IDENTIFYING ADVERSE OUTCOMES FROM INSUFFICIENT SLEEP IN THE HOSPITALIZED NON-CRITICAL OLDER ADULT POPULATION: A SYSTEMATIC REVIEW

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Abstract

On average, humans spend one-third of their lives fulfilling basic sleep needs (Cirelli, 2019). Theories suggest that sleep improves immune responses, reduces energy, allows for the recuperation of cognitive functions, and removal of waste; however, the exact function is unknown (Zielinski, McKenna & McCarley, 2016). Research has revealed when sleep is chronically disrupted the individual experiences a reduction in their quality of life, an increased risk for mortality as well as cerebrovascular and cardiovascular events (Chattu, Sakhamuri, Kumar, Spence BaHammam & Pandi-Perumal, 2018). Ever changing variables that affect sleep in the hospital setting have created a need to ask the question, what happens when such disruptions occur in an environment like the hospital? Therefore, the primary purpose of this study was to identify adverse outcomes associated with insufficient sleep experienced by hospitalized non-critical older adults in literature.

Design

A systematic review utilized the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane, Health Source, and MEDLINE which included original, full length, English-text publications with dates limited to January 2010 to October 2019.

Methods

The systematic review was used to identify adverse outcomes with the inclusion criteria of non-critical, adults older than 65 years, who have experienced insufficient sleep while

hospitalized for more than one night. A secondary review was completed to ensure the quality and validity of the studies reviewed, while data was reported through narrative skills.

Findings

The research produced 406 full-text articles that were evaluated for eligibility, and 400 studies were excluded due to exclusion criteria. A total of six articles met the full inclusion criteria for the systematic review. Out of the six studies, three studies describe delirium as a possible adverse outcome of insufficient sleep experienced by an older hospitalized adult. Two studies noted a correlation of insufficient sleep with reporting of poor quality of sleep. Finally, the last study indicated a relationship between poor sleep with increased confusion experienced by cognitively impaired older subject.

Conclusion

Delirium, poor quality of sleep, and increased confusion could be considered an adverse outcome from insufficient sleep experienced by hospitalized, non-critical older adults. Future research will need to study the consequences of insufficient sleep experienced by this population.

Clinical Relevance

Addressing insufficient sleep in the hospital may reduce the risk of delirium, poor quality of sleep, and worsening confusion in the older adult patient.

Keywords: sleep, sleep disruption, geriatric, older adult, adverse outcomes, hospitalized, a systematic review

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CHAPTER I. INTRODUCTION

Background

The American Academy of Sleep Medicine partnered in 2013 with the Centers for Disease Control and Prevention (CDC) to recognize sleep insufficiency as a public health epidemic (Hatcher, 2013). The estimated economic impact of this epidemic is 280-440 billion dollars (Chattu et al., 2018). Insufficient sleep is defined as a reduction in the number of hours slept or the reduction of quality sleep with sleep requirements varying between age groups, socioeconomic status, and are specific to the individual (Cirelli, 2019). One group particularly affected by sleep insufficiency is the adult over the age of 65 years, with half of them reporting issues with sleep (Wennberg, Canham, Smith, & Spira, 2013). The American Academy of Sleep Medicine and Sleep Research Society recommends older adults obtain seven to eight hours of sleep a night (Chaput, Dutil & Sampasa-Kanyinga, 2018). When the older adult does not achieve sufficient sleep, they are at risk for developing mental symptoms like depression, anxiety, and physical symptoms such as increased blood pressure and impaired glucose control (Harvard Medical School, 2007a). In addition, this group makes up 40% of the adults in the hospital (Matthison, 2019). The hospital setting is well known for being unfavorable for good sleep hygiene. Hospitals can be a noisy environment with unfamiliar beds, climate, and lighting creating barriers to sleep. Hospitalized patients are subject to frequent monitoring, such as vital signs or blood sugar checks, which can disrupt sleep. Similarly, the administration of

medications and treatments, such as dressing changes, may occur at night and result in insufficient sleep (Auckley, 2019).

The purpose of this project was to complete a systematic review to identify adverse events associated with sleep insufficiency in the hospitalized non-critical older adult patient. This study was necessary due to the lack of research identifying adverse outcomes related to sleep insufficiency experienced by the non-critically ill older adult in the hospital setting. Finally, the authors wished to identify commonalities between studies on common causes of and short- and long-term sequela of sleep insufficiency.

Benefits of Sleep

The exact function of sleep is unknown. Though studies have shown numerous physiologic benefits, including the clearance of "brain waste" which allows for increased removal of molecular waste with adequate sleep (Zielinski et al., 2016, p. 1). Sleep has known anti-inflammatory benefits with a positive impact on the immune system, and is hypothesized that brain synapses weaken during sleep, which eliminates irrelevant information while conserving brain energy (Zielinski et al., 2016).

Memory and cognition have also benefitted from adequate sleep (Harvard Medical School [HMS], 2007b). Researchers have theorized that sufficient sleep is essential for proper memory functioning, including fact-based or declarative memory, as well as procedural memory, or remembering how to do something (HMS, 2007b). Finally, sleep enables new information to be stabilized or consolidated as a memory (HMS, 2007b).

