gsu.edu/irb) are observed, and to ensure that relevant laws and regulations of any jurisdiction where the research takes place are observed in its conduct.

Any unanticipated problems resulting from this study must be reported immediately to theUniversity Institutional Review Board. For more information, please visit our website at www.gsu.edu/irb.

Sincerely,



Jamie Zaikov, IRB Member