# Implementation of a Non-pharmacologic Sleep Promotion Protocol on the Intensive Care Unit

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**Abstract**

*Problem & Purpose*: Complex care requirements on medical intensive care units (MICU) cause patient's sleep to be deprioritized. Critical care patients who encounter sleep disturbances are at an elevated risk for delayed healing, prolonged stays, elevated cost of care, and mortality. The MICU at a large academic center uses sleep promotion tactics on less than 10% of their patients despite evidence demonstrating the benefits of non-pharmacologic sleep promotion protocols. The purpose of this quality improvement project is to implement a sleep promotion protocol on the MICU to enhance patient sleep quantity and quality through non-pharmacologic interventions. *Methods:* Sleep promotion protocol education occurred for one week. Sleep promotion was added to a MICU rounding checklist and a sleep promotion protocol algorithm was created and displayed in each patient room. Data was collected using chart audits and surveys to assess if the sleep promotion protocol was ordered appropriately, if sleep promotion was discussed during rounds, and how many hours a patient slept. Run charts were used to analyze variations, central tendencies, runs, and trends in the data collected and to determine if a sleep promotion protocol increases patients sleep. *Results:* Prior to project implementation 0% of patients had sleep discussed during rounds, 0% of patients had sleep promotion ordered, and patients slept an average of 3 hours per night. Results from post implementation data suggest 90% of patients have sleep promotion discussion during rounds, 90% of patients have the sleep promotion protocol ordered appropriately, and patients using the sleep promotion protocol sleep on average 5.5 hours per night. *Conclusions*: Findings suggest that the implementation of a sleep promotion protocol on the MICU increases communication about patient's sleep and increases the quantity of patient's sleep. Discussing sleep during dayshift rounds increases the likelihood of sleep promotion interventions during night-shift sleep time. *Keywords:* Sleep protocol, MICU.

**Implementation of a Non-pharmacologic Sleep Promotion Protocol on the Intensive Care Unit**

The Medical Intensive Care Unit (MICU) at a large urban teaching hospital encountered a practice problem with the promotion of patients' sleep hygiene. This problem occurred on a 29-bed unit, where patients were commonly diagnosed with pulmonary, liver, and renal failure. The invasive treatments needed to care for MICU patients often caused a lack of sleep, which increased their risk of acute sleep deprivation (Delaney, Van Haren, & Lopez, 2015).

The problem with the promotion of patients' sleep was identified by interviews with key MICU personnel. The unit manager, senior nurses, and medical providers were interviewed to gather internal evidence on the topic of sleep promotion. The MICU's standard sleep promotion practices were to order sleep promotion at the providers discretion. Interviews with MICU stakeholders revealed that the sleep promotion order-set was underutilized, that sleep was rarely discussed during patient rounds, and that sleep promotion practices were disregarded by staff.

External evidence from the literature stated that more than fifty percent of ICU patients encounter sleep disturbances, causing an elevated risk for prolonged ICU stays, elevated cost of care, and increased mortality (Bani-Younis & Hayajneh, 2018). Additionally, complex care requirements for ICU patients caused sleep to be deprioritized (Delaney, Van Haren, & Lopez, 2015). A fishbone diagram was completed to analyze the root causes of decreased sleep promotion on the MICU (Figure 1). Analysis of this diagram suggested the root cause of decreased sleep promotion was due to the lack of priority placed on patients' sleep by the MICU interdisciplinary care team.

A proposed evidence-based solution to sleep deprivation on the MICU was the use of a non-pharmacologic sleep promotion protocol. The purpose of implementing the sleep promotion

protocol on the MICU was to enhance patient sleep quantity and quality through non-pharmacologic interventions. The main process goals included 100% of MICU patients will have sleep promotion protocol orders discussed during rounds, 100% of patients who met requirements of sleep promotion would have sleep promotion orders, and 100% of nurses would be educated on the sleep promotion protocol. The main outcome goal was that 100% of patients utilizing the sleep promotion protocol would have 4 hours of uninterrupted sleep.

This proposal was created with evidence from six studies. Hu et al., (2015) and Patel et al., (2014) studied the effects of sleep promotion interventions in ICU patients. They both found implementing a sleep promotion protocol can improve patients' sleep quality and decrease the incidence of delirium. Chen et al., (2021), Patel et al., (2014), and Ozlu and Ozner (2017), found that a sleep promotion protocol was successful in lowering the sound, light, and number of nocturnal disturbances for patients, while also increasing the patients' sleep quality. Menear et al., (2017), and Knauert et al., (2018) studied the ease-of-use of a sleep protocol, and patients' sleep quality. Findings from both studies suggest that a sleep protocol was easily implemented by nurses, and that patients' sleep quality was improved through sleep promotion. All studies noted that sleep promotion conflicts with the ICU culture of critical patient care, and that the involvement of ICU stakeholders in unit-wide sleep promotion protocols will help with the success of the implementation throughout the culture change. See Tables 1 and 2 for a detailed review and synthesis of each study.

Lewin's Theory of Planned Change was utilized to facilitate the implementation of the sleep promotion protocol (Figure 2). This quality improvement framework used three phases, unfreezing – change – refreezing (Shirey, 2013). During unfreezing, a nurse leader recognizes the problem, identifies options for change, and mobilizes others to help this change. The second

phase, change, involves planning, educating, and implementing the protocol. The last phase, refreezing, involves stabilizing the change in order to embed it into the unit's existing system. In terms of the sleep promotion protocol, nurse leaders and key stake holders recognized a problem with sleep, identified a need for change, and a team was mobilized to create a solution to the problem. Change occurred as the sleep promotion protocol was planned with medical providers to include unit-wide education and implementation strategies for success. Refreezing occurred as barriers to implementation were identified and dismantled, causing the sleep promotion protocol to be the MICU's standard of practice. This process allowed for the longevity and sustainability of the sleep promotion protocol as it assessed the need for change, identified an appropriate solution, enhanced factors that strengthened the project, limited issues that affected implementation, and stabilized the change as the new unit-wide norm.

## Methods

The context of the MICU environment was important to consider when developing this project. Figure 3 displays the baseline process for sleep promotion on the MICU. At baseline, if the sleep promotion order-set was ordered, the nursing staff rarely participated in sleep interventions. Additionally, sleep promotion was neglected as a patient care priority because critical care treatments were the first focus of a patient's treatment plan. Thus, implementing this protocol was a large change in practice, and creating this sleep protocol with stakeholder buy-in was an important factor to successful implementation.

It was important to have a skilled, enthusiastic, and communicative sleep promotion team. Table 3 illustrates the MICU team that was mobilized to implement this practice change. The team members included nurses, providers, champions, managers, and educators. Providers oversaw ordering the protocol and discussed sleep promotion during patient rounds. The nurse

manager and educator were helpful with unit buy-in and education of the protocol. The champions were leaders of the endeavor and assisted other nurses in the implementation process. A chart review by data collectors ensured all eligible participants were involved in this project, as inclusion criteria was screened for every patient admitted to the unit during the day of data collection. Figure 4 displays the updated process maps for sleep promotion on the MICU.

This intervention occurred over a 15-week period. During day shift rounds, sleep was discussed through the use of the ICU checklist. The ICU checklist was an already successful communication tool that was edited to include sleep promotion. The provider then deemed the patient appropriate for the sleep promotion protocol. If the patient met inclusion criteria, the sleep promotion order set was ordered. Then, during night shift, the nurse acted as the gatekeeper to prevent unnecessary in-room disturbances. The nurse completed all necessary bathing, dressing changes, respiratory care, and assessments outside of the sleep window (00:00 to 04:00 AM). The patient continued to have vital signs assessed hourly, or as ordered, through the use of automatic telemetry machines. The nurse ensured the patient's room lights, television, and other unnecessary noises were off, and doors were closed. If a medical emergency were to occur, the sleep promotion protocol was disregarded, and appropriate patient care was administered. The timeline for this intervention implementation can be found in Table 4.

To achieve the project aims, and to ensure the implementation occurred successfully, the Bingham ABCDE framework was used (Bingham & Main, 2010). All nurses were educated on the protocol through the medical system's on-line education platform. Sleep promotion protocol displays were placed in every patient room, and sleep champions were resources to the staff during the intervention period. These tactics were instrumental in creating positive change to patient's sleep promotion.

The measurement plan for this project was as follows. To measure the process goal, 100% of MICU patients will have sleep promotion orders discussed during rounds, day shift nurses were surveyed (Figure 5). To measure the process goal, 100% of patients who met criteria will have sleep promotion orders, a chart audit was conducted using a chart auditing tool (Figure 6). To measure the process goal, 100% of nurses will be educated on the sleep protocol, a post-test score of 100% from all nurses was analyzed. The outcome goal, 100% of patients utilizing the protocol will have at least 4 hours of un-interrupted sleep, was assessed through a survey where nurses stated how many hours the patient slept and how many in-room disturbances occurred (Figure 7). All surveys and chart audit tools were analyzed by an attending physician to ensure validity and reliability.

Data was collected weekly on Fridays from 6:00 AM to 12:00 PM. The data collection procedure ensured completeness and accuracy as all data collection was completed on the same day, using the same data collection procedures each week. The aim of the data analysis for this project implementation was to demonstrate favorable change overtime. This project used quantitative statistics including frequencies and percentages to draw inferences. Run charts illustrated these inferences over time.

There was likely a pattern of variability in the data set. This variation came from fluctuations of patient acuity and provider discretions of placing sleep promotion orders. Special causes that affected variation of the data included a work-force shortage due to the COVID-19 pandemic, which caused a large number of untrained new-hires to work on the MICU during the implementation of this project. Using a run chart to illustrate the favorable change to patients' sleep through the use of the protocol helped identify the variability in the data set. As data varies

during a specific time period on the chart, it was easy to identify what occurred during this time period to cause fluctuations in the data.

This initiative utilized important ethical principles. Non-human Subject's Research determination from the Human Research Protections Office Institutional Review Board was obtained prior to project implementation. Ethical considerations to ensure patients were not excluded from the sleep promotion protocol involved identifying inclusion criteria. This criterion included patients who were hemodynamically stable, patients who had a Richmond Agitation Sedation Scale (RASS) score of less than +3 and greater than -3, and patients who did not require monitoring every one to two hours. Data was collected in a private area using HIPAA privacy practices. The project data was recorded directly onto REDCap, a password protected, HIPAA compliant server. Data extracted for analysis was coded to protect confidentiality. Only the project lead had access to the raw data collected.