Effects of Sleep Insufficiency

Insufficient sleep may be acute, affected for only a few days, or chronic, persistent problems for more than three months, both having individualized adverse effects related to it

(Cirelli, 2019). One night of poor sleep can lead to irritability, fatigue, and reduction in performance with increased risk for errors, as well as affect logical reasoning, subtraction, complex sentence formation, and attention (Cirelli, 2019). Studies have shown an individual chronically experiencing insufficient sleep (sleeping less than five hours a night) can have an approximate all-cause mortality of fifteen percent (Harvard Medical School [HMS], 2007a). Chronic sleep insufficiency is associated with mood disorders, poor quality of life, and increased stress (HMS, 2007a). Insufficient sleep individuals also experience an increase in the production of cortisol and insulin, placing the individual at increased risk for weight gain, elevated blood glucose, and diabetes (HMS, 2007a). In addition, insufficient sleep is linked to an increase in acute-phase protein called C-reactive protein (CRP). Elevated CRP increases the risk of atherosclerotic cardiovascular disease like heart disease, stroke, peripheral artery disease, aneurysm, heart failure, and diabetes (Crea & Morrow, 2019).

Watson and colleagues (2012) reported that insufficient sleep has been shown to place the older adult at risk for delirium. Delirium is a dysfunction of the brain and characterized by restlessness, hallucinations, "inattention, disorganized thinking, and an altered level of consciousness" (Watson, Ceriana, & Fanfulla, 2012, p. 356). Delirium has an increased mortality risk of 14 to 22% at one- and six-months post-hospitalization, and effects from delirium can still be present twelve months after onset (Francis, 2019).

Sleep in the Hospital

Hospitals are not conducive to healthy sleep hygiene due to environmental factors such as alarms from monitors, extraneous hallway sounds, or noise from other patients, which can exceed the World Health Organization (WHO), the recommendation of less than 40dBA for hospitals at night (Berglund, Lindvall, & Schwela, 1999). Park (et al. 2014) evaluated the

average noise in 29 wards of a hospital for 24 hours while evaluating 103 participants' perception of the quality of sleep using the Pittsburgh Sleep Quality Index (PSQI) and Leeds Sleep Evaluation Questionnaire. Results revealed the average noise level during this period was 63.5 dBA, with 86% of the participants reporting poor sleep, which correlated directly to noise (Park et al., 2014).

Auckley (2019) states that hospitalized patients are often disturbed during the late-night or early morning hours for their phlebotomy, medication administration, testing, or surgical procedures. Le and colleagues (2012) evaluated the causes of insufficient sleep in five Intensive Care Units (ICU) and found 200 participants' sleep interrupted by 1,831 nocturnal nursing interactions. These interactions included patient care activities, nursing assessments, and interventions. This study also reported sleep disruptions "may be associated with increased morbidity and/or mortality" (Le et al., 2012, p. 310).

Purpose of the Study

Through a systematic review, the authors searched to identify adverse outcomes from insufficient sleep in the hospitalized, non-critical older adult population.

Statement of Research Problem

Numerous studies described the cause of insufficient sleep in hospitalized patients; the primary purpose of this study was to identify in literature if adverse outcomes were associated with insufficient sleep experienced by the non-critical older adult.

Nature of Study

The problem required a systematic review of all available English, full-text articles found through Edinboro University’s electronic database published from January 2010 to October 2019. Keywords utilized in this literature search included ‘sleep,’ ‘older adult,’ and ‘hospital.’

Several criteria and factors were considered for inclusion in this review. A key consideration included the population over the age of 65 years old, hospitalized for at least two nights in a non-critical care unit in all countries, who experienced adverse outcomes from insufficient sleep. The sample size had no limits imposed. The final inclusion criterion covers all research with no time frame during which the studies took place. Exclusion criteria for this systematic review included any participant under the age of 65 years old, hospitalized for less than two nights, or whose care received outside the general ward unit. Literature that did not mention adverse outcomes associated with insufficient sleep were also excluded. All literature selected for review were assessed for validity by reviewing data that was present and identifying a cause-effect relationship between insufficient sleep and adverse outcomes experienced in the hospital.

Significance of the Study

Insufficient sleep in the hospital has been attributed to the setting and management of the disease. This study was based on the reported problem of insufficient sleep experienced by hospitalized patients and wanted to identify adverse outcomes associated with it. Adverse outcomes have an average financial burden of 17-29 billion dollars annually in the US, with 43.5% of incidents being preventable (de Vries et al., 2008). Therefore, if there is a relationship between insufficient sleep and adverse outcomes, hospitals will have evidence to promote the basic need for sleep through intervention and education (Cirelli, 2019).

Definitions of Key Terms

Adverse outcomes are unintentional injuries or complications resulting in a lengthen hospital stay, debility, or death, which was caused by a healthcare organization and not the patient's underlying condition (de Vries et al., 2008, p.216).

Older adult is anyone considered 65 years and older.

Hospitalization is spending more than one night in the hospital setting.

Quality of sleep is the number of interruptions of sleep (Chattu et al., 2018).

Quantity of sleep is the number of hours slept (Chattu et al., 2018).

Summary

Sleep is an essential human need that is not adequately studied while hospitalized. The older adults in the hospital are at increased risk for adverse outcomes (Matthison, 2019). The purpose of this project was to compile evidence of adverse outcomes from insufficient sleep in hospitalized older adults.

CHAPTER II. LITERATURE REVIEW

The purpose of this study was to identify if sleep insufficiency associated with adverse outcomes in hospitalized non-critical older adults. There is proof of adverse outcomes associated with chronic sleep deprivation as well as the factors that contribute to the insufficiency of sleep in the hospital. Matthews and colleagues (2016) mentioned knowledge gaps with adverse effects of poor sleep on health outcomes as well as the impact of sleep insufficiency during the hospitalization as the individual transitions out of the hospital. Addressing these problematic areas will support a need to create a model to incorporate sleep into care plans and provide education to healthcare workers reducing adverse outcomes, healthcare burden, and improve quality of life.

