

12-2021

The Effects of Sleep Disturbances on Patients in the Intensive Care Setting

Bronwyn Schmidt
Dominican University of California

<https://doi.org/10.33015/dominican.edu/2021.NURS.ST.16>

Survey: Let us know how this paper benefits you.

Recommended Citation

Schmidt, Bronwyn, "The Effects of Sleep Disturbances on Patients in the Intensive Care Setting" (2021). *Nursing | Senior Theses*. 38.
<https://doi.org/10.33015/dominican.edu/2021.NURS.ST.16>

This Senior Thesis is brought to you for free and open access by the Department of Nursing at Dominican Scholar. It has been accepted for inclusion in Nursing | Senior Theses by an authorized administrator of Dominican Scholar. For more information, please contact michael.pujals@dominican.edu.

The Effects of Sleep Disturbances on Patients in the Intensive Care Setting

Bronwyn E. Schmidt

Department of Nursing, Dominican University of California

NURS 4500 Nursing Research

Dr. Patricia Harris

May 07, 2021

Table of Contents

<i>Abstract</i>	4
<i>Introduction</i>	4
<i>Problem Statement</i>	5
<i>Literature Review</i>	6
Search Strategy	6
Causes of Sleep Disturbances in the ICU Setting	7
Effects of Sleep Disturbances on ICU Patients	11
Sleep Promotion Protocols and Interventions	13
Discussion of Literature	16
<i>Research Proposal</i>	18
Theoretical Framework	18
Research Method	19
Sample and Recruitment	21
Data Analysis	21
<i>Part 1</i>	21
<i>Part 2</i>	21
<i>Part 3</i>	22
Ethical Considerations	22
<i>Conclusion</i>	22

References

24

Appendix

26

Abstract

The objective of this research proposal is to identify short-term and long-term health consequences due to sleep disturbances in patients admitted to intensive care units. When reviewing published literature regarding sleep loss in the intensive care unit (ICU), it was discovered that adult patients admitted to a variety of ICU settings both in the United States and abroad reported disruptions in sleep to be a common complaint and barrier to their recovery. This is due to noises made by bedside alarms such as IV pumps, lights in the unit, and interruptions made by medical staff members to provide time-sensitive care.

In the proposed research design, the goal is to recruit adults over the age of 18 to participate in a longitudinal quantitative study. Data will be collected by researchers using interviews and asking participants particular questions to determine sleep habits and changes in health status. Researchers will also assess participant's baseline health and sleep status prior to their admission to the ICU. With this information the team may be able to compare baseline data to long-term data post-discharge. Collected data will be analyzed using both quantitative and qualitative methods in three different stages.

Introduction

Sleep is an integral part of human health and is essential for cell regeneration and to promote physical and mental health. The circadian rhythm is a 24-hour cycle that acts as the body's internal clock to control the sleep-wake cycle. When environmental cues are altered, it can affect the circadian rhythm causing disruptions to sleep. One definition of sleep disturbance is "insufficient amount or quality of sleep with subsequent daytime impairment and significantly reduced general wellbeing" (Lewandowska et al., 2020, p.1). Health problems related to sleep

disturbance can include immunologic dysfunction, cardiovascular disturbances, hormonal and metabolic disturbances.

Research has shown that patients who are admitted to the hospital, particularly the intensive care unit, experience interrupted sleep patterns. This is in-part due to on-going close monitoring and interventions along with technological devices inherent to intensive care settings. Fear and anxiety experienced by patients and disturbances from noise and light within the unit disrupt sleep and are problematic to a vulnerable patient population that requires adequate rest to recover. While this lack of adequate sleep certainly contributes to patient dissatisfaction, it may also contribute to a more permanent disruption to a patient's sleep habits post hospital stay.

Problem Statement

In a clinical review titled *Sleep in the Intensive Care Unit*, Pisani et al “review the latest literature on sleep disturbances that persist or develop after critical illness” (2015, p.731). In the intensive care unit (ICU) 50% of a patient's total sleep time occurs during the day. This is a drastic change compared to an adult who maintains a normal sleep-wake cycle. Patients admitted to the ICU spend approximately the same number of hours asleep compared to healthy adults, but experience decreased or absent stage 3 and REM sleep (Pisani et al., 2015).

This data was gathered by observing EEG patterns to track sleep cycles of these patients and using patient surveys that question the ICU in-patient experience. Just like those who are shift workers or travelers experiencing jetlag, ICU patients experience disruption to their circadian rhythm, which is the mechanism that controls the sleep-wake cycle (Pisani et al., 2015). The data collected does not identify exactly why this disruption to the circadian rhythm occurs in the intensive care setting, but it suggests that a loss of daytime light exposure may be correlated.