## Results

During the first week of data collection, sleep promotion was not discussed during interdisciplinary rounds and there were zero sleep promotion orders for all patients. Sleep promotion was added to the rounding checklist, then during weeks 2 through 15 an average of 25 out of 29 patients had sleep promotion discussed during rounds. During weeks 2 through 4, 100% of patients who met sleep promotion criteria had sleep promotion ordered. During weeks 5 through 15 an average of 90% of patients who met criteria had sleep promotion ordered. In terms of number of hours slept, patients who had sleep promotion orders slept an average of 5.5 hours per night over the 15-week implementation period. Patients who met sleep promotion criteria but were not utilizing the sleep promotion protocol slept on average 3.5 hours per night. Lastly, patients who were ordered the sleep promotion protocol had an average of 3 in-room

disturbances, and patients who were not ordered the protocol had an average of 6 in-room disturbances during the patient's sleep time.

Upon analysis of the results, it is evident that the sleep promotion protocol, structure, process, and outcome goals were achieved. Process outcomes were almost achieved as an average of 90% of patients had sleep promotion discussed during interdisciplinary rounds throughout the 15 weeks of implementation. This was a large increase from the 0% of patients who had sleep discussed during rounds during the first week of implementation. While there was a decrease in sleep discussion during rounds during weeks five and six, meetings with attendings and residents were implemented to increase awareness of the MICU sleep promotion initiatives. Also, 100% of the MICU staff were educated on the sleep promotion protocol using the facility education system. Outcome goals were achieved as patients utilizing the sleep promotion protocol have had an average of greater than 4 hours of sleep, with only 3 sleep interruptions during nighttime. Structural goals have been achieved as the sleep promotion algorithm was created and posted in all patient rooms, and as sleep promotion was added to the MICU rounding checklist.

Figure 8 shows a run chart depicting sleep promotion discussion during rounds over the 15-week implementation period. In this run chart, no shifts were noted, there was a positive trend from week five through 15, and the run test showed a statistically significant change in the data set. Figure 9 shows the percentage of patients who met sleep promotion criteria and had sleep promotion ordered. In this run chart, no shifts were noted, there was a positive trend noted from weeks 5 through 10, and the run test was only consistent with random variation. Figures 10 and 11 depict run charts that show an upwards trend in the number of hours patients slept when using the protocol versus patients who were not ordered the protocol. Figures 12 and 13 detail the

average number of in-room disturbances that occur during sleeping hours for patients using the sleep promotion protocol versus those who were not. The graphs show that those who use the protocol had less in room disturbances, but there were no trends noted. There were no astronomical data points evident from the data set.

Unexpected benefits of this project were seen as night shift nurses became important facilitators to this project. Night shift nurses had increased satisfaction during their day-to-day shift-work requirements as patients sleeping actually decreased with work load. This in large part was a huge reason this project's process and outcome goals were met.

## Discussion

This quality improvement project focuses on the implementation of a sleep promotion protocol to improve patient's sleep quality and quantity in the intensive care unit setting. The key findings of the project indicate a significant improvement in patient sleep, as the use of the sleep promotion protocol increases rates of sleep promotion discussion during rounds, sleep promotion orders placed by providers, and an increase in the average number of hours patients slept on the ICU. Use of the ICU checklist significantly improves project outcomes as it helps make sleep a priority in each patient's treatment plan, thereby increasing the amount of sleep promotion orders placed. Additionally, the project has a positive impact on hospital staff, who report a reduction in workload during the patient's sleep time. This project comes at zero additional cost to the facility as all resources are already available to the unit.

A comparison of this quality improvement project's findings from other publications indicate that this project was consistent with previous studies that have shown that sleep promotion protocols can be effective in improving patient outcomes. Similar to other studies, this project results in an increase in patient sleep quality and quantity. Secondly, this project shows

that sleep promotion protocols can help decrease in-room nighttime disturbances, thereby increasing the number of hours a patient sleeps. Like other studies, this project shows that a sleep promotion protocol was easily implemented in the intensive care unit setting.

Limitations to this project included reduced staff retention following the COVID-19 pandemic. There was a 20% vacancy rate of staff nurses during the implementation of this project. This caused an influx of new hires who were not educated on the sleep promotion protocol during the time of project implementation, thereby decreasing internal validity. There is a potential for bias as patients are not randomly assigned to intervention vs control groups, which can lead to unequal characteristics between those who utilize the sleep promotion protocol and those who do not. Other potential sources of bias include the subjective influence of healthcare providers deciding if the patients should or should not be ordered the sleep promotion protocol. In addition, the providers on the MICU frequently change, making it difficult to create consistency in the placement of sleep promotion orders. The sleep promotion team was required to educate the providers and new nurse hires on the sleep promotion protocol each week in order to combat this issue.

## Conclusion

In conclusion, the sleep promotion protocol implementation on the MICU demonstrates its usefulness and value in improving patient sleep quantity, quality, and overall outcomes. Key components of the sleep promotion protocol in this project include the introduction of resources to identify patients who meet sleep promotion protocol criteria, and education on ways to optimize the patient's sleeping environment. These resources include the laminated sleep promotion protocol displays, and the ICU checklist. The findings of this project contribute to the body of knowledge regarding sleep promotion protocols and their impact on patient outcomes.

The strengths of this project include the multidisciplinary approach utilized to develop and implement the protocol, the rigorous data analysis conducted to ensure the accuracy of the findings, and the sustained efforts made to maintain the protocol's effectiveness over time. The ICU checklist has been permanently updated to include sleep promotion, thereby increasing sustainability of this sleep promotion endeavor. This project has the potential for spread to other contexts, as the protocol is easily adaptable to other intensive care unit settings and populations.

The implications for practice and future quality improvement initiatives are significant. Hospitals and healthcare providers should consider the implementation of sleep promotion protocols to improve patient outcomes, improve patient and nursing satisfaction, and overall reduce healthcare costs by decreasing risks of prolonged hospital stays. Future quality improvement initiatives should continue to explore the effectiveness of sleep promotion protocols on long-term patient outcomes and identify ways to sustain their impact over time. In conclusion, the strengths of this project, along with the potential for spread to other contexts, make it a valuable contribution to the field of healthcare quality improvement.