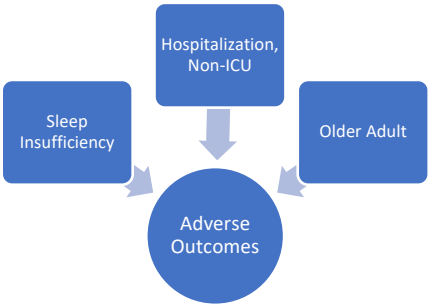
This literature review was completed with the help of Edinboro University of Pennsylvania's CINAHL, Cochrane, Health Source: Nursing/Academic Edition, and MEDLINE Complete. The publication dates for the search were specified from January 2014 to October 2019. The literature review utilized various combinations of search terms: sleep or sleep deprivation or sleep disruption or lack of sleep or sleep loss; older adult or aged or elderly;

outcomes, adverse outcomes or adverse healthcare events; hospitalization or hospital or inpatient. The literature had to be full-text and published in English.

Theoretical Framework

This systematic review utilized the Theory of Unpleasant Symptoms (TOUS) as a theoretical framework for the proposed hypothesis that sleep insufficiency experienced by non-critical older adults will result in adverse healthcare events. TOUS is a nursing theory composed of three parts. The first part of the theory is the symptom experienced by the patient. The next element of TOUS is the physiological, psychological, and environmental influences on the symptom. Then, interventions were created to address these influences. Finally, the outcomes are evaluated and monitored to ensure improvement in the quality of care with a reduction of adverse outcomes (Lenz, 2018) (see Figure 1).

Figure 1. Theoretical Framework



For this systematic review, the first part of the theoretical framework was to identify the symptom experienced by the patient, which was sleep insufficiency, also described as lack of sleep, loss of sleep, and/or sleep deprivation. The second factor is the various influences of insufficient sleep, which includes hospitalization (environmental), older adults experiencing an acute illness requiring treatment (physiological), and mood or cognition (psychological). The goal was to identify outcomes experienced by non-critical older adults affected by sleep insufficiency in the hospital. If the hypothesis is proven correct, then the systematic review may

be used as evidence to implement interventions to address factors contributing to sleep insufficiency in the hospital.

The predicted adverse outcomes associated with sleep insufficiency in the hospital are based on previous studies of chronic sleep insufficiency outcomes. These outcomes include irritability, fatigue, and increased stress (HMS, 2007a). Poor sleep also leads to an increase in the production of cortisol, thus elevating blood glucose as well as elevating blood pressure in individuals with a history of hypertension (HMS, 2007a). Lastly, sleep may be disrupted in the hospital, increasing the risk of developing delirium (Watson, Ceriana, & Fanfulla, 2012).

Non-critically ill patients were chosen due to the shortage of information on sleep insufficiency outside the ICU setting. The sample was specified as older adults due to their increased risk for hospitalization from chronic diseases. Therefore, the prediction is that the older adult is more likely to experience sleep insufficiency and increase their risk for adverse outcomes.

Related Research

Sleep Insufficiency Outcomes

The study of Le Grande et al. (2016) identified the prevalence of sleep insufficiency with its correlation to treatment adherence, competence, and anxiety/depression over 12 months in the cardiac population. Two Australian hospitals identified 134 patients who were hospitalized after acute myocardial infarction, bypass surgery, or percutaneous coronary intervention. Sleep insufficiency was evaluated using the Beck Depression Inventory, while Hospital Anxiety and Depression scale were used to assess anxiety and depression over three intervals (6 weeks, four months, and 12-months). The results revealed at six weeks, 69% of the participants had sleep disturbances. If it continued at four months, then the individual had a reduction in self-efficacy

and adherence to treatment. If the sleep disturbance continued at 12-months, then the participants had high anxiety and depression scores (Le Grande, Jackson, Murphy, & Thomason, 2016).

Van Herzlee and colleagues (2016) evaluated the treatment of nocturnal enuresis with desmopressin therapy in 30 Belgian pediatric (six to 16 years of age) participants. This study utilized video polysomnography and neuropsychological testing to assess sleep, quality of life, inattentiveness, functioning, and first enuresis. The results showed that the treatment of nocturnal enuresis with desmopressin delayed the first undisturbed sleep episode as well as improved neuropsychological functioning in ten of the participants (Van Herzeele et al., 2016). This study proved that reduction in night awakenings even in the pediatric population improves neurophysiological functioning, which could also enhance the quality of sleep.

Chiang (2014) completed a cross-sectional study that recruited 353 healthy adult participants with no medical history of cancer, end-stage renal disease, and chronic infectious disease from a southern hospital in Taiwan between 2009 to 2011. The study aimed at evaluating if a short duration of sleep correlates to the elevated inflammatory marker called high-sensitivity C-reactive protein (hs-CRP). Previous studies have linked elevated hs-CRP to diabetes and cardiovascular diseases. A research board approved this study, and the participants were able to give informed consent. Laboratory data, demographics, and questionnaires on sleep were obtained. The results revealed increased hs-CRP was associated with a 2.2 times higher risk in short sleep duration in participants. Increased inflammatory markers were also observed in participants over 70 years old with higher white blood cell count, creatinine, and glucose levels. Conversely, participants who had longer sleep periods of greater than five and a half hours had a lower risk of elevated hs-CRP (Chiang, 2014).

Musich and colleagues (2018) completed a retrospective study in adults over the age of 65 years who had new or chronic sleep medication prescriptions and risk for adverse health outcomes. This study identified that 70% of new users of sleep medication had a higher risk of falling compared to 22% of chronic users. It also reported older adults who started a sleep prescription had a higher risk for hospitalization (Musich et al., 2018).