Pisani's research team was able to show that sleep deprivation can result in adverse physiologic affects (2015). Sleep deprivation may result in “a modulation of immune function secondary to changes in the sleep pattern” that has the possibility of putting patients at a higher risk for infection (Pisani et al., 2015, p.735). At this time there is no evidence that supports a clear connection to sleep deprivation and increased susceptibility to infection. However, increased cortisol levels can result in insulin resistance disturbing patients’ glucose metabolism and causing hyperglycemia (Pisani et al., 2015). Researchers have been able to correlate hyperglycemia and increased insulin resistance to higher rates of morbidity and mortality in certain patient populations.

This thesis contains a literature review and proposal for further research to answer the question: In patients admitted to the intensive care unit, are sleep disturbances a predictor for adverse patient health outcomes?

Literature Review

The first question to answer is why patients are losing sleep during their admission to an intensive care unit. From there I am interested in gathering information on what adverse effects this may have on patients both short and long-term. Lastly, I would like to explore how some ICU units, particularly the staff involved in direct patient care, are managing this problem and promoting rest, relaxation, and easing patient anxiety during a hospital stay.

Search Strategy

To explore this question, I used PubMed and Dominican University’s Archbishop Alemany Library database to identify primary research articles. In the search bar I entered “sleep disturbances” and “intensive care unit.” These search terms led to a variety of research articles ranging from qualitative studies examining first-person patient experiences and health team

member perspectives to quantitative studies that used specific parameters and a large number of participants. Of interest to me were quantitative studies that produced data correlating specific aspects of the ICU setting to decreased sleep for patients. Other articles of interest were those that allowed for the patient to describe their objective experiences. One article in particular used patient recommendations to create a sleep protocol that was then used to conduct a quantitative study.

Causes of Sleep Disturbances in the ICU Setting

In the study titled *Factors Influencing Patients' Sleep in the Intensive Care Unit: Perceptions of Patients and Clinical Staff*, Ding and colleagues used interview responses from ICU staff, patients and patient surrogates to identify environmental and nonenvironmental factors that affect patients' sleep (2017). To do this the team used an exploratory qualitative method to conduct semi-structured interviews which the researchers then used to identify common themes. The participants consisted of 24 medical intensive care unit staff members, 8 patients and 6 patient surrogates.

Staff participant requirements included providing direct patient care while working a 12-hour overnight shift in a 38 bed Medical Intensive Care Unit (MICU). Patient criteria were defined as patients who were admitted to the MICU for at least one night, were over the age of 21, were able to speak English, and had no neurological deficits including agitation. Surrogates were used for patients who fit the participant criteria excluding the ability to speak English. These surrogates had to have been at the patient's bedside during the MICU admission and act as an interpreter for the patient. To maintain patient privacy, patients' protected health information was not collected, and staff members were only identified by job title and number of years of clinical experience. All interviews were conducted by research assistants.

After collecting the interview data and participant demographics, it was determined that the mean MICU stay for patients was 4.1 days and the average years of experience for staff was 4.8 years. The four main themes determined by the interviews were as follows: “(1) effect of environmental factors; (2) effect of non-environmental factors; (3) perceptions of sleep quality; and (4) strategies to improve sleep” (Ding et al., 2017, p.4).

Theme one determined that the medical intensive care unit is an inherently noisy environment. Of the total number of participants, 21% of surrogates/patients and 100% of the staff members concluded that noise had a negative impact on patient sleep, and that noise from in-room disruptions kept patients awake (Ding et al., 2017). The source of the noise was determined to come from staff talking near the bedside, noise coming from other patient rooms, and alarms produced by IV pumps and other equipment. While disruptive, 88% of the patient/surrogate group stated that these nocturnal interruptions did not equate to negative experiences regarding their MICU stay. Of the 88%, 50% of these individuals described the noisy interruptions as “necessary” and “expected,” and an indication to patients that the staff were monitoring them closely and providing life-sustaining interventions (Ding et al., 2017, p.4).

The second theme, “non-environmental stressors that affect overnight sleep,” identified that 54% of the patient/surrogate group believed that non-environmental factors such as worrying about their health condition impacted their ability to sleep more than environmental factors (Ding et al., 2017, p.4). Another aspect of the study worth noting is that patients with pre-existing sleep conditions were not excluded from this study; 21% of the patient group stated that they had a prior condition affecting their sleep before admittance and continued to experience sleep disturbances during their MICU stay. The last non-environmental disturbance involved the treatments and interventions provided to the patients. This data was submitted by 50% of the

staff, who made remarks such as, “if I were a patient and I had an ET [endotracheal] tube and a Foley and lines and everything, I don’t think I’d be able to sleep very comfortably “ (Ding et al., 2017, p.5).

The third theme to be identified was “perceptions of sleep and how it was achieved in the MICU was variable” (Ding et al., 2017, p.5). Within the staff participants, 63% stated that high quality sleep was an important aspect of patient recovery, yet only 8% of these staff members implemented strategies to actively improve sleep. Even with multiple distractions such as light and noise, 57% of the patient group reported getting an adequate amount of sleep, and 36% of the patient group believed that their sleep was not adequate. This was after 54% of the staff approximated that the typical patient only slept 2-4 hours per night.