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## Figure 1

***Fishbone Diagram***

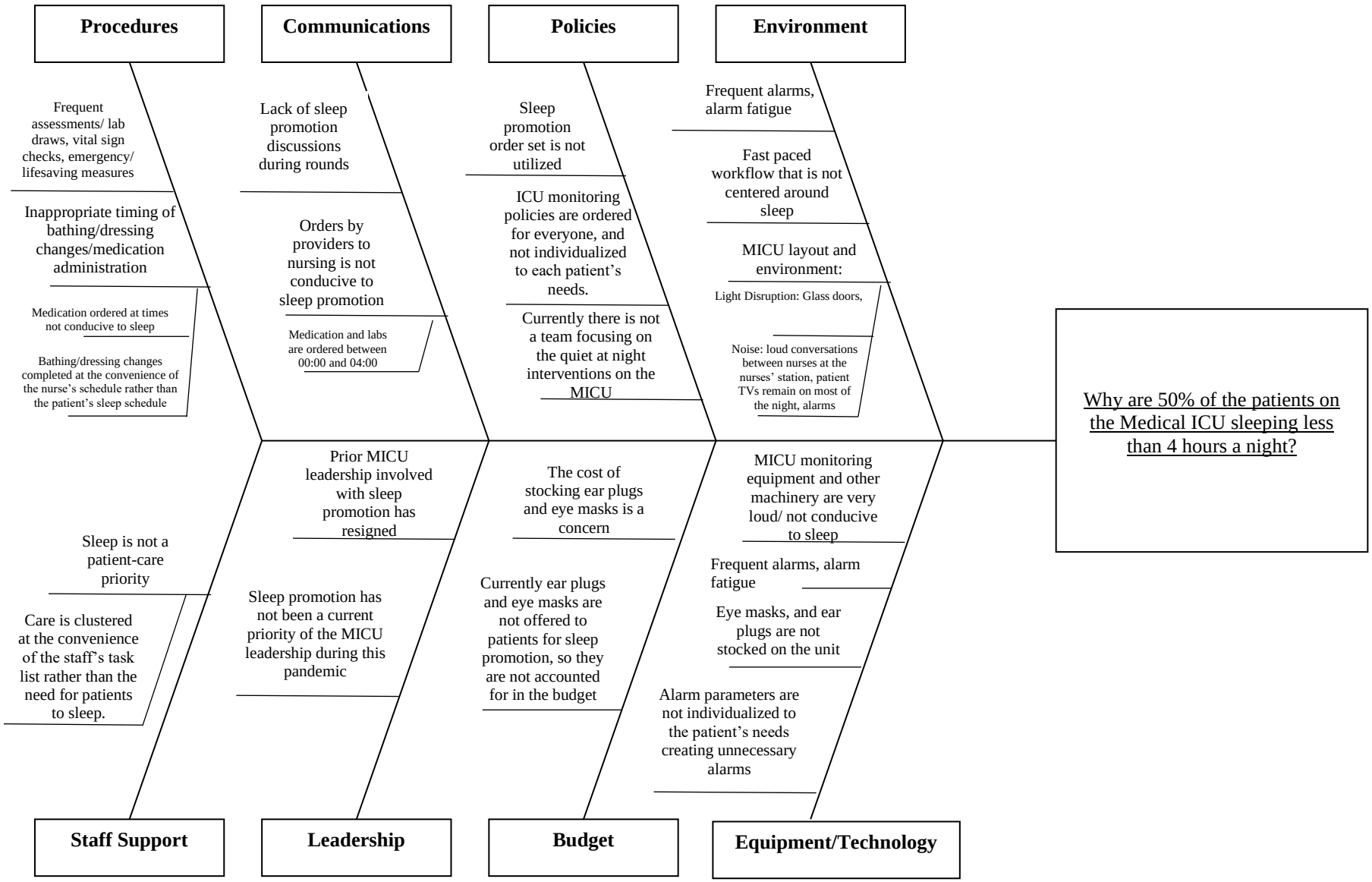

**Table 1**

***Evidence Review Table***

| Citation: Hu, R.F., Hiang, X.Y., Chen, J., Zeng, Z., Chen, X.Y., Li, Y., Huining, X., Evans, D.J.W. (2015). Non-pharmacological interventions for sleep promotion in the intensive care unit. *Cochrane Library*. https://www-cochranelibrary-com.proxy-hs.researchport.umd.edu/cdsr/doi/10.1002/14651858.CD008808.pub2/full | | | | | **Level and Quality:** Level III Quality C |
|---|---|---|---|---|---|
| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "To assess the efficacy of non-pharmacological interventions for sleep promotion in critically ill adults in the ICU. To establish whether non-pharmacological interventions are safe and clinically effective in improving sleep quality and reducing length of ICU stay in critically ill adults. To establish whether non-pharmacological interventions are cost effective." | Research: Systematic review of randomized control trials and quasi-randomized control trials that evaluated the effects of non-pharmacological interventions for sleep promotion in adult critical care units. | **Sampling Technique**: The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, PubMed, Alt Healthwatch, the China Biological Medicine Database, and the China National Knowledge Infrastructure databases were used to identify applicable studies.<br><br>The sample included any non-pharmacological intervention for improving sleep, such as those that examined one or a combination of interventions, and compared these interventions with different non-pharmacological interventions, pharmacological interventions, or standard care.<br><br>**#Eligible**: 72 trials<br>**#Accepted**: 30 trials – 1569 participants | The systematic review included trials of ventilator mode, earplugs or eye masks, massage, relaxation, music interventions, and nursing interventions bundles.<br><br>**Control & Intervention**: The sample included any non-pharmacological intervention for improving sleep, such as those that examined one or a combination of interventions, and compared these interventions with different non-pharmacological interventions, pharmacological interventions, or standard care.<br><br>**Intervention fidelity:** Intervention fidelity in the selected cases was not discussed. | **DV:**<br>Primary outcomes:<br>Objective sleep outcomes, subjective sleep quality and quantity, risk of delirium, participant satisfaction, length of ICU stay, and adverse events<br><br>**Measurement procedure:** Two authors independently assessed the trials eligibility according to inclusion and exclusion criteria. The two authors then extracted data using a tool developed by the authors. Two review authors entered data into a review manager software and a third author double-checked the data. Post-test scores involving objective sleep quality, subjective sleep quality, hours of sleep, length of ICU stay, delirium, PTSD, and economic outcomes were used.<br><br>Mean differences with 95% confidence intervals for | **Statistical Results**: The mean difference in total sleep quantity with sleep promotion interventions versus usual care was 2.19 hours (95% CI 0.41 to 3.96) although there was observed evidence of heterogeneity.<br><br>A lower incidence of delirium during ICU stay (risk ratio 0.55, 95% confidence interval (CI) 0.38 to 0.80, P value = 0.002, two studies, 177 participants) and a positive effect of earplugs or eye masks, and sleep promotion interventions on total sleep times were calculated (mean difference 2.19 hours, 95% CI 0.41 to 3.96, P value = 0.02, two studies, 116 participants).<br><br>**Clinical Significance**: Although the quality of evidence is low, implementing nursing interventions for sleep promotion may add benefit to the overall care, risk of delirium, and sleep quantity in adult ICU patients. |

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| | | **Power analysis**: Few of the studies accepted calculated a power analysis, thereby, limiting the study power.<br><br>**Group Homogeneity**: There was a lack of homogeneity between accepted trials due to the wide range of scales used to assess outcomes, and due the use of different study designs. | | continuous data and standardized mean differences for outcome measures were calculated using results from different scales. | **Conclusions:**<br>The quality of existing evidence relating to the use of non-pharmacological interventions for promoting sleep in adults in the ICU was low. There is some evidence that the use of earplugs or eye masks, and nursing sleep interventions may have beneficial effects on sleep and the incidence of delirium in this population, although the quality of the evidence was low. Further high-quality research is needed to strengthen the evidence base. |

| Citation: Chen, L., Zheng, J., Lv, S., Li, B. Yang, L.Y. (2021). Impact of a sleep promotion protocol on off-pump coronary artery bypass graft patients. *Nursing in Critical Care*. https://onlinelibrary-wiley-com.proxy-hs.researchport.umd.edu/doi/10.1111/nicc.12637 | | | | | **Level and Quality:**<br>Level II<br>Quality B |
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| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "This study aimed to explore the effects of an evidence-based sleep promotion protocol on patients who underwent OPCABG in a cardiac ICU." | Research: A quasi-experimental study was conducted in a comprehensive hospital in the Shandong province of China. | **Sampling Technique**: Convenience sampling was utilized. Inclusion criteria included adult patients on the cardiac ICU, patients who could understand information provided by medical staff, verbal consent by the patients. Exclusion criteria included patients with sleep disorders, ICU stays <24 hours, CNS disease, mental health disorders, dementia, alcohol abuse disorders, and unstable hemodynamics. | **Control:**<br>Patients were informed they could sleep after receiving medically necessary treatments at 10PM each day. Lights were turned off, and ECG alarms were decreased to volume 7. At 7AM patients would report their sleep duration to the charge nurse, who would then record it in the patients' medical record.<br><br>**Intervention**:<br>Light exposure is applied for 2-5 hours in the daytime, and | **DV:**<br>Sound levels, light intensity, the number of nocturnal interventions, and sleep status.<br><br>**Instrument & measurement procedure:**<br>Sound levels were measured according to the "measurement method of acoustic environment noise where the meter was placed close to the patient's ear corridor and sound was | **Statistical Results**:<br>Compared to the control group, the intervention group was exposed to significantly lower sound levels at 11 PM (P = .031), 1 AM (P = .036), 3 AM (P = .016), and 5 AM (P = .020).<br><br>The intervention group experienced significantly lower light intensity at 9 PM (P = .008, .044), and 11 PM (P = .003, < .001, 1AM (P <.001 <.001), 3AM (P<.001, <.001), |

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| | | **#Eligible**: 70 participants<br>**#Accepted**: 67 participants<br>**#Control:** 37 participants<br>**#Intervention:** 30 participants<br><br>**Power analysis**: The required sample size was determined based on a comparison of two sample means and Hu's report. Assuming a type II error of 5% the minimum sample size was determined to be 23 participants per group.<br><br>**Group Homogeneity**: Demographics, lifestyle factors, and disease severity were found to be comparable between the control and intervention group (P < 0.05) | dark exposure is applied for as long as possible in the night time, smooth light music is played for 30-45 minutes starting at 9 PM, patients receive back massages for 6 minutes prior to sleep, and patients are offered earplugs and eye masks from 9PM to 6AM, ECG alarm sounds are reduced to volume 4, cell phones are turned off, TVs are turned off, bathing, drug administration, physical examinations, and blood collections are performed during daytime as much as possible, and melatonin, propofol, and dextromethadone are avoided. Nurses evaluate patient sleep using the Richards-Campbell Sleep Questionnaire (RCSQ) at 7 AM.<br><br>**Intervention fidelity:** The team leader of each shift was designated responsible for monitoring the implementation of all interventions. A digital video recorder was installed at the workplace and one researcher reviewed the interventions of the previous day to ensure adherence to the protocol. Nurses were trained on protocol implementation, and four ICU nurses were trained on data collection. | recorded every 2 hours between 7PM - 7AM.<br><br>A light meter was used to test light intensity 5cm outside each patient's room between 7PM – 7AM.<br><br>A self-constructed questionnaire was developed to calculate nocturnal interventions between 8PM – 7AM. Interventions included vital sign monitoring, catheter care, blood collection, drug administration, blood transfusion, respiratory management, and ADLs. This was completed by the nurses each morning<br><br>Sleep status was measured using the RCSQ scale.<br><br>**Reliability:**<br>The measurement method of acoustic environment noise meter and the light meter have previously documented reliability. In regards to the nocturnal interventions questionnaire, a content validity index was calculated to be 1.00, Cronbach's alpha was 0.828. The RCSQ had a Cronbach's alpha was 0.869. | 5AM (P<.001, <.001), and 7Am (P= .001 <.001).<br><br>Compared to the control group, the intervention group experienced significantly lower nocturnal interventions (t=4.203, P<0.001).<br><br>The intervention group experienced lower RCSQ scores (t= - 4.242, P= .000_<br><br>**Clinical Significance**:<br>Clinicians on other intensive care units can adopt this protocol to help improve patient's sleep quality and quantity, and improve patient outcomes.<br><br>**Conclusions:**<br>The sleep promotion protocol reduced sound levels, night-time light intensity, the number of nocturnal interventions, and improved sleep among adult patients in the Cardiac ICU. |

| Citation: Patel, J., Baldwin, J., Bunting, P., & Laha, S. (2014). The effect of a multicomponent multidisciplinary bundle of interventions on sleep and delirium in medical and surgical intensive care patients. *Anesthesia*, *69*(6), 540-549. https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/epdf/10.1111/anae.12638 | | | | | **Level and Quality:** Level II Quality B |
|---|---|---|---|---|---|
| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "This study investigated whether the implementation of a bundle of non-pharmacological interventions, consisting of environmental noise and light reduction designed to reduce disturbing patients during the night, was associated with improved sleep and a reduced incidence of delirium" | Research: A quasi-experimental pre/post design | **Sampling Technique**: Convenience sampling was used for this cohort-based study on a 24-bed adult medical/surgical ICU unit.<br><br>Inclusion criteria: age >18, patient spending one or more nights on the ICU<br><br>Exclusion criteria: history of sleep pathology, history of cognitive dysfunction, previously discharged from the ICU during this hospital admission, neurosurgical patients, CAM+ delirious patients, patients on sedatives within the past 24 hours.<br><br>**#Eligible:** 338 patients<br>**#Accepted:** 338 patients<br>**# In control:** 167 patients<br>**# In intervention:** 171 patients<br><br>**Power analysis:** At the time of conducting the study, there were no reported papers published to inform a power calculation for sample size. All patients who met inclusion criteria were included. | **Control:** Data including hours of sleep, environmental noise, light exposure, and nocturnal nursing interventions was gathered on each patient.<br><br>**Intervention:** The multicomponent bundle of interventions was designed to be multidisciplinary, and included measures taken to reduce noise, light and iatrogenic sleep disturbance as well as attempts to modify risk factors for delirium. The sleep promotion protocol included closing doors during night time hours, turning patient lights off during night time hours, offering eye masks, encouragement of clustered care activities between 2300 and 0800, hourly pain scores, and the use of early mobilization.<br><br>**Intervention fidelity:** Staff education and training sessions of the protocol were performed. 8 senior nurses were utilized as Champions to ensure the protocol was implemented appropriately to the intervention groups. | **DV:** sleep quality, noise levels, light levels, number of awakenings caused by care activities, and incidence of delirium<br><br>**Instrument, reliability, & measurement procedure:** To assess sleep quality, the Richards Campbell Sleep Questionnaire was completed by the patients each morning. This questionnaire has been validated against polysomnography. The mean score from this questionnaire was used to estimate the sleep efficiency index.<br><br>Light and sound levels were measured using two CEM DT-8820 environmental meters placed centrally for the full duration of the study.<br><br>Nursing staff recorded assessments of whether the patient was asleep or awake each hour, and the number of nocturnal nursing interventions required in | **Statistical Results**<br>Compliance with the bundle was >90%. Implementation resulted in reduction in mean (SD) of night-time noise ($p=0.002$), night-time light ($p=0.003$), night-time awakening for staff interventions ($p=0.003$), and an increase in the mean (SD) of the sleep efficiency index ($p<0.001$). Patients spent more time asleep at night after bundle implementation – 6.6 hours before and 8.5 hours after ($p < 0.001$). Implementation of the bundle resulted in a reduction in the incidence of delirium ($p< 0.001$), and a reduction in mean (SD) length of time spent delirious ($p=0.021$).<br><br>**Clinical Significance**<br>A sleep promotion bundle can increase the patient's quality of sleep and decrease the risk of delirium on ICUs.<br><br>**Conclusions**<br>The introduction of an environmental noise and light reduction program as a bundle of non-pharmacological interventions in the intensive |