Sleep Insufficiency and the Hospitalized Patient

Hospitalization is not conducive to proper sleep hygiene as sleep-wake cycles are disrupted due to routine laboratory monitoring, checking of vital signs, noise, and light sources. A study completed by Milani et al. (2018), over 2.5 years, evaluated 3,245 medical-surgical patients. The intervention group consisted of 1,185 participants who had measures implemented to reduce noise, delay laboratory testing and vital signs, the use of red lighting after sunset and received education to access their daily health records. Results in both quality and quantity of sleep improved. The intervention group also experienced a shorter length of stay by eight and a half hours with a 30-day readmission rate of 16% and higher reporting of improved emotional and mental health. This study concluded that minimal intervention could enhance the length of stay, quality, and quantity of sleep (Milani et al., 2018).

As research has shown, sleep disruption is prevalent in the hospital setting; however, understanding the adverse relationship between sleep and the patients' outcomes needs further exploration. Farrehi and collaborators (2016) examined whether the randomized education on sleep tools in the hospital for 120 adults in the non-ICU cardiac monitoring units had an impact on their health outcomes, inpatient opioid use, and length of stay. The results proved that education reduces fatigue and perception of pain. However, there was no significant difference between the use of opioids and the length of hospital stay (Farrehi et al., 2016).

A cross-sectional study completed by Javadi et al. (2015) studied factors that helped to improve the quality of sleep in the hospital from July 2013 to December 2013. This study used the PSQI and a research-design questionnaire to record 240 hospitalized heart failure patients' factors that contributed to sleep disruptions in the hospital. Results showed that 91.2 % of the participants reported poor quality of sleep. There was also a correlation of the quality of sleep with the participants' age, body mass index, number of comorbidities, medications, and length of stay (Javadi, Darvishpour, Mehrdad & Lakeh, 2015).

A descriptive-correlation study completed by Hacker and colleagues (2015) evaluated sleep in hospitalized stem cell transplant patients. This study used wrist actigraphy to monitor their rest and activities during their four to eight-day hospitalization. The personal data was collected during this period from the participants to evaluate sleep disturbance and quality of life. Results from this study showed that the total sleep time was 232 minutes, and only 14 of the 40 patients were able to get more than three hours of consecutive sleep. There was also an association between age and reports of sleep disturbance. As the length of hospital stay increased, participants also felt a correlation to increase sleep disturbance. Although no relationship could be attributed objectively or subjectively to these findings. This study is a form of evidence for establishing nursing interventions, including reducing nighttime awakenings (unless necessary) and attempting to group care at night to improve sleep quality (Hacker et al., 2015).

Sleep Insufficiency Causes in the Hospital

There are many factors that contribute to insufficient sleep in the hospital. Modifiable factors are defined as elements that can be changed, such as noise, the temperature of the room, lighting, frequency of vital sign assessment, and management of pain. Non-modifiable factors

are factors that cannot be changed, which would include symptoms of acute illness, medication side effects, and an unfamiliar environment. Wesselius et al. (2018) completed a study in 39 hospitals in the Netherlands on February 22, 2017. This study enlisted 2,005 adults in a hospital ward which had the participants complete a sleep diary and Dutch-Flemish Patient-Reported Outcomes Measurements Information System (PROMIS) sleep disturbance. This study reported the average number of nighttime awakenings were 3.3 times a night while in the hospital compared to two times a night at home. External factors are the cause of awakenings in 70.4% of participants, which include noise, medical equipment, pain, and need for elimination. On average, the patients woke up 44 minutes earlier in the hospital than at home, and the quality of sleep reported as worse in the hospital. The goal of this study was to create awareness of sleep disruption to develop interventions to address factors contributing to the reduced quantity and quality of sleep experienced (Wesselius et al., 2018).

Longley and colleagues (2018) completed a pilot study in an intensive care unit (ICU) to evaluate sleep insufficiency experienced in this setting. Patients were given a six-question Richards-Campbell Questionnaire with additional open-ended questions to explore the 60 participants' sleep experience further. Interruptions accounted for 37% of the reasons why sleep was disrupted, with 21.6% attributing the disruption to noise attributed to pumps and monitors. Other factors related to poor sleep included pain (30%), and bed discomfort (11.7%). This information allows research developers to formulate interventions to address the factors of poor sleep, thereby reducing sleep deprivation in the ICU (Longley et al., 2018).

A qualitative study by Stewart et al. (2017) evaluated non-mechanically ventilated adult patients who stayed at least one night in the ICU and compared their sleep quality before, during and after their ICU stay. Results proved that rest before hospitalization was a significant factor

in the perception of sleep in the ICU. Participants who experienced poor sleep quality before admission found no difference in their quality of sleep at home as compared to the ICU. While 4.9 out of ten participants reported their quality of sleep notably worse in the ICU than at home, the factors that contributed to poor sleep in the ICU from the 56 participants included: noise (53.6%), discomfort (33.9%), pain (32.1%), awoken for procedures (32%), connected to a medical device (28.6%), stress/anxiety (26.8%), and lighting (23.2%) (Stewart, Green, Stewart, & Tiruvoipati, 2017).

Patient Reports on the Quality of Sleep

Numerous studies have shown that it is common for patients to report discontent with sleep quality and quantity. There have been reports as many as 55% of the patients who suffer from coronary heart disease have experienced disruption of sleep (Wang et al., 2014). This particular population also reported a lack of restorative sleep, daytime sleepiness, and mood changes. From June 2009 to May 2011, an experimental study was focused on this concern and searched for non-pharmacological interventions to address this problem. A Chinese Hospital enrolled 128 participants with coronary heart disease and no history of sleep disorders and assigned them to four different groups: intervention (morning, night, and morning-night) versus control group. The study evaluated whether biofeedback assisted relaxation led by a nurse is an effective intervention and at what time of the day. Self-reported sleep factors were measured using both the PSQI, Zung's Self-rating Anxiety Scale. Results identified an improvement in the quality of sleep after the implementation of the intervention. There is also evidence that the night and night-morning intervention group had the most considerable increase in the quality of sleep and used less estazolam (sleep medication) as compared to the morning and control group (Wang et al., 2014).