The last theme to be identified as a barrier were the ways in which staff promoted sleep were highly varied among the reporting staff members and were not tailored to individual patient needs. Some of the interventions used included closing patient room doors, reducing noise in the room, promoting patient comfort in non-specific ways, clustering care, and maintaining patient wakefulness during the day to promote rest through the night. The two most highly reported interventions included clustering patient care and rescheduling non-critical interventions to different times that allowed a patient to sleep for a longer block of time. When asked what could help to promote and maintain sleep, the patient/surrogate group widely recommended supporting patients in understanding and managing emotions such as stress and worry during their stay, and to prescribe pharmaceutical sleep aids (Ding et al., 2017).

In the second primary research article in this category, *Sound and Light Levels Are Similarly Disruptive in ICU and Non-ICU Wards*, Garcia and colleagues used an observation study to measure and analyze average hourly sound and light levels in ICU and non-ICU patient

rooms (2007). Battery operated sound and light-level sensors were placed throughout 24 patient rooms in a hospital located in La Jolla, California. Sound and light levels were recorded for 24-72 hours. The rooms consisted of 8 intensive care unit rooms, 8 telemetry rooms, and 8 general medical-surgical rooms. The sensors were placed strategically within two meters of the patients' head of bed and all patient rooms had a window. No consent was required from the patients.

This study was conducted based on the World Health Organization's recommendation that in order to promote restful sleep "nighttime baseline noise levels do not exceed 30 decibels (dB) and that nighttime noise peaks (i.e., loud noises) do not exceed 40 dB" (Garcia et al., 2007, p. 798). The world health organization also states that most intensive care unit patient rooms have noise levels that are consistently higher than this recommendation.

Ambient sound levels were recorded in dB every 2 seconds. This data was then averaged to provide hourly sound levels and analyzed to determine the number of sound peaks during a 24-hour time interval (Garcia et al., 2017). Sound peaks were "defined as the number of times sound levels exceeded 65 dB, 70 dB, or 80 dB" (Garcia et.al, 2007, p. 800). Light measurements were taken at 2-minute intervals to determine average and maximum light levels. Light levels were of importance because light is an essential factor in the maintenance of the circadian rhythm, which plays a role in the sleep-wake cycle (Garcia et al., 2007). The team hypothesized that both sound and light levels would be higher in the ICU patient rooms compared to non-ICU units.

The data from the sound sensors revealed that in both ICU and non-ICU hospital rooms, the average level of sound was always above 30-35 decibels (Garcia et al., 2007). What differed in the intensive care unit, were the sound peaks that were greater than 80 dB, 70 dB and 65 dB over a 24-hour period and during nighttime hours. Light levels revealed patterns that were not

conducive to supporting a normal circadian rhythm, with light levels remaining low in the morning and reaching a maximum average at around 5 PM (Garcia et al., 2007, p. 798).

However, these levels remained consistent in values between both the ICU and non-ICU rooms, with no significant differences between the two.

Effects of Sleep Disturbances on ICU Patients

A phenomenological qualitative study, titled *Sleep Deprivation from the Perspective of a Patient Hospitalized in the Intensive Care Unit—Qualitative Study*, documented the effects of sleep disturbance and how it impacts sleep long-term in patients who were admitted to a general or cardiac surgery ICU unit (Lewandowska et al., 2020). The researchers conducted this study throughout the entire year of 2019 and included patients who were admitted to the ICU for at least 7 consecutive days and provided conscious consent; 23 patients participated.

Data was collected from patients post-discharge via semi-structured interviews using open ended questions. Examples of the open-ended questions included, “Could you describe the ICU environment at night?” “Was your sleep sufficient for you during your stay in the ICU?” and “Has hospitalization affected your sleep nowadays?” (Lewandowska et al., 2020 p. 4). After all interviews were conducted, thematic analysis was used to identify themes that emerged from the study. A selection of the themes that were identified in all participants are as follows:

“anxiety,” “noise” and “light” (Lewandowska et al., 2020 pp. 5-7).

As patients lost a sense of time, their circadian rhythm was disrupted causing a lack of sleep, ultimately resulting in increased anxiety. This pattern is a continuing cycle of lack of sleep causing anxiety, which in turn causes patients to lose sleep due to feeling anxious. One patient in particular described fearing sleep due to the worry that they may never wake up (Lewandowska et al., 2020). The anticipation of noise throughout the night made it difficult for some patients to

sleep; they never knew how much sleep they may get or what loud noise may startle them out of sleep. Light in the ICU was described by one patient as “exhausting” (Lewandowska et al., 2020 p. 6). They reported feeling physically dizzy when aroused from sleep unexpectedly by bright lights being turned on in their room. An indicator that patients were not getting adequate sleep was the extreme exhaustion that many participants expressed feeling during their stay and post-discharge. These comments included complaints of never feeling rejuvenated or well-rested after sleep, feeling more exhausted after each day spent in the ICU, and prolonged exhaustion after being discharged home (Lewandowska et al., 2020).