| | | | | | |
|---|---|---|---|---|---|
| | | **Group Homogeneity:** Baseline characteristics of the two cohorts were similar. There was no statistical difference between the two cohorts median sleep quality before admission (p = 0.107) | | order to assess patient's quantity of sleep.<br><br>All patients with a RASS > -4 were screened for delirium using the CAM-ICU assessment which has been proven to have sensitivity and specificity for detecting delirium. | care unit was effective in reducing sleep deprivation and delirium, and this suggests to implement a similar program more widely on other ICUs. |
| Citation: Ozlu, Z., Ozner, N. (2017). The effect of enhancing environmental factors on the quality of patients' sleep in a cardiac surgical intensive care unit. *Biological Rhythm Research*, *48*(1), 85-98. https://www.tandfonline.com/doi/full/10.1080/09291016.2016.1232462?scroll=top&needAccess=true | | | | | **Level and Quality**<br>Level II<br>Quality B |
| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "The aim of this study was to investigate the effect of enhancing environmental factors on the duration and quality of sleep among patients in a Cardiac Surgery ICU" | **Research:** Quasi-experimental pre/post design | This study was conducted on the Cardiac Surgery ICU in Turkey<br><br>**Sampling Technique:** Nonprobability sampling was utilized to place patients to either experimental or the control group.<br><br>**#Eligible:** 100 patients<br>**#Accepted:** 100 patients<br>**#In control:** 50 patients<br>**#In intervention:** 50 patients<br><br>**Power analysis:**<br>A power analysis was conducted resulting in the study being 99% with 0.05 alpha level and 95% reliability levels with 50 or more participants.<br><br>**Group Homogeneity:** | **Control**<br>Standard care was performed for control group patients. Environmental factors that negatively affect nocturnal sleep questionnaire and the RSCQ questionnaire was administered to the control group patients.<br><br>**Intervention**<br>Consent was first obtained. Then, starting at 2100 the unit telephone volumes were decreased, television was turned off, non-essential conversations were discouraged, suction units were turned off, room lights were turned off, dirty linens were replaced, and curtains remained closed for privacy. Environmental factors that negatively affect nocturnal sleep questionnaire and the | **DV:** Environmental factors that negatively affect nocturnal sleep in the CSICU, and quality of sleep.<br><br>**Instrument, reliability, & measurement procedure:**<br>A 16-item form (yes/no questions) called the Environmental Factors that Negatively Affect Nocturnal Sleep in the CSICU was issued to each patient to determine environmental factors that may interrupt nigh time sleep after the protocol was implemented<br><br>The RCSQ questionnaire was issued to every patient to assess quality of sleep after the protocol was implemented. The Cronbach | **Statistical Results**<br>Per the authors of this article, it was statistically significant that there are fewer patients in the experimental group that answered "yes" to 8/16 of the times on the Environmental Factors Questionnaire. The mean RSCQ score in the control group was 44.43 and the experimental group was 66.57 ($p<0.001$)<br><br>**<u>Clinical Significance</u>**<br>By improving environmental factors that are conducive to sleep on the ICU a patient is more likely to have a better quality of sleep. Sleep promotion bundles can be helpful in improving environmental factors on the ICU.<br>**Conclusions** |

| | | | | | |
|---|---|---|---|---|---|
| | | There were no statistical differences in the demographic variables between both groups | RSCQ questionnaire was administered to the control group patients.<br><br>**Intervention fidelity:** Unit nurses were educated on the intervention protocols, and on the use of the questionnaires to ensure appropriate interventions and documentation. | alpha reliability coefficient = 0.91 | Nursing interventions should be used to control the environmental factors that negatively affect nocturnal sleep in CSICUs. |
| Citation: Menear, A., Elliott, R., Aitken, L.M., Lal, S., McKinley, S. (2017). Repeated sleep-quality assessment and use of sleep-promoting interventions in ICU. *Nursing in Critical Care*, *22*(6), 348-354. https://onlinelibrary-wiley-com.proxy-hs.researchport.umd.edu/doi/10.1111/nicc.12315 | | | | | **Level and Quality**<br>Level III<br>Quality B |
| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "The aims of this study were to assess the feasibility of the ongoing repeated use of the RCSQ to assess ICU patients' sleep quality, contrast the use of sleep-promoting strategies in a locally developed clinical practice guideline with usage previously reported, and assess any improvement in self-reported sleep quality since its implantation and outline self-reported sleep facilitators and deterrents. | Research: A prospective observational study in which quantitative data from the RCSQ were compared with data from previous investigations in the same ICU. | The research was conducted in Sydney, Australia on a 58-bed ICU<br><br>**Sampling Technique:** Convenience sampling was used as any patient on the unit that met eligibility criteria was enrolled in the study. Inclusion criteria included: adult patients, and ICU stays >24 hours. Exclusion criteria included: known or suspected sleep disorder, dementia diagnoses, and confirmed alcohol abuse.<br><br>**#Eligible:** 182 patients<br>**#Accepted:** 50 patients observed and analyzed<br><br>**Power analysis:** A retrospective sample size | An observational study of a sleep promotion protocol intervention first gathered informed consent for each patient. The RCSQ score was then administered daily, mostly in the morning, for the patients' entire ICU stay, or up to 3 months. Nurses self-reported the use of sleep-promotion strategies by documenting a checklist that noted usual sleep practices, patient settled before 2200, ear plugs and eye shades offered, and care was clustered during night time hours.<br><br>**Intervention fidelity**: nurses were previously educated on the use of the protocol, and documentation expectations in order to track appropriate data. | **DV:** feasibility of repeated assessment of sleep quality using the RCSQ, ease of use of sleep-promoting strategies, and sleep quality.<br><br>**Instrument, reliability, & measurement procedure:** Feasibility of repeated assessment of sleep quality was measured by counting daily use of RCSQ for each patient. RCSQ assessments were completed on their second ICU Day, and their fourth ICU Day.<br><br>ICU documentation databases were used to assess the ease of use of sleep-promotion protocol strategies. Nurses documented the use of sleep | **Statistical Results**<br>The repeated completion rate of 72% indicated that collection of sleep quality data using the RCSQ repeatedly was feasible.<br><br>The audit of ICU quality database indicated nurses' documentation of adherence to strategies presented in the "Rest and Sleep guideline for ICU patients" was high, >90%, ensuring that a sleep promotion protocol was easily usable by ICU nurses.<br><br>Four years after the implementation of a sleep promotion bundle, patients still experienced discomfort in sleep (SD .5), however their sleep quality was improved |

| | | | | | |
|---|---|---|---|---|---|
| | | calculation confirmed that a sample size of 50 provided 95% confidence that the point estimate for the mean total RCSQ score represented the population mean.<br><br>**Group Homogeneity:**<br>There were not groups to differentiate/assess. However, out of this sample, the average age was 60 years old, the median length of ICU stay was over 3 days, and 1/3 of patients were male. | | promotion strategies using a checklist in their database daily. Chart audits allowed for easy assessment.<br><br>Sleep quality was assessed by RCSQ Total Scores from all participants in this investigation versus RCSQ Total Scores from all participants in previous investigation in the same ICU (prior to sleep promotion interventions being implemented). The RCSQ has documented reliability in testing sleep quality prior to this study being implemented | when sleep promotion strategies were implemented vs when they were not.<br><br>**Clinical Significance**: Sleep is always a problem when the patient is on the ICU, however, sleep promotion protocols can help increase the sleep quality from baseline when in the hospital.<br><br>**Conclusions**<br>The RCSQ can be utilized for frequent measurements of sleep quality on the same patient to create mathematical trends, sleep promotion protocols are easily utilized by ICU nurses, and while sleep promotion protocols may improve sleep for ICU patients, it may not create quality sleep for these individuals. |
| Citation: Knauert, M. P., Redeker, N.S., Yaggi, H.K., Bennick, M., Pisani, M.A. (2018). Creating naptime: an overnight, nonpharmacologic intensive care unit sleep promotion protocol. *Journal of Patient Experience, 5*(3), 180-187. https://journals.sagepub.com/doi/10.1177/2374373517747242?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed | | | | | **Level and Quality**<br>Level V<br>Quality C |
| **Purpose/ Hypothesis** | **Type of Evidence Research Design** | **Sample – Population, Size, Setting** | **Intervention/Procedures** | **Primary Outcome/Measures** | **Results/Conclusions** |
| "Our objective is to describe the development, pilot, implementation, and revision of a medical ICU sleep promotion protocol." | Research: Cohort study | The research was conducted on an U.S. medical ICU in an academic medical center.<br><br>**Sampling Technique:**<br>Convenience sampling was used as any patient admitted to the medical ICU was considered for the study. | At the time of this study's implementation the hospital was already dimming hallway lights, limiting overhead pages, providing headphones and eye masks, and educating on the importance of sleep from 2300 to 0600. | **DV:** Sources of disturbance, Naptime implementation success.<br><br>**Instrument, reliability, & measurement procedure:**<br>Chart reviews were the source of data collection for sleep disturbances. The | **Statistical Results**<br>Chart review revealed that 10.5% of blood transfusion, 8.7% of diagnostic imaging, 27% of lab draws, and 9.3% of medications were the reason for sleep disturbances between 0000 and 0400. |

| | | | | | |
|---|---|---|---|---|---|
| | | Enrollment to the protocol was agreed upon by the primary team and bedside nurse in all cases.<br><br>**#Eligible:** 26 patients<br>**#Accepted:** 26 patients<br><br>**Power analysis:** A power analysis was not calculated.<br><br>**Group Homogeneity:** There weren't groups to analyze descriptive statistics. | The implementation of this intervention called "Naptime" was developed in conjunction to the hospital wide protocol. This protocol involved sleep promotion between 0000 and 0400. Bedside nurses were the gatekeepers on the unit, preventing in room noise. Care was clustered outside of the Naptime hours. Medications were rescheduled for appropriate times. Lab draws occurred outside of 0000 and 0400. Bathing was not completed during Naptime.<br><br>A checklist was developed to ensure patient care activities were completed before or after Naptime to assist with implementation.<br><br>**Intervention fidelity**: The entire nursing department staff, and the medical team were educated on treatment protocols, checklists, and documentation to ensure appropriate data was collected, and to ensure patient care was administered appropriately. For unit-wide implementation nurse champions were created to ensure intervention fidelity. | success of Naptime implementation was analyzed through surveys where bedside nurses indicated how many times the medical team entered the patients' room during Naptime. The reliability of the surveys was not noted. | Surveys concluded that 92% of nurses though Naptime was easily implemented and that patient care could be completed outside of this time.<br><br>**Clinical Significance**<br>Sleep promotion conflicts with the ICU culture of critical patient care. Implementing a protocol can help enhance sleep promotion on intensive care units.<br><br>**Conclusions**<br>The involvement of broad stakeholders to identify sources of disturbance in an individual ICU will help improve sleep promotion protocols and diminish patient sleep disturbances. The wide dissemination of sleep promotion interventions will positively impact outcomes in critically ill patients. |

*Note.* The level and quality ratings are based upon the Johns Hopkins Evidence-based Practice Model.