Langerud et al. (2018) completed a Norwegian longitudinal study that evaluated the health outcomes from participants over the age of 18 years who spent greater than 48 hours in an ICU from May 2010 to January 2014. Participants who were able to give consent, read, write, and understand Norwegian were given questionnaires at three-months and one-year post-hospitalization regarding adverse health outcomes. A total of 3,242 participants were identified; however, only 118 patients completed a survey at three months and 89 at one year. The questionnaire included the Brief Pain Inventory Short form (BPI-SF), Hospital Anxiety and Depression Scale (HADS), General Sleep Disturbance Scale, Lee Fatigue Scale, and Post-Traumatic Stress Symptoms (PTSS)-10. The median time in the ICU was nine days, with six days spent on the ventilator. Results showed at three months 49.2% continued to report pain, 20.8% suffered anxiety/depression, 12.8% experienced PTSS, 49.2% uncovered severe sleep disturbance, 15.3% fatigue. While results at one year demonstrated, 38.2% of participants continued to experience pain with a slight increase in anxiety and a decrease in depression. Participants also experienced a rise in PTSS one year later, and 465% of people still reported severe sleep disturbances, while changes in fatigue were minimal (Langerud et al., 2018).

Addressing Sleep Disruption in the Inpatient Setting

A randomized controlled trial study completed by Sweity and colleagues (2019) in the United Kingdom teaching hospital evaluated sleep quality, fall risk, length of stay, and use of zopiclone in an intervention group compared to the standard care group. A total of 1,600 participants admitted, but only 206 were eligible to participate. Therefore, 109 people were included in the intervention group and provided with eye masks and earplugs, but only 91participants reported using sleep aids. The results concluded that there was no difference in

falls, length of stay, or use of zopiclone. However, the intervention group scored higher (6.33) on a sleep quality questionnaire compared to standard care (5.09) (Sweity et al., 2019).

An occupational therapy (OCT) viewed sleep as a daily activity of living and utilized a tool to intervene with sleep in the hospital. Clore et al. completed a double-blinded RCT pilot study in 2016, which included 120 adults in the general medicine and cardiac units. The results on the first and third days were compared with the implementation of the sleep intervention versus standard care. The study found there was a positive change in the reduction of pain with the application of the OCT tool (Clore et al., 2016). A similar study by Heidt et al. (2016) evaluated OCT implementing education on sleep and how it improved the quality of sleep in the hospital. This experimental study was completed on 52 adults in non-critical areas between the ages of 18 to 75 years old who were able to give informed consent. The participants completed a pre-survey on day one and educated on the advantages of sleep as well as provided with sleep tools like an eye mask, earplugs, and white noise machine. On the third day the participants completed a survey which evaluated sleep quality, fatigue, ability to complete activities of daily living, and wake disturbances using a Likert scale. Research revealed education improved the perception of fatigue, sleep quality, and wake disturbances (Heidt et al., 2016).

Adverse Outcomes in the Hospital

A literature review completed an assessment of the number of adverse outcomes that occurred at night, and the time interval between the last vital sign assessment with rapid response or cardiac arrest events. Newman (2017) used a retrospective descriptive method, which was completed in five medical units for one year. The results showed that 46 cardiac arrest codes and 168 rapid responses occurred during this period. Data also revealed 38% of those events

happened within one hour of an assessment, while 85% of incidents occurred within four hours of the last evaluation (Newman, 2017).

Risk to Hospitalized Elderly

The elderly population is at higher risk for adverse healthcare events due to living with multiple chronic diseases. Living with chronic illnesses, especially when exacerbated, can be cumbersome to the quality of life, increase healthcare costs, and reduce resilience (Wister et al., 2018). Wister's (et al.) study wanted to compare multimorbidity in the vulnerable older adult and its effects on the ability to recover after an adverse event. A longitudinal study completed in Canada recruited 51,388 participants between the ages of 45 to 85 years, that total multimorbidity resilience with quality sleep, apparent health, pain, visits to the Emergency Department (ED), and hospitalizations. When sleep quality and health perception were positive, the total resilience had a positive response, while increased pain, hospitalizations and ED visits showed opposite effects (Wister et al., 2018).

The goal of Limpawattana et al. (2016) was to identify the prevalence and risk factors of delirium in the older adult population. This study was completed in Thailand Medical School ICU from May 2013 to August 2014. Utilizing the Confusion Assessment Method for the ICU (CAM-ICU), researchers found 44 of the 99 patients developing delirium. Results revealed 62.5% of mechanically ventilated patients experienced delirium with the average onset within five days of ICU admission. This study also identified predisposing factors contributing to the development of delirium in the older adult, which included age, disease severity, and cognitive impairment. Medications, environmental changes, physical constraints, sleep deprivation and mechanical ventilation were predisposing factors (Limpawattana et al., 2016).

CHAPTER III. METHODOLOGY

The purpose of this systematic review was to identify adverse outcomes associated with insufficient sleep in hospitalized non-critical older adults from previous healthcare research.

Research Methodology and Design

A systematic review was utilized to evaluate sleep insufficiency correlation to adverse outcomes. The population of focus was patients the age of 65 years and older, who are hospitalized in a non-intensive care unit for greater than one night. The decision to eliminate critical care patients from this review was related to the abundance of research on the stressful effects of the intensive care setting and the numerous complex elements that could be contributing to adverse outcomes. Ultimately, there was no time limit to when the research was completed but publication of the study had to fall between 2010 to 2019.