This study concluded that while all participant’s sleep patterns returned to a pre-hospitalization baseline, it was not immediate. For some this was a result of the anxiety and stress related to their hospitalizing, mental health disorders that developed during their stay and a loss of a healthy sleep hygiene resulting from hospitalization in the ICU (Lewandowska et al., 2020).

Another study researching this topic used the method of observation to determine if delirium experienced during admission to the medical intensive care unit (MICU) resulted in sleep disturbance and disability (Altman et al., 2018). The participants enrolled in this study were those with an expected MICU admission and were interviewed for baseline preexisting medical conditions and functional status. If they had a preexisting condition affecting sleep or if they were placed on mechanical ventilation they were excluded from the study. Other parameters that excluded patients from this study were a MICU stay of less than 24 hours, or if their discharge interview was conducted more than 365 days after discharge.

To begin, the team used a screening tool called the Confusion Assessment Method for each patient on a daily basis to determine episodes of delirium and acute confusion while

admitted to the MICU. If the assessment showed either such episode, the participant was determined to be delirium positive. After discharge home from the hospital, each participant was followed-up via telephone interviews.

For follow-up, the team used the Pittsburg Sleep Quality Index (PSQI) to assess sleep post discharge, using 17 questions to assess basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs); 122 ADL surveys and 112 PSQI surveys were completed. If the participant scored a PSQI of >5 , they had experienced sleep disturbances post-discharge, and if they experienced a change in baseline compared to their pre-hospitalization interview, they had experienced a decline in BADLs and/or IADLs. Examples of BADLs and IADLs included shopping, preparing meals, taking medications, driving, grooming, toileting, and household chores (Altman et al., 2018).

Results showed that 63% ($n=71$) of participants had a PSQI score of >5 , which was indicative of long-term poor sleep quality after MICU admission (Altman et al., 2018). Of these individuals, those who experienced “increasing delirium were significantly associated with higher PSQI scores” (Altman et al., 2018, p.4). Worsening disability, or a loss of ADLs, upon discharge from the MICU was 37% ($n=45$) (Altman et al., 2018). Of these patients, 51% ($n=23$) experienced delirium during their MICU stay.

Sleep Promotion Protocols and Interventions

In a primary study titled *Sleep Promotion in the Intensive Care Unite – A survey of Nurses' Interventions*, Eliassen and Hopstock conducted a study at the University Hospital of Northern Norway to examine how nurses working in an ICU unit assisted patients to promote better sleep while in their care. The total number of participating nurses was 49, which consisted of registered nurses who held permanent positions in the intensive care unit.

To collect data, the hospital agreed to send a web-based anonymous questionnaire to the participating nurses; participation was voluntary and the head nurse of the ICU unit provided the staff with an orientation to the study (Eliassen and Hopstock, 2011). Focusing on interventions provided by the nurses to promote nighttime and daytime sleep, the survey included close-ended questions that provided a selection of answers, with the option to answer with “other” and fill in a comment. A sample of the included questions were, “whether the nurse informed the patient when it was time to sleep (yes often/no seldom),” “Your patient has slept little last night, how long will you let him sleep on this dayshift? (one hour, two hours or until he wakes up by himself),” “Your patient has slept little last night, how long will you let him sleep on this dayshift? (one hour, two hours or until he wakes up by himself) and “Which patient care interventions will make you wake up a patient who is sleeping during the daytime and slept little last night?” (central venous catheter care, physiotherapy, X-ray, doctor's rounds, administration of antibiotics, visit by relatives and blood gas control)” (Eliassen and Hopstock, 2011, p. 139).

Out of the 49 nurse participants who were sent the survey, 25 nurses completed the questions. Those who completed the questionnaire answered all questions. The data collected from the questionnaires were organized into three intervention categories: noise and light, patient comfort and patient care activities (Eliassen and Hopstock, 2011).

For the first category, the results showed that while noise and light reduction were promoted during the day and night-time hours, sleep was prioritized more often during the night (Eliassen and Hopstock, 2011). Ways in which this was achieved was by refraining from holding conversations near the patients’ bedsides, lowering voices and asking other staff members to do the same, and increasing the time between providing medical interventions during the night. For daytime noise and light reduction, nurses reported using various interventions such as putting

signage on patient doors to indicate that the patient is sleeping, offering eye masks, and keeping curtains closed when safe to do so.