## Table 2

### *Synthesis Table*

| Category (Level Type) | Total Number of Sources/Level | Overall Quality Rating | Synthesis of Findings |
|---|---|---|---|
| Level 1 – Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis | 0 | N/A | N/A |
| Level II · Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis | 3 | B – There were reasonably consistent results, sufficient sample size for the study designs, some control, fairly definitive conclusions, and reasonably consistent recommendations. | Chen et al., (2021) and Patel et al., (2014) both utilized a quasi-experimental study where sound levels, light intensity, the number of nocturnal interventions, and sleep quality were measured. They found that a sleep promotion protocol was successful in lowering the sound, light, and number of nocturnal disturbances for patients, while also increasing their sleep quality per the RCSQ scale. Ozlu and Ozner (2017), a quasi-experimental study, also studied the effect of sleep promotion on the patients' quality of sleep using the RCSQ scale. They too found that RCSQ scores were higher in the implementation group than the control group, meaning sleep quality was increased with the use of a sleep promotion protocol.<br><br>Patel et al., (2014) additionally studied the effect sleep promotion bundles on delirium. It was found that the implementation of a sleep promotion bundle reduced the incidence of delirium and the length of time a patient spent delirious. |

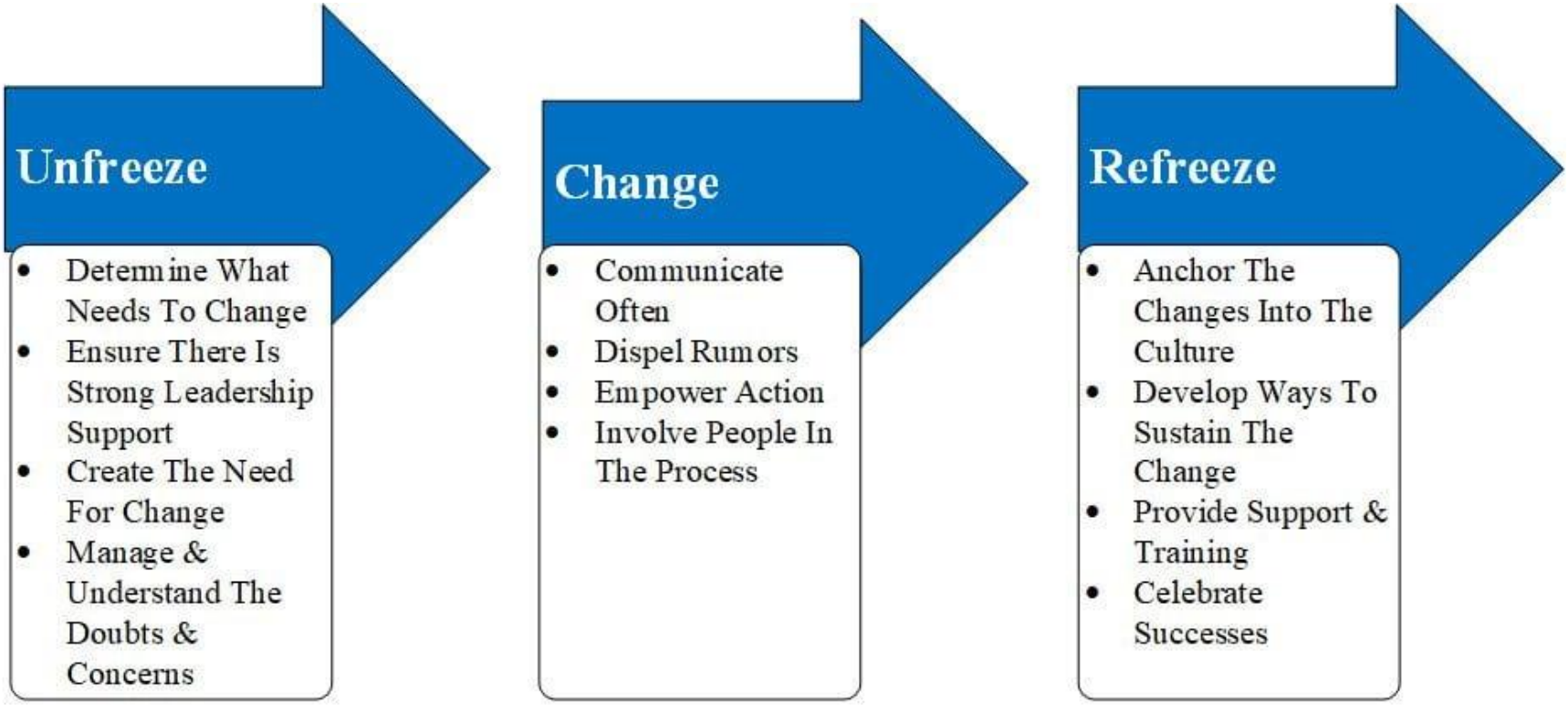
| | | | |
|---|---|---|---|
| Level III · Non-experimental study · Systematic review of a combination of RCTs, quasi-experimental, and non-experimental studies, or non-experimental studies only, with or without meta-analysis · Qualitative study or systematic review of qualitative studies with or without meta-synthesis | 2 | C – There is reasonably consistent results amongst RCTs reviewed, however studies had insufficient sample sizes, and there was little control between each of the studies. | Menear et al., (2017), an observational study of a sleep promotion protocol intervention studied the feasibility of using the RCSQ scale for sleep quality assessments on the ICU, the ease-of-use of a sleep promotion protocol, and patients' sleep quality. Findings from this study suggest that the RCSQ is feasible to use for ICU sleep quality assessments, and that a sleep promotion protocol was easily implemented by ICU nurses.<br>Hu et al., (2015) utilized a systematic review of randomized control trials and quasi-randomized control trials. They found that the quality of evidence is low, however, implementing a sleep promotion protocol can improve the incidence of delirium.<br><br>Both studies showed patients' sleep quality was improved after the implementation of a sleep bundle as evidence by an increase in RCSQ scores. |
| Level IV · Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence | 0 | N/A | N/A |

| | | | |
|---|---|---|---|
| Level V · Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports · Opinion of nationally recognized expert(s) based on experiential evidence | 1 | C – There was insufficient evidence of adequate sample size, however, there were reasonably consistent results based on fairly comprehensive literature reviews that includes some reference to scientific evidence. | Knauert et al., (2018) is a cohort study that implemented the use of a sleep promotion protocol on a medical ICU. This protocol was called "Naptime" and lasted from 0000 to 0400, where other protocols that were analyzed lasted from 2300 to 0600. This study found that the use of a sleep promotion protocol from 0000 to 0400 was easy for ICU nurses to implement, and still gave the nurses adequate time to provide patient care during their shift. The study noted that the largest reason for sleep disturbances were lab draws and medications, proving that these tasks should be scheduled outside of the patients sleep window if they are non-urgent orders. This study also noted that sleep promotion conflicts with the ICU culture of critical patient care, and that the involvement of ICU stakeholders in unit-wide sleep promotion protocols will help with the success of the implementation throughout the culture change. |
| Recommendations Based on Evidence Synthesis: There is good and consistent evidence that sleep promotion protocols improve the sleep quality and quantity for patients in the ICU setting. Therefore, practice change is indicated. In addition to the improvement of patients' sleep quality and quantity, there is good evidence that sleep promotion protocols are easily implemented on intensive care patients, especially with key stakeholder involvement. | | | |

*Note.* The level and quality ratings are based upon the Johns Hopkins Evidence-based Practice Model

**Figure 2**

***Framework – Lewin's Theory of Planned Change***




*Note.* Figure obtained from Shirey, M.R. (2013). Lewin's theory of planned change as a strategic resource. *Journal of Nursing Administration, 43*(2), 69-72. https://pubmed-ncbi-nlm-nih-gov.proxy-hs.researchport.umd.edu/23343723/