Inclusion and Exclusion Criteria

The development of keywords inclusion and exclusion criteria was focused on the topics of insufficient sleep, older adult, hospital, and adverse outcomes. For this study, insufficient sleep included articles that discussed lack of sleep, sleep loss, sleep deprivation, poor quality of sleep, or disruption of rapid eye movement and non-rapid eye movement sleep. Hospitalization, for this study, was defined as being in the hospital for greater than one night. Synonyms for hospitalization include general medicine ward, inpatient, acute care setting, and hospitalized. Inclusion criteria also included the older adult population; for this study, it is considered any participant's age of 65 years and older. The older adults are interchangeable with aged, elderly, or geriatric. Then, the final inclusion criteria were focused on adverse outcomes caused by the problem of insufficient sleep in the hospital. Adverse outcomes are "defined as an unintended injury or complication resulting in a prolonged hospital stay, disability at the time of discharge or

death and caused by healthcare management rather than by the patient's underlying disease process" (de Vries et al., 2008, p. 216). As per definition, complications can include physical, psychological, emotional, perceived quality of sleep, and financial.

The exclusion criteria were created at this point to assist with narrowing the systematic review to only relevant literature. Exclusion criteria included intensive care unit patients, older adults who spent less than 24 hours in the hospital, and patients under the age of 65 years. Other search terms omitted infants and pediatric patients. Terms which did not pertain to sleep insufficiency and/or adverse effects from sleep were excluded (see Table 1).

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Original, peer-review, full-text, English published articles from January 2010 to October 2019: quantitative and qualitative studies.	Abstracts only, blogs, social media, personal communications, newsletters, unpublished data, and conferences.
Older adults age of 65 years and older.	Participants younger than 65 years old.
Hospitalization for more than one night in a non-ICU setting.	Hospitalization less than 24 hours or ICU admission.
Insufficient sleep, sleep disruption, sleep experience, sleep deprivation (acute), and sleep duration.	
Adverse outcomes: physical, psychological, emotional, financial, prolonged hospital stay, and poor perception of sleep quality.	

The development of the search strategy began in September 2019 in collaboration with Edinboro University's research librarian. The bibliographic databases employed: CINAHL, Cochrane (Registered of Controlled Trials, Clinical Answers, and Database Systematic Review), Health Source: Nursing/Academic Edition, and MEDLINE Complete. Keywords combinations including sleep or insufficient sleep or sleep deprivation or disruption sleep or sleep loss or lack of sleep and inpatient or hospitalization or aged or elderly, and non-critically ill older adults resulted in a plethora of irrelevant articles. The search terms were expanded yet simplified to sleep, older adult and hospital, which became the final keywords. Finally, the search was limited to original studies published in full text from January 2010 to October 2019 unlike the literature review which included studies from 2014 to 2019.

The systematic review research incorporated all published peer-reviewed quantitative and qualitative articles. Blogs, social media, personal communications, newsletters, unpublished data, and conferences were excluded. All applicable information from the literature was to be maintained as data through the use of a Microsoft Excel spreadsheet. The information documented contained authors, publication year, number of participants, age range, study design, outcomes, and inclusion/exclusion criteria. After the completion of the first review of literature for inclusion and exclusion criteria, a secondary review was completed for an appraisal of quality and relevance. The final step in the systematic review process included summarizing all findings through an objective narrative, followed by making recommendations.

Sample Size

The sample size was expanded to include research from all countries for which the research met the inclusion criteria. Older adult patients who are 65 years and older were selected for this project due to the fact they are a growing population, and they are three times more likely

to be hospitalized due to their multimorbid chronic diseases. This population is more likely to have complications and adverse events as well as an extended hospital stay (Mattison, 2019).

The search criteria were narrowed by adding the characteristic of non-critically ill older adults who spent greater than one night in the hospital. Restricting the literature search to participants who spent greater than one night in the hospital allowed for a more significant observation of insufficient sleep and increases the likelihood of adverse events observed. Since many factors in the intensive care unit may cause adverse outcomes in addition to sleep insufficiency, the studies of non-critical patients were reviewed.

Data Analysis

The authors followed the process of a systematic review with the start of a literature search. The search keywords were chosen (older adult, sleep, and hospital) and able to be reproduced to ensure the reliability of the literature search before the start of the project. The author assessed each study for inclusion and exclusion criteria for sleep insufficiency in the non-critical older adult patients with a hospital stay longer than one night. The literature was evaluated for reliability and adverse outcomes as a result of sleep insufficiency. Results were recorded in an electronic database. Finally, the results of the systematic review were summarized in an objective narrative with recommendations that were discovered.

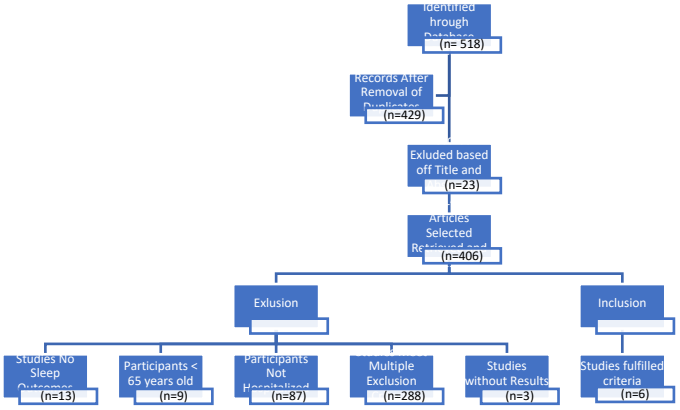
Assumptions

This study assumed that if sleep is insufficient, then adverse outcomes would occur, creating an emotional, physical, psychological, extended length of hospital stay and/or increased healthcare cost. It was also assumed that chronic sleep disorders experienced in the hospital would not result in adverse outcomes since this is the individual's sleep requirement baseline. The final assumption was that every patient will experience insufficient sleep while hospitalized.