As with light and noise reduction, patient comfort measures were implemented more often in the evening time to promote sleep and relaxation (Eliassen and Hopstock, 2011). Examples of patient comfort measures provided at greater rates at night were massage and mouthcare. Nighttime measures ranged from nurses sitting at the bedside to sooth anxious patients, to turning on music or the television to transition the patient to a bedtime routine.

Of the participating nurses, 72% reported that they actively planned daytime sleep for a patient who did not sleep well at night. Of these 18 respondents, the most popular amount of time offered to patients for uninterrupted daytime sleep was 2 hours (Eliassen and Hopstock, 2011). If the patient was sleeping during the day, 56% of nurses stated that they would not wake up a patient for any of the care interventions that were provided in the questionnaire.

The second primary research in this category is titled, *Pilot Study: An Intensive Care Unit Sleep Protocol*. This study was conducted by Knauert and colleagues, with the purpose of testing the impact of a sleep promotion protocol in the intensive care unit (2019). The research took place in a 38-bed medical ICU (MICU) where all patients had a private room with three solid walls and one glass sliding door (Knauert et al., 2019). Other controls in the study included a hospital wide quiet period between 23:00 and 06:00 when lights were dimmed and overhead announcements were limited; all patients received earplugs, an eye mask, and headphones. After excluding patients who were expected to die within 24 hours of the study, were receiving comfort care, or were going to be transferred from the MICU during the time of the trial were excluded, the total number of participants was 56. The study was randomized with n=30 receiving standard care and n=26 receiving the sleep protocol.

To develop the protocol the team used interviews from a previous study to understand sleep barriers for patients admitted to the ICU (Knauert et al., 2019). The sleep protocol that was developed was as follows: non-urgent bedside care was limited between the hours of 00:00 and 3:59, with any urgent or time-sensitive care that needed to be completed within those hours to be clustered. To assess the outcome of the study the team used sound and light meters placed at the head of patient beds, and motion-activated cameras placed in patient room doorways to count the number of times staff entered the rooms. Days of research were broken down into three distinctive blocks of time, “20:00–23:59 (baseline), 00:00–03:59 (rest), 04:00–07:59 and 08:00–11:59” (Knauert et al., 2019, p.2). Hourly mean and maximal light measurements in sound equivalent levels (Leq) were calculated, along with light peaks per hour (greater than 250 lux). The video recordings were used “to calculate the average length of room entrances and the number of minutes per hour that a room had activity” (Knauert et al., 2019, p.2).

During the baseline time block, 20:00–23:59, there was found to be no statistical difference in the amount of entries between the control and sleep protocol group (Knauert et al., 2019). However, during the rest period 00:00-03:59, the sleep protocol group had an average of 1.4 entrances per hour compared to 2.1 entrances per hour for the control group. This led to an average reduction of 9.1 minutes of in-room activity in the sleep protocol group. As with staff entrances into patient rooms, sound and light levels were significantly decreased in the sleep protocol group during the designated rest period.

Discussion of Literature

According to the data collected for this literature review the prevalence of sleep disturbances in the intensive care unit is a problem throughout hospitals worldwide. These findings can be associated with a high degree of generalizability. In all reviewed studies similar

themes were identified that affect patient sleep which include noise, light, medical interventions, and patient anxiety. In qualitative studies the majority of patient participants described sleep loss as a major factor that had a negative impact on their ICU stay. Medical staff who participated in studies came to the same conclusions. Multiple studies showed that by implementing sleep promotion protocols, light and sound levels in patient rooms were significantly reduced and interruption-free periods of rest during sleeping hours were increased. Overall, both patients and staff believed that improvements are needed to allow for adequate sleep for patients admitted to intensive care units.

There are identifiable limitations in these studies and gaps in the current research that could be investigated in greater detail. Three limitations that were commonly encountered when using ICU patients as research participants were a limited sample size, the inability to assess baseline sleep prior to ICU admission and difficulty in obtaining participation in long-term post discharge follow up conversations. Many individuals who have experienced hospitalization, particularly in the ICU, encounter stress and anxiety when recollecting their illness. They often do not want to continue to discuss their experience once discharged. Because of this there is not much research available that determines long-term health outcomes related specifically to sleep loss during and ICU admission and post-discharge.

Along with further investigation as to how sleep disturbances may affect recovery and long-term health, alternative sleep aides are also missing from the literature. Alternative sleep aids that have not been explored thoroughly in the ICU setting are using methods such as relaxing music, aromatherapy, massage, and providing personal hygiene care prior to sleep.

Research Proposal

The aim of the following proposed research is to identify patients who continue to experience sleep deprivation after discharge home from a hospital stay that included ICU admission. From this population, the question could be asked, “are these individuals suffering from adverse health effects due to continued loss of sleep?”