**Figure 3**

***Current Process Map***

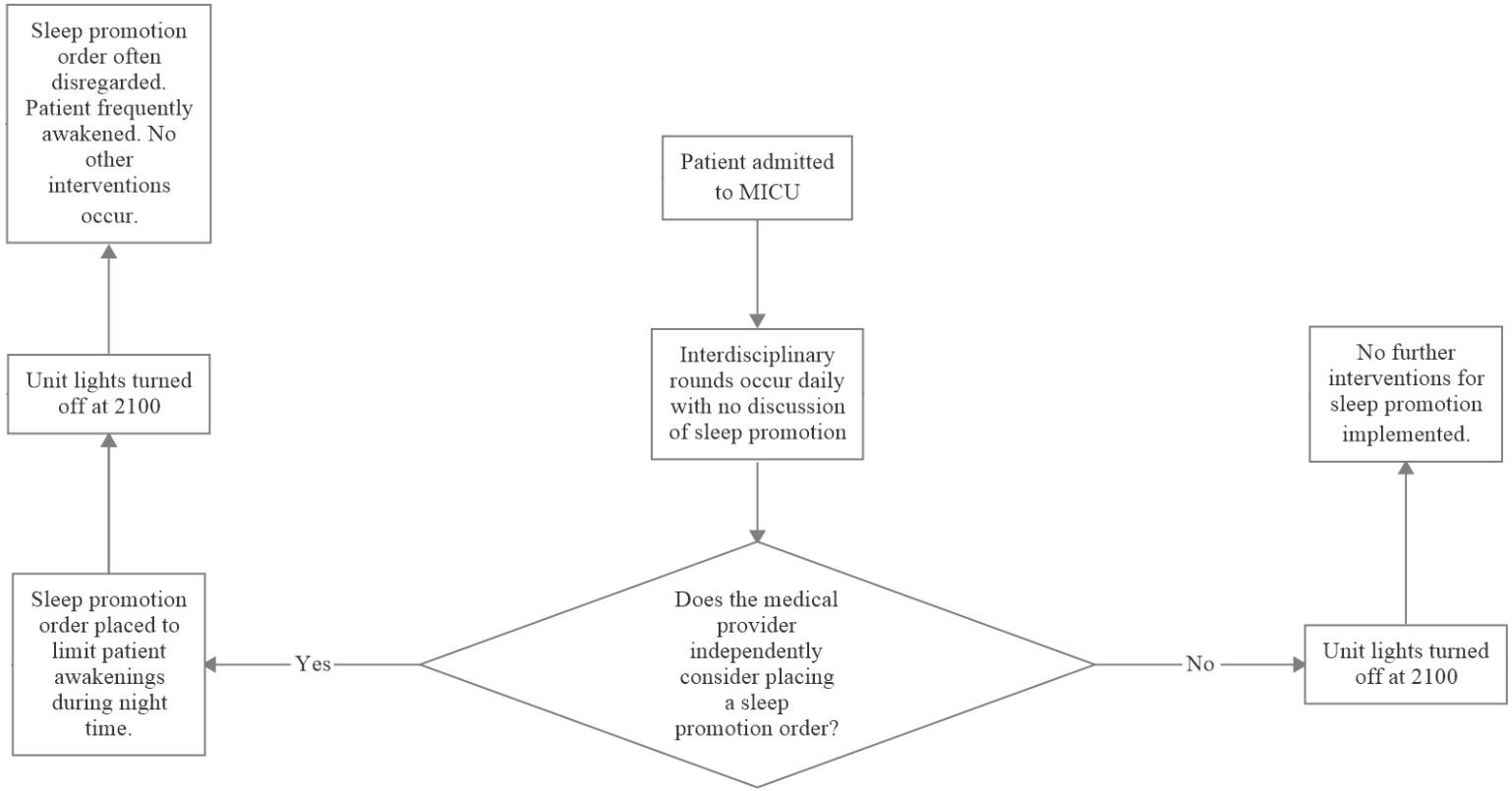


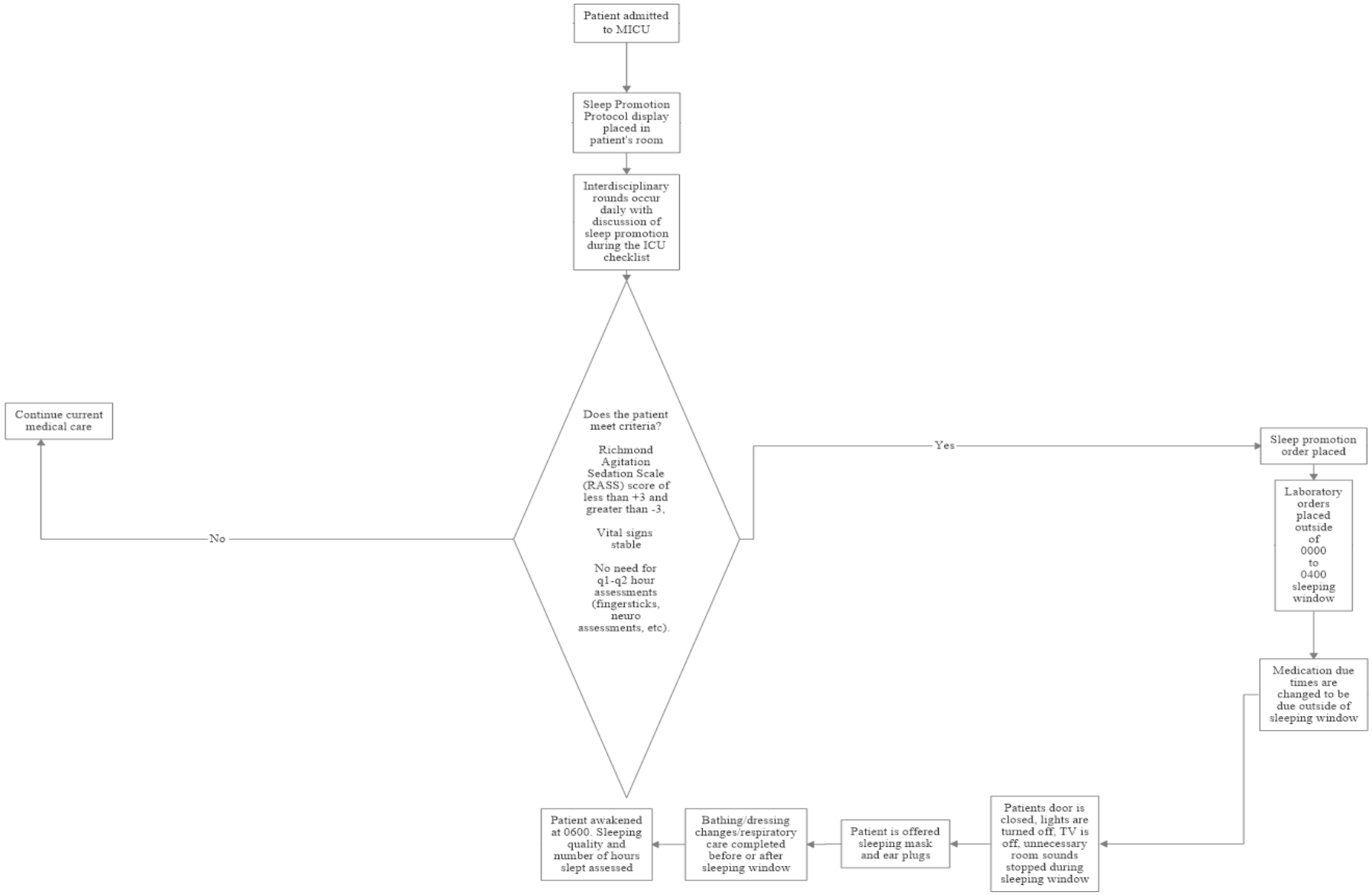
**Table 3**

***Site Team***

| Team Member Name/Credentials/Title | Responsibilities |
|---|---|
| 1. Brooke Spalt, BSN, RN, CCRN | Project Lead – communication, education, planning, project development |
| 2. Megan Wanzer, DNP, CRNP, AGACNP-BC, ACCNS-AG, CCRN-CMC-CSC | Project Advisor – facilitates project implementation, ensure timelines are completed |
| 3. T.W. | Clinical Site Representative – DNP specialist that helps facilitate project implementation on the unit, planning, unit buy-in, and data analysis. |
| 4. S.H | Sponsor – Facilitates project implementation at the hospital-wide level |
| 5. K.M. | MICU Nurse Manager – Unit buy-in, unit wide education |
| 6. S.W. | MICU Educator – Provides MICU education days and facilitates education of staff |
| 7. C.B.S | MICU Medical Director – Head attending physician responsible for provider buy-in of sleep promotion discussion during rounds |
| 8. Change Champions | Sleep promotion protocol leaders, data collection, auditing, education of MICU staff |

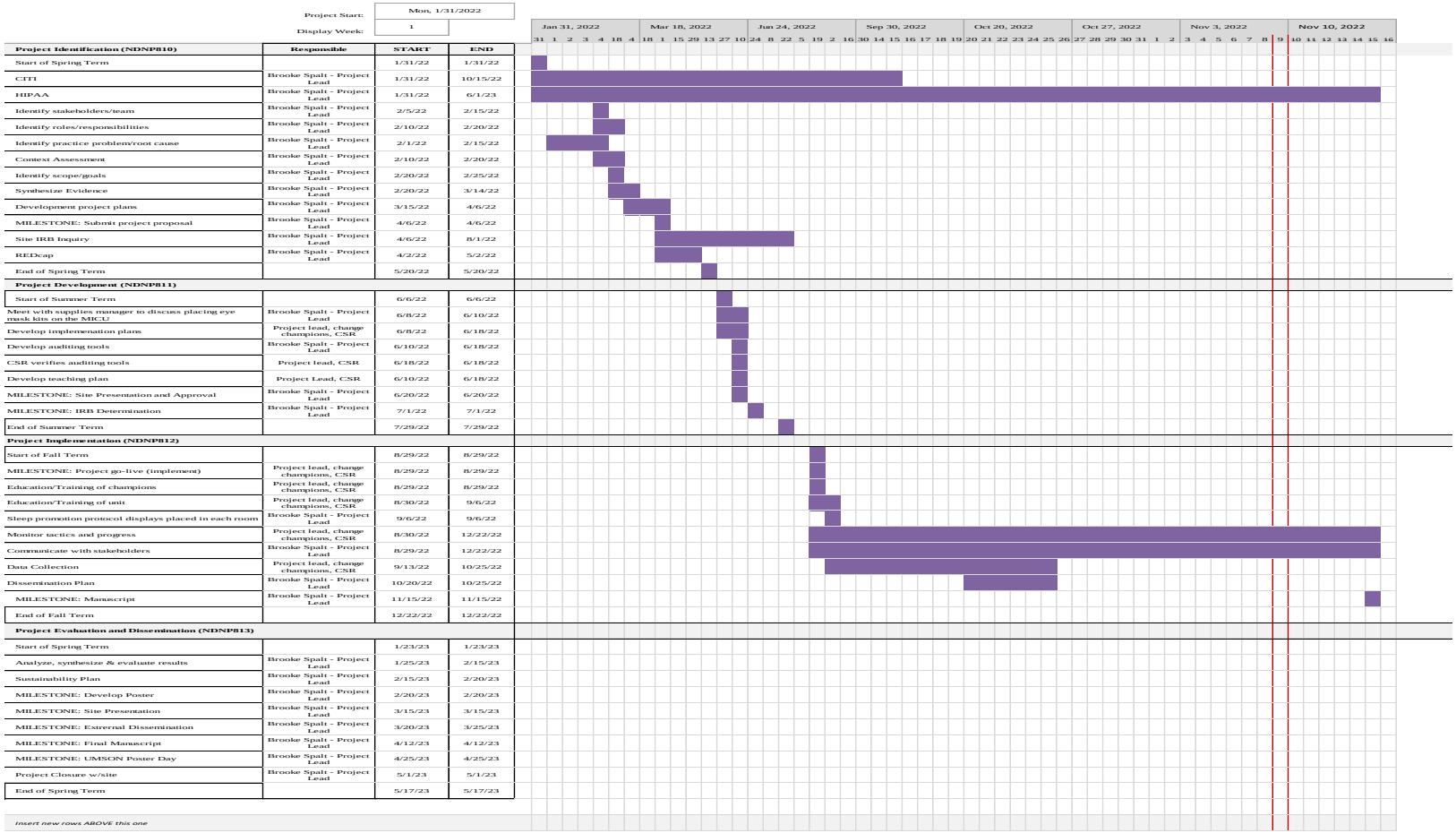
**Figure 4**

***Updated Process Map***



## Table 4

### *Gantt Chart*



| | | Project Start: | Mon, 1/31/2022 |
|---|---|---|---|
| | | Display Week: | 1 |