CHAPTER IV. ANALYSIS OF DNP PROJECT

A systematic review was utilized to identify adverse outcomes experienced by non-critical older adults in the hospital setting as a result of insufficient sleep. The research included a review of 518 abstracts through database search from January 2010 to October 2019. After removing the duplicates, 429 abstracts remained. The articles' titles and abstracts were reviewed for inclusion and exclusion criteria. Then 23 articles were removed because there was no full-text article available, thus 406 full-text articles were read and evaluated for eligibility which resulted in 400 studies being excluded. A total of six articles met the full inclusion criteria for the systematic review (see Figure 2).

Figure 2. Analysis of Literature Through the Search Process

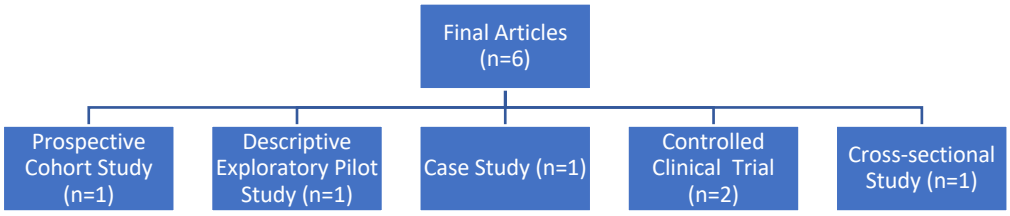


Description of Study Sample Characteristics

Setting and Design

The studies occurred in Germany (n=1), the United States (n=4), and Iran (n=1). Study designs included one cross-sectional, one case study, two control clinical trials, one descriptive exploratory pilot study, and one prospective cohort where participants were followed for seven consecutive nights. The sample size ranged from one to 469 participants (see Figure 3).

Figure 3. Analysis of Final Articles



Participant Characteristics

The six studies yielded a total of 1,088 participants. The mean age of participants was 78.3 (+/- 4.3) years old. Studies ranged from 44 to 72% female (n=5) except for the case study, which was based on an 82-year-old female. Two studies reported race, with a range of 9.1% to 16.7% non-white participants (Jaiswal et al., 2018; Dharmarajan et al., 2017). Finally, the length of stay in the hospital ranged from 1.06 to 12.1 days (see Table 2).

Research Questions

Delirium

This review identified several articles that resulted in delirium (n=3) as a risk for sleep insufficiency. The first article was a cohort study completed by Todd and colleagues (2017) January 21, 2013, to October 22, 2013, at a German teaching hospital with participants who underwent elective surgery. This study utilized actigraphy to quantitate activity before and after the surgery, which started on night one and followed for a minimum of five days. The participants' sleep at home over the last four weeks was retrospectively evaluated using the PSQI on admission as well as an assessment to determine if the patients were a morning or evening type of person. The participants-maintained sleep diaries and had a subjective measurement of tiredness using the Epworth Sleepiness Scale. Findings of the study showed post-operatively 27 of the 101 participants developed delirium, and results were compared to the 74 participants who did not develop delirium. The study found participants who developed delirium had poorer sleep

quality at home before the hospitalization (81% compared to 49%). The delirium group also showed an increased number of sleep disruptions (19.5 +/ SD 9.1% compared to 14.2 +/- SD 9.9%) (Todd et al., 2017).

The second study was a controlled clinical trial completed at Yale-New Haven Hospital by Dharmarajan et al. (2017) from 1995 to 1998 with follow up in 2000. This study recruited participants who were over 70 years of age without delirium to partake in a daily delirium evaluation (Confusion Assessment Method-CAM), while monitoring illness and health care practice with mortality tracking post-hospitalization. Sleep was evaluated using daily patient interviews, even if the participant was experiencing delirium. Results revealed 70 of the 469 participants developed delirium during the hospitalization, with 24% of the delirious participants dying within 90 days of admission as compared to non-delirious with a 6% mortality rate. The study showed 186 (39.7%) participants experienced sleep deprivation with 46% of delirious and 39% non-delirious participants. Both groups experienced a higher hazard of death ratio of 2.5 when sleep deprivation was experienced in the hospital (Dharmarajan et al., 2017).

A controlled clinical trial completed by Jaiswal and colleagues (2018) from November 2015 until December 2016 evaluated if melatonin prevented delirium. Sleep was objectively assessed in this study utilizing actigraphy with data collected on average nighttime sleep, total sleep time, and sleep fragmentation. Also, a sleep assessment questionnaire was administered every morning during the study. Results showed participants who received melatonin slept 539.8 minutes compared to the placebo group of 492.3 minutes. Both groups experienced fragmented sleep during the night, with an average sleep duration of 8.7 minutes. The delirium group experienced an average sleep fragmentation of 7 +/- 3 minutes compared to 9.5 +/- 5.3

minutes. Finally, eleven of the 69 participants experienced delirium (three in the placebo and eight in the melatonin per-protocol group) (Jaiswal et al., 2018).

Confusion

Hedges & Gotelli (2019) reported a case study (n=1) of an 82-year-old female with probable dementia had a follow-up appointment after a three-day hospitalization, where she was admitted for weakness. The patient was found to have a urinary tract infection treated with an antibiotic. The family voiced concerns over increased forgetfulness and confusion since the patient had developed confusion at night and did not sleep while hospitalized. The family also reported the patient sleeping more during the day and not at night since discharge from the hospital. A plan was implemented, and a follow-up visit two weeks later found that sleep had improved. However, the patient was still experiencing difficulty falling asleep two to three times a week (Hedges & Gotelli, 2019).