Theoretical Framework

This research proposal is designed around Faye Glenn Abdellah’s contributing nursing theory; Twenty-One Nursing Problems. Abdella’s theory “is based on an art and science that moulds the attitudes, intellectual competencies, and technical skills of the individual nurse into the desire and ability to help people, sick or well, cope with their health needs” (*Faye Abdella-Nursing*, 2016, para 4). Twenty-one Nursing Problems is a patient-centered approach which is applicable to nursing education, with the intention of meeting patient needs and alleviating impairment. Her twenty-one stages include 10 steps to identifying patient problems and 11 nursing skills which are essential to the development of intervention methodology (*Faye Abdella-Nursing*, 2016).

Included in Abdella’s ten steps to identify patient problems are a selection of points that can be specifically replicated in the proposed research study. Step one, learn to know the patients, is important in the screening and selection of research participants when designing a study. The second step “make generalizations about available data in relation to similar nursing problems presented by other patients” allows the proposed study to generalize sleep loss between various hospitals and ICU settings; the study setting does not have to be isolated to one specific hospital unit (*Faye Abdella-Nursing*, 2016, para 7). Allowing the patient, or participant, to develop conclusions about nursing problems can aid in the development of sleep promotion

protocols for hospital institutions. The proposed research is a longitudinal study, which is consistent with Abdella's seventh step to "observe and evaluate the patient over a period of time to identify any attitudes and clues affecting his or her behavior" (*Faye Abdella-Nursing*, 2016, para 9).

Research Method

The study will use a three-pronged approach. The first part of the study will be a quantitative analysis of patient questionnaires to identify demographic factors and trends related to sleep and overall health. The second part will be a qualitative analysis of participant interviews. The third part will be a longitudinal cohort study that examines the correlation between long-term sleep deprivation and adverse health effects in adults who have experienced an intensive care unit admission. The benefit of a longitudinal study is that it can detect health changes in participants over an extended period of time and may *suggest* a cause-and-effect relationship (although recognition of a relationship does not mean that cause and effect is definitively proved); in this case between sleep loss and negative health outcomes.

The first part of the study will involve asking participants demographic questions, such as gender, age and ethnicity. In addition, there will be questions to assess their baseline sleep patterns and health status prior to their most recent ICU hospital admission. These questions will include:

- How many hours of sleep do you average per night?
- Do you have difficulty falling asleep?
- Do you have difficulty staying asleep once you fall asleep?
- Do you use pharmaceutical sleep aids?
- Do you have a history of any of the listed health disorders?

- Sleep Apnea
- Other diagnosed sleep disorders
- Hypertension
- Anxiety
- Depression
- Memory loss
- Type 2 Diabetes
- Dyslipidemia
- Unexplained weight gain

The second part of the study will be a qualitative analysis based on patient interviews. The interviewer will ask each participant to describe their sleep experience during their ICU stay, and if they believe that a loss of sleep contributed to a difficult recovery. This portion of the research is highly subjective and relies on participants' accurate re-call and reporting.

From there, a longitudinal study will be used to identify particular health disorders and the presence of on-going sleep alterations in participants. This will be done using a questionnaire and interviews with participants. As with the first stage of the study, which determined pre-ICU admission baseline, this questionnaire will ask the same questions in order to compare the participants' current and ongoing health changes compared to baseline. The length of the study will be two years, with participant interviews occurring at 6-month intervals from the time of hospital discharge. The goal is to identify those participants who, previous to ICU admission, had no difficulties or on-going problems with sleep disturbances, and to see if they then experienced sleep disturbances in the ICU and following their discharge. It is then important to identify changing health parameters such as increased depression, hypertension, or any of the other health

disorders listed in the questionnaire. From there, there may be an opportunity to associate health conditions with a lack of sleep, possibly beginning from the time of the ICU admission.

Sample and Recruitment

Recruitment will involve finding participants who have had an intensive care unit admission within the last six months and can provide baseline health information prior to their hospital stay. The goal is to recruit at least 100 participants who are over the age of 18.

Identification of potential participants will be done through the Nursing Research Department at Kaiser Permanente Healthcare system, which has hospitals throughout California.

Data Analysis

Part 1

Descriptive statistics will allow researchers to make summations of the data collected from the participants to determine the participants' baseline health status and demographic information. This will give the mode and median of participants' ages and categorize trends in pre-admission health status to use to compare to the data collected in part three of the study. This data may also potentially identify common health trends related to patient demographics.

Part 2

Qualitative analysis of patient interviews will allow participants to expand upon the answers they gave in the surveys and provide the researchers with the opportunity to identify common words and phrases and derive themes within the participants' description of their ICU stay. A content analysis of this data will provide more in-depth information about those who experienced sleep disturbances in the intensive care unit.

Part 3

Multiple logistic regression will be used to identify changes in multiple variables over time. The outcome variable will be changes in health status and sleep patterns after the hospital stay in intensive care. Potential predictor variables could be the participants' sleep status at baseline, any previous health disorders, and/or the reason for ICU admission. This data may identify a correlation between sleep disturbances and various health status trends.