| Project Identification (NDNP810) | Responsible | START | END |
|---|---|---|---|
| Start of Spring Term | | 1/31/22 | 1/31/22 |
| CITI | Brooke Spalt - Project Lead | 1/31/22 | 10/15/22 |
| HIPAA | Brooke Spalt - Project Lead | 1/31/22 | 6/1/23 |
| Identify stakeholders/team | Brooke Spalt - Project Lead | 2/5/22 | 2/15/22 |
| Identify roles/responsibilities | Brooke Spalt - Project Lead | 2/10/22 | 2/20/22 |
| Identify practice problem/root cause | Brooke Spalt - Project Lead | 2/1/22 | 2/15/22 |
| Context Assessment | Brooke Spalt - Project Lead | 2/10/22 | 2/20/22 |
| Identify scope/goals | Brooke Spalt - Project Lead | 2/20/22 | 2/25/22 |
| Synthesize Evidence | Brooke Spalt - Project Lead | 2/20/22 | 3/14/22 |
| Development project plans | Brooke Spalt - Project Lead | 3/15/22 | 4/6/22 |
| MILESTONE: Submit project proposal | Brooke Spalt - Project Lead | 4/6/22 | 4/6/22 |
| Site IRB Inquiry | Brooke Spalt - Project Lead | 4/6/22 | 8/1/22 |
| REDcap | Brooke Spalt - Project Lead | 4/2/22 | 5/2/22 |
| End of Spring Term | | 5/20/22 | 5/20/22 |
| **Project Development (NDNP811)** | | | |
| Start of Summer Term | | 6/6/22 | 6/6/22 |
| Meet with supplies manager to discuss placing eye mask kits on the MICU | Brooke Spalt - Project Lead | 6/8/22 | 6/10/22 |
| Develop implemenation plans | Project lead, change champions, CSR | 6/8/22 | 6/18/22 |
| Develop auditing tools | Brooke Spalt - Project Lead | 6/10/22 | 6/18/22 |
| CSR verifies auditing tools | Project lead, CSR | 6/18/22 | 6/18/22 |
| Develop teaching plan | Project Lead, CSR | 6/10/22 | 6/18/22 |
| MILESTONE: Site Presentation and Approval | Brooke Spalt - Project Lead | 6/20/22 | 6/20/22 |
| MILESTONE: IRB Determination | Brooke Spalt - Project Lead | 7/1/22 | 7/1/22 |
| End of Summer Term | | 7/29/22 | 7/29/22 |
| **Project Implementation (NDNP812)** | | | |
| Start of Fall Term | | 8/29/22 | 8/29/22 |
| MILESTONE: Project go-live (implement) | Project lead, change champions, CSR | 8/29/22 | 8/29/22 |
| Education/Training of champions | Project lead, change champions, CSR | 8/29/22 | 8/29/22 |
| Education/Training of unit | Project lead, change champions, CSR | 8/30/22 | 9/6/22 |
| Sleep promotion protocol displays placed in each room | Brooke Spalt - Project Lead | 9/6/22 | 9/6/22 |
| Monitor tactics and progress | Project lead, change champions, CSR | 8/30/22 | 12/22/22 |
| Communicate with stakeholders | Brooke Spalt - Project Lead | 8/29/22 | 12/22/22 |
| Data Collection | Project lead, change champions, CSR | 9/13/22 | 10/25/22 |
| Dissemination Plan | Brooke Spalt - Project Lead | 10/20/22 | 10/25/22 |
| MILESTONE: Manuscript | Brooke Spalt - Project Lead | 11/15/22 | 11/15/22 |
| End of Fall Term | | 12/22/22 | 12/22/22 |
| **Project Evaluation and Dissemination (NDNP813)** | | | |
| Start of Spring Term | | 1/23/23 | 1/23/23 |
| Analyze, synthesize & evaluate results | Brooke Spalt - Project Lead | 1/25/23 | 2/15/23 |
| Sustainability Plan | Brooke Spalt - Project Lead | 2/15/23 | 2/20/23 |
| MILESTONE: Develop Poster | Brooke Spalt - Project Lead | 2/20/23 | 2/20/23 |
| MILESTONE: Site Presenation | Brooke Spalt - Project Lead | 3/15/23 | 3/15/23 |
| MILESTONE: Extrernal Dissemination | Brooke Spalt - Project Lead | 3/20/23 | 3/25/23 |
| MILESTONE: Final Manuscript | Brooke Spalt - Project Lead | 4/12/23 | 4/12/23 |
| MILESTONE: UMSON Poster Day | Brooke Spalt - Project Lead | 4/25/23 | 4/25/23 |
| Project Closure w/site | Brooke Spalt - Project Lead | 5/1/23 | 5/1/23 |
| End of Spring Term | | 5/17/23 | 5/17/23 |

*Insert new rows ABOVE this one*

*Note.* Excel spreadsheet is linked for better visibility of Gantt Chart.

**Figure 5**

***Rounding Survey***

*Implementation of a Non-pharmacologic Sleep Promotion Protocol on the Intensive Care Unit*
*Page 1*

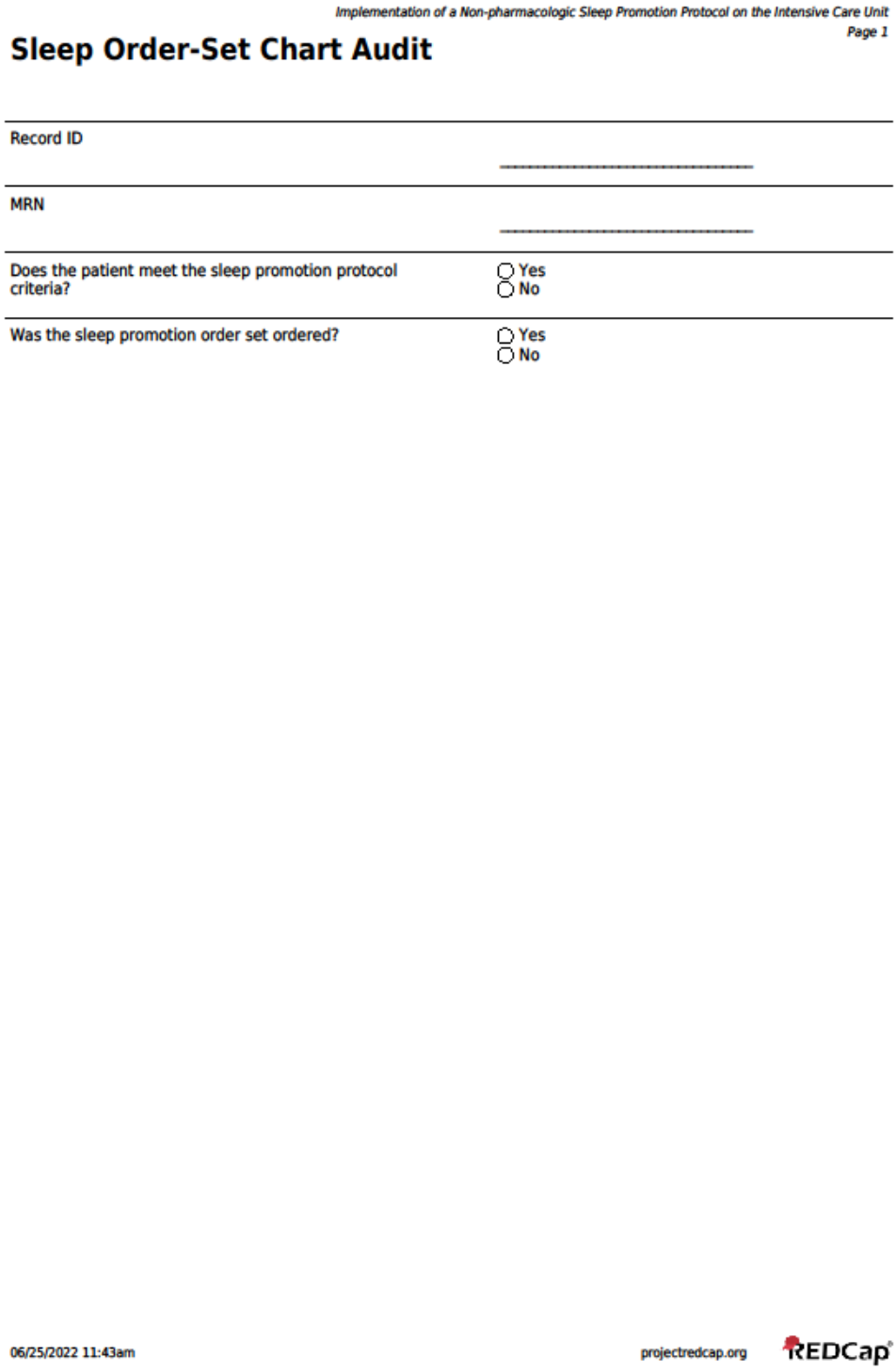
**Rounding Survey**

| | |
|---|---|
| Record ID | _____ |
| MRN | _____ |
| Was sleep promotion discussed during interdisciplinary rounds? | ○ Yes<br>○ No |

06/25/2022 11:47am projectredcap.org REDCap

**Figure 6**

***Sleep Chart Audit***



*Implementation of a Non-pharmacologic Sleep Promotion Protocol on the Intensive Care Unit*
*Page 1*