Poor Sleep Quality

The remaining articles (n=2) reported poor sleep quality and efficiency by numerous participants. The purpose of a cross-sectional study completed by Adib-Hajbaghery et al. (2016) purpose was to evaluate if sleep quality among the hospitalized elderly. This study was completed in Kashan's University teaching hospitals, Iran, from June 1, 2009, to October 31, 2009. Sleep was evaluated using the PSQI (Pittsburgh Sleep Quality Index) that was translated in Farsi (FPSQI) with a score higher than six as an indication for poor sleep quality. The results showed that among the 220 participants, the average FPSQI was 7.3. There was also a correlation between medical illness and sleep quality. The average FPSQI reported for respiratory disorders was 10.3 (Adib-Haibaghery, Izadi-Avanji & Akbari, 2016).

The final article of the review was a descriptive exploratory pilot study completed by Missildine et al. (2010) during the Summer of 2008. The elderly hospitalized participants in two acute care hospitals in central and southern United States were evaluated for sleep disturbance. The 48 participants wore an actigraphy for an objective measurement of sleep, while subjective sleep was assessed using the Richards Campbell Sleep Questionnaire (RCSQ) after the second evening. This study revealed that the mean nighttime sleep was 225 minutes with a standard deviation (SD) of 137 minutes. According to RCSQ, the average sleep efficiency is 50.7 (zero is the lowest and 100 is the best efficiency). Participants experienced an average nighttime awakening lasting, on average, 45 minutes about 13 times per night (Missildine et al., 2010) (see Table 2).

Table 2. Outcomes

Article	Study Design	n=1088	Delirium	Confusion	Poor Sleep Quality
(Adib-Hajbagherty, Izadi-Avanji, & Akbari, 2012).	Cross-sectional	400			220
(Dharmarajan, et al., 2017)	Controlled Clinical Trial	469	32.2		186
(Hedges & Gotelli, 2019)	Case Study	1		1	
(Jaisawl et al., 2018)	Controlled Clinical Trial	69	11		
(Missildine et al., 2010)	Descriptive Exploratory Pilot	48			48

(Todd et al., 2017)	Prospective Cohort	101	27

CHAPTER V. IMPLICATIONS IN PRACTICE AND CONCLUSION

Evidence has suggested that sleep insufficiency occurs in the hospital due to numerous modifiable and nonmodifiable factors. Patients have reported dissatisfaction with the quality of sleep they experience while hospitalized which is likely due to sleep disruption during, or not achieving, the refreshing non-rapid eye movement stage N3 sleep (National Institutes of Health [NIH], 2018). Unlike chronic sleep insufficiency, which leads to an increase in C-reactive protein, mood changes, elevated blood pressure, and glucose (Chiang, 2014), there is limited data available on outcomes from acute insufficiency of sleep. In turn, research has shown adverse outcomes from insufficient sleep increase the length of hospital stay, risk of exposure to nosocomial infections, and hospital cost. Currently, 40% of all adults hospitalized are older adult patients (Matthison, 2019). Hence, this systematic review aimed to determine adverse outcomes associated with insufficient sleep in the non-critical hospitalized older adult. Poor quality of sleep and delirium were commonly described in the majority of the studies. However, in the six studies that met inclusion criteria for this systematic review, only a few adverse outcomes caused by insufficient sleep were identified.

Summary of Outcomes as Related to Systematic Review

The systematic review resulted in 406 full-text articles in English that were reviewed for inclusion and exclusion criteria. However, only six studies met the criteria. Out of the six studies, three studies describe delirium as a possible adverse outcome of insufficient sleep while two studies indicated that insufficient sleep is related to poor sleep quality experienced by an older hospitalized adult. Finally, the last study correlated a relationship between poor sleep in

the elderly with increase confusion. The review did not meet its aim of identifying an exact correlation of insufficient sleep with a precise adverse outcome experienced by the hospitalized older adult.

Implications in Practice

The systematic review did not yield significant results for the correlation of insufficient sleep in hospitalized older adults with adverse outcomes. However, it did reveal that delirium, subjective reports of poor quality of sleep, and increased confusion in the cognitively impaired adult could be the result of insufficient sleep in the hospital.

Recommendations for Future Research

Additional research is needed to identify and recognize the effects of sleep insufficiency in the hospitalized older adult. Through this review, interventions in the hospital should be undertaken to improve the quality of sleep for hospitalized older adults as a means of reducing the risk of delirium and increase confusion.

Limitations

Limitations of the review include the nonmodifiable factors that contribute to sleep disruption. These factors include an unfamiliar hospital environment, anxiety, stress, and pain experienced by the patient. An acute illness resulting in more frequent monitoring or interventions may be another factor associated with sleep disruption. Lastly, medication side effects or administration schedules can contribute to insufficient sleep.

An additional limitation is the narrow inclusion and exclusion criteria may have restricted the number of studies that resulted and were reviewed. Finally, sleep disruption is often not recognized or reported, thus underreporting could be a limitation to this study.

Conclusions

Insufficient sleep has been recognized as a public health epidemic (Cirelli, 2019). The adverse outcomes associated with chronic sleep insufficiency have been well-studied and include increased mortality as well as decreased cognitive function and quality of life (Chattu et al., 2018). This systematic review revealed that sleep quality is not adequately addressed in the hospitalized adult age 65 and older, while the causes of sleep disruptions experienced in the hospital have been thoroughly investigated.

A wide range of study designs was observed in this systematic review to evaluate the outcomes of sleep insufficiency. The results of this systematic review demonstrated a need for further inquiry for research on sleep insufficiency in the hospitalized older adult.

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