Ethical Considerations

Ethical considerations include maintaining privacy for the participants and keeping all health information confidential. Validity is also a concern in research; does the design of the study address specific research questions? There must also be benefits to the study. Will the findings of the study be used to recognize a current problem, and are the aims of the research clear and appropriate? Difficulties with this study may include a high rate of participant drop out; individuals may not want to continue to speak about their health over a long period of time. The participants will also need to be evaluated by medical professionals in order to identify changes in health, and then self-report these changes to the researchers. It is also important to consider how each participants' disease state may affect their sleep or certain aspects of their health. Determining what the actual cause of sleep loss for the patient in the ICU is challenging. Informed consent from all participants and internal review board review and approval prior to starting data collection must be obtained.

Conclusion

It is well-known that sleep disturbances have been an on-going problem with patients who are admitted to the hospital overnight, particularly those admitted to the intensive care unit. The cause of sleep impact ranges from the pathophysiologic effect of the patient's disease state,

to beeping alarms and frequent interruptions to provide medical interventions. While long-term consequences of sleep loss directly related to ICU admissions are unknown, the acute effects have been vocalized by both patients and hospital staff. The next steps in this research is to identify if individuals who have been discharged from an intensive care unit and experienced sleep loss suffer from continuing adverse health effects. This research, along with the existing literature, may be used to develop sleep protocols to be used in the hospital setting to increase patient rest and sleep times.

References

- Altman, M. T., Knauert, M. P., Murphy, T. E., Ahasic, A. M., Chauhan, Z., & Pisani, M. A. (2018). Association of intensive care unit delirium with sleep disturbance and functional disability after critical illness: an observational cohort study. *Annals of Intensive Care*, 8(1). <https://doi.org/10.1186/s13613-018-0408-4>
- Ding, Q., Redeker, N. S., Pisani, M. A., Yaggi, H. K., & Knauert, M. P. (2017). Factors Influencing Patients' Sleep in the Intensive Care Unit: Perceptions of Patients and Clinical Staff. *American Journal of Critical Care*, 26(4), 278–286. <https://doi.org/10.4037/ajcc2017333>
- Eliassen, K. M., & Hopstock, L. A. (2011). Sleep promotion in the intensive care unit—A survey of nurses' interventions. *Intensive and Critical Care Nursing*, 27(3), 138–142. <https://doi.org/10.1016/j.iccn.2011.03.001>
- Faye Abdellah - Nursing Theory. (2016). Nursing Theory. <https://nursing-theory.org/nursing-theorists/Faye-Abdellah.php>
- Garcia, S., Jaiswal, S., & Owens, R. (2017). Sound and Light Levels Are Similarly Disruptive in ICU and non-ICU Wards. *Journal of Hospital Medicine*, 12(10), 798–804. <https://doi.org/10.12788/jhm.2826>
- Knauert, M. P., Pisani, M., Redeker, N., Murphy, T., Araujo, K., Jeon, S., & Yaggi, H. (2019). Pilot study: an intensive care unit sleep promotion protocol. *BMJ Open Respiratory Research*, 6(1). <https://doi.org/10.1136/bmjresp-2019-000411>
- Lewandowska, K., Mędrzycka-Dąbrowska, W., Pilch, D., Wach, K., Fortunato, A., Krupa, S., & Ozga, D. (2020). Sleep Deprivation from the Perspective of a Patient Hospitalized in the

Intensive Care Unit—Qualitative Study. *Healthcare*, 8(3).

<https://doi.org/10.3390/healthcare8030351>

Pasini, M. A., Friese, R. S., Gehlbach, B. K., Schwab, R. J., Weinhouse, G. L., & Jones, S. F. (2015, April 1). *Sleep in the Intensive Care Unit*. *American Journal of Respiratory and Critical Care Medicine*. <https://www.atsjournals.org/doi/abs/10.1164/rccm.201411-2099CI>.

Appendix

Authors/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design/Methods	Major Finding(s)	Strengths	Limitations
Altman et al. <i>Association of intensive care unit delirium with sleep disturbance and functional disability after critical illness: an observational cohort study.</i> (2018)	To identify a connection between post-discharge sleep disturbances and functional disabilities in patients admitted to Medical Intensive Care Units.	N=422 327 participants were eligible for follow-up	Qualitative. This was an observational study of MICU patients. Delirium was assessed daily during the admission using the Confusion Assessment Method for the ICU. Telephone follow-up was conducted post-discharge and included the Pittsburg Sleep Quality Index and instrumental activities of daily living.	Poor sleep quality was reported in 68% of participants. Increasing days of delirium during Medical Intensive Care Unit stays were associated with higher PSQI scores (indicating decreased sleep quality). The general conclusion was that impairment in sleep and functional disability is highly prevalent in individuals post-discharge from MICU.	Sample size was above 100 participants.	A large number of individuals who were initially eligible while admitted to the MICU were unreachable (25%) for follow-up questions. Another portion of these participants died in the MICU or prior to follow-up post-discharge. A baseline analysis or participants' sleep prior to hospitalization was not obtained.
Ding et al. <i>Factors influencing patients' sleep in the intensive care unit: Perceptions of patients and clinical staff.</i> (2017)	Use interview responses from ICU staff and patients/surrogates to identify environmental and nonenvironmental factors that affect patient sleep.	N = 38	Qualitative. Semi-structured interviews were conducted, and analysis of answers was used to code, categorize, and identify themes.	The ICU environment is not the only factor that influences patient sleep. Patients' emotions and anxiety must be addressed to promote improved sleep.	This study included nonenvironmental factors such as mental health and made recommendations for improvement.	Unequal proportion of patients and staff with low sample size. There may have been bias in the staff response regarding the importance of patient sleep in the ICU because staff was aware of the purpose of the study.
Eliassen, K. M., & Hopstock, L. A. <i>Sleep promotion in the intensive care unit—A survey of nurses' interventions.</i> (2011).	Identified how nurses in the ICU in Norwegian hospitals implemented strategies to improve patient sleep. The researchers were interested in 4 categories: noise	N=49 Respondents had to be registered nurses with continuing education as critical care nurses and with permanent positions in the ICU.	Quantitative. A web based anonymous questionnaire was sent to nurses who fit the criteria at University Hospital of Northern Norway. The questionnaire	Noise and light reduction interventions were prioritized for nighttime hours. Comfort was prioritized equally for both day and night to promote rest. 72% of the respondents	Nurses were asked to provide very specific interventions used to promote sleep, and if the promotions were used during the day or night.	Self-reported answers may produce bias among the nurses. What is reported vs. what is actually performed is not known. There was a small sample size

Authors/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design/Methods	Major Finding(s)	Strengths	Limitations
	reduction, light reduction, improvement of patient comfort, and clustering of care activities.		was optional for the staff to complete. A short orientation was provided to each unit by a nurse manager to encourage participation. Close ended questions were used.	reported that they planned a sleep period for patients during daytime hours.	Questions were closed ended to provide numerical data.	from one hospital.
Knauert et al. <i>Pilot study: an intensive care unit sleep promotion protocol.</i> (2019)	The researchers tested the impact of a sleep promotion protocol in an ICU setting	N=56 263 patients were assessed to participate in the study, with 56 who were deemed eligible. The study was conducted in a 38-bed medical ICU.	Quantitative. The patients were randomized with 30 patients receiving usual care and 26 receiving interventions. The sleep promotion protocol included restricting non-urgent bedside care between 00:00 and 03:59. If there was an urgent intervention required, time in the patient room was limited and care was clustered.	Patients in the sleep protocol group had an average of 9.6 min per hour of in-room activity compared with 18.7 min per hour for usual care. Corresponding decreased sound levels were also recorded in the sleep protocol rooms.	The study used a control group which was randomized. Patients were involved in the sleep protocol development but not the design of the study.	A small sample was used. An important variable, light, was not altered or controlled. The study did not include objective sleep measurements, so outcomes were limited to environmental measures.
Lewandowska et al. <i>Sleep deprivation from the perspective of a patient hospitalized in the intensive care unit – qualitative study.</i> (2020)	This study was aimed at describing the experiences of patients hospitalized in ICU settings related to sleep and nighttime rest. It asked patients to describe how	N=23	Qualitative. The patients had to have stayed in the ICU for at least 7 days, with the last 7 days of their stay excluding pharmacologic sedation. The research was	Each of the participants reported anxiety related components that disrupted their sleep. Noises were frequently described as an interference to sleep, including alarms and staff	Adequate sample for a qualitative study.	It is difficult to find patients who will agree to follow up post-discharge for data collection. People are often traumatized by their experience and do not want to discuss or recall it in depth.

Authors/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design/Methods	Major Finding(s)	Strengths	Limitations
	their sleep has been impacted post-discharge.		conducted through semi-structured interviews with researches using a questionnaire.	talking. Light was a common disrupting factor.		
Garcia et al. <i>Sound and light levels are similarly disruptive in ICU and non-ICU wards.</i> (2017)	The purpose of this study was to compare ambient sound and light levels in ICU and non-ICU units.	Meters were placed in 24 patient rooms.	Observational study of the sound and light levels using meters placed in patient rooms. Meters were placed as close to the head of the patients' bed as possible. Data was recorded for 24-72 hours.	Light and sound are major influences in determining patient sleep quality leaving room for improvement. For example, more light during the day may be more helpful than attempting to limit light during the night.	Comparisons were made between intensive care and non-intensive care units. Patient rooms were randomly selected throughout different units in the hospital.	Sound quality was not assessed (for example high vs. low frequency levels). Light levels were not measured directly at patients' eye level.