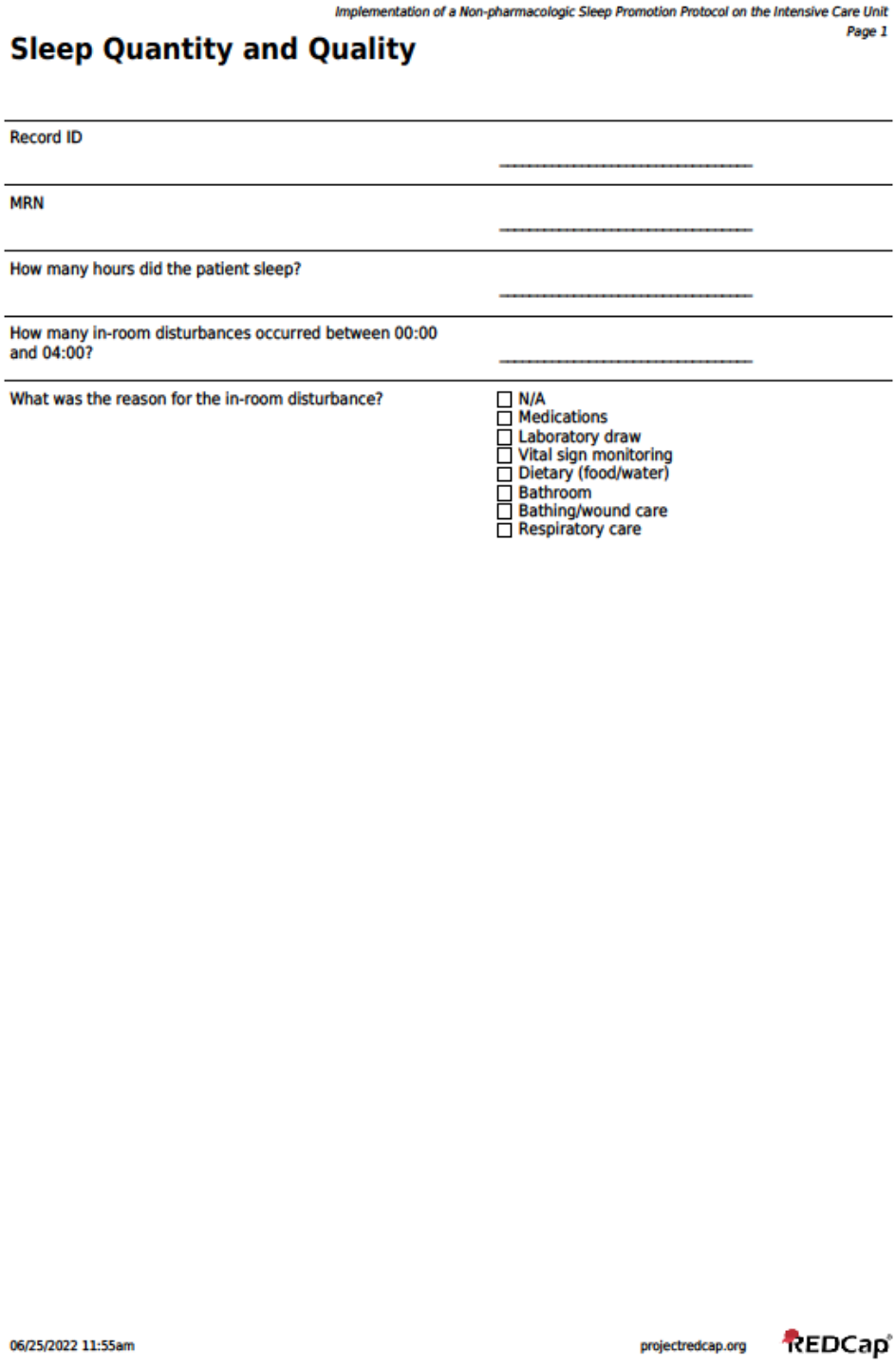
**Sleep Order-Set Chart Audit**

| | |
|---|---|
| Record ID | _____ |
| MRN | _____ |
| Does the patient meet the sleep promotion protocol criteria? | ○ Yes<br>○ No |
| Was the sleep promotion order set ordered? | ○ Yes<br>○ No |

06/25/2022 11:43am projectredcap.org REDCap

**Figure 7**

***Sleep Quantity and Quality Survey***



*Implementation of a Non-pharmacologic Sleep Promotion Protocol on the Intensive Care Unit*
*Page 1*

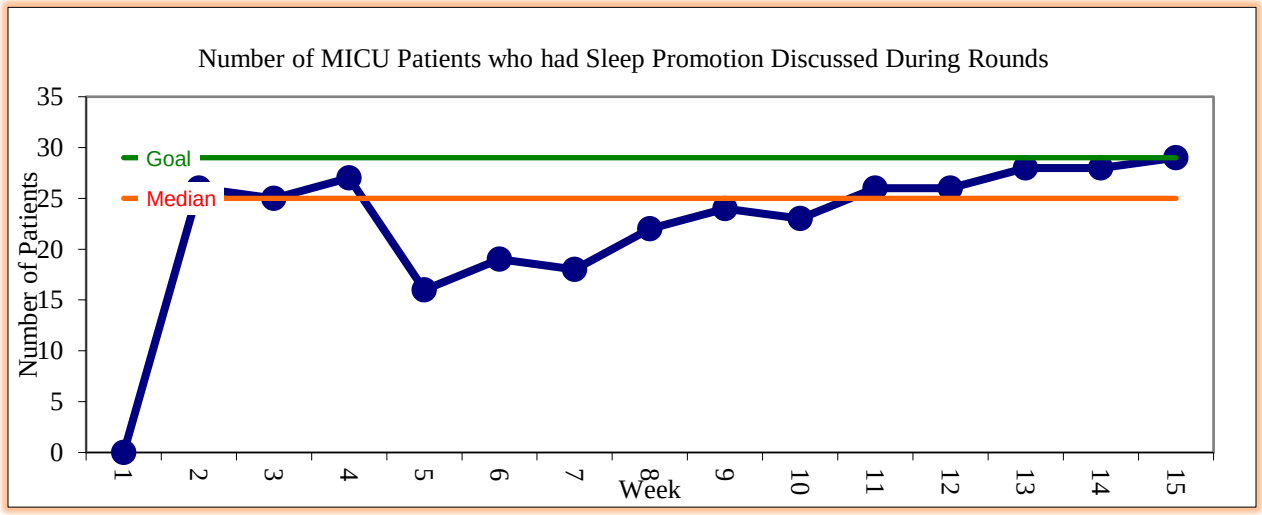
## Sleep Quantity and Quality

| | |
|---|---|
| Record ID | _____ |
| MRN | _____ |
| How many hours did the patient sleep? | _____ |
| How many in-room disturbances occurred between 00:00 and 04:00? | _____ |
| What was the reason for the in-room disturbance? | ☐ N/A<br>☐ Medications<br>☐ Laboratory draw<br>☐ Vital sign monitoring<br>☐ Dietary (food/water)<br>☐ Bathroom<br>☐ Bathing/wound care<br>☐ Respiratory care |

06/25/2022 11:55am projectredcap.org REDCap

**Figure 8**

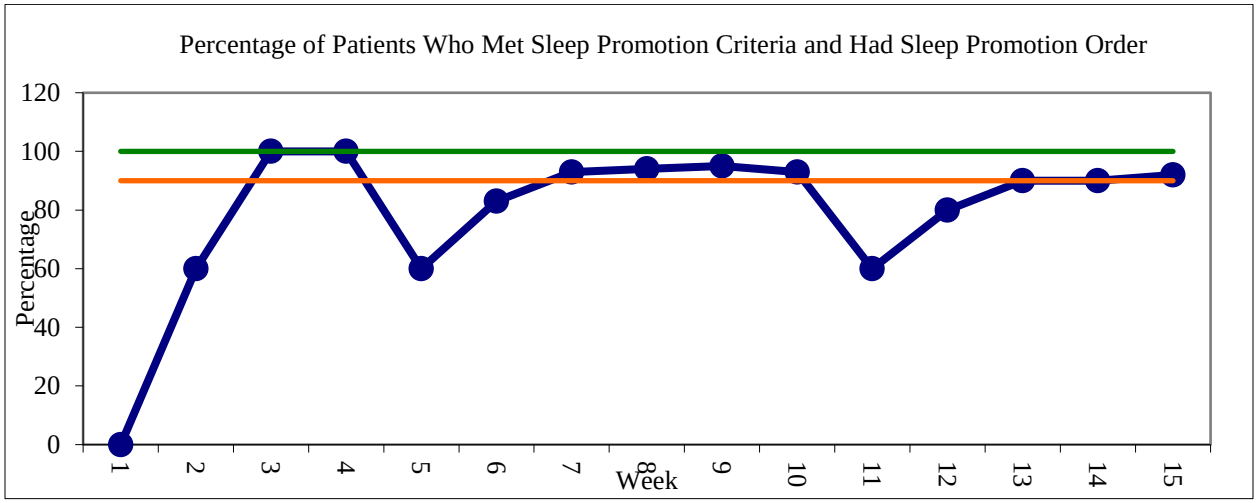
***Number of Patients Who had Sleep Promotion Discussed During Interdisciplinary Rounds***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29, Week 11: 25/29, Week 12: 28/29, Week 13: 27/29, Week 14: 29/29, Week 15: 29/29.

**Figure 9**

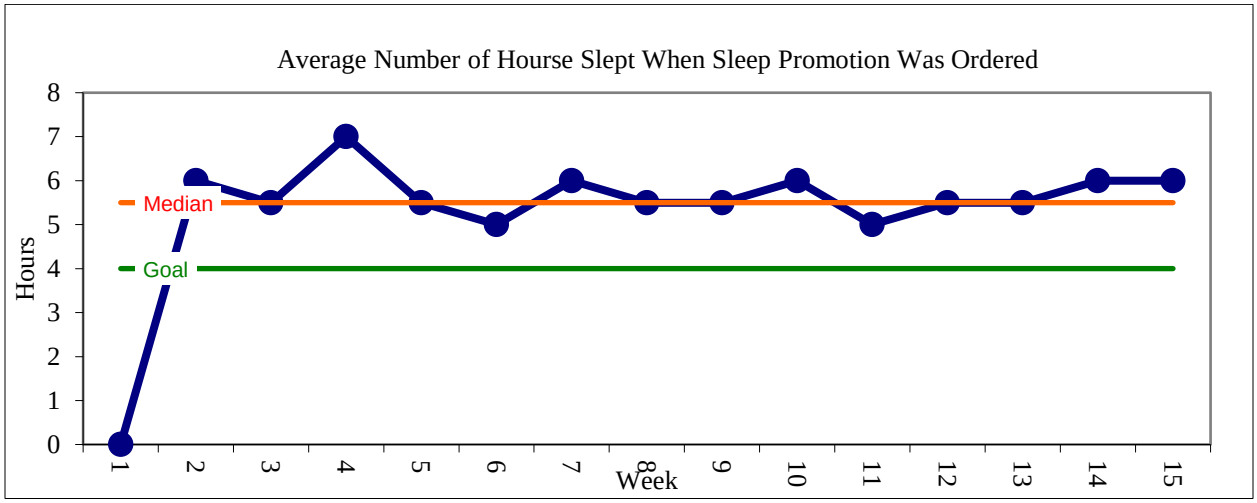
***Percentage of Patients Who Met Sleep Promotion Criteria and Had Sleep Promotion Orders***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29, Week 11: 25/29, Week 12: 28/29, Week 13: 27/29, Week 14: 29/29, Week 15: 29/29.

**Figure 10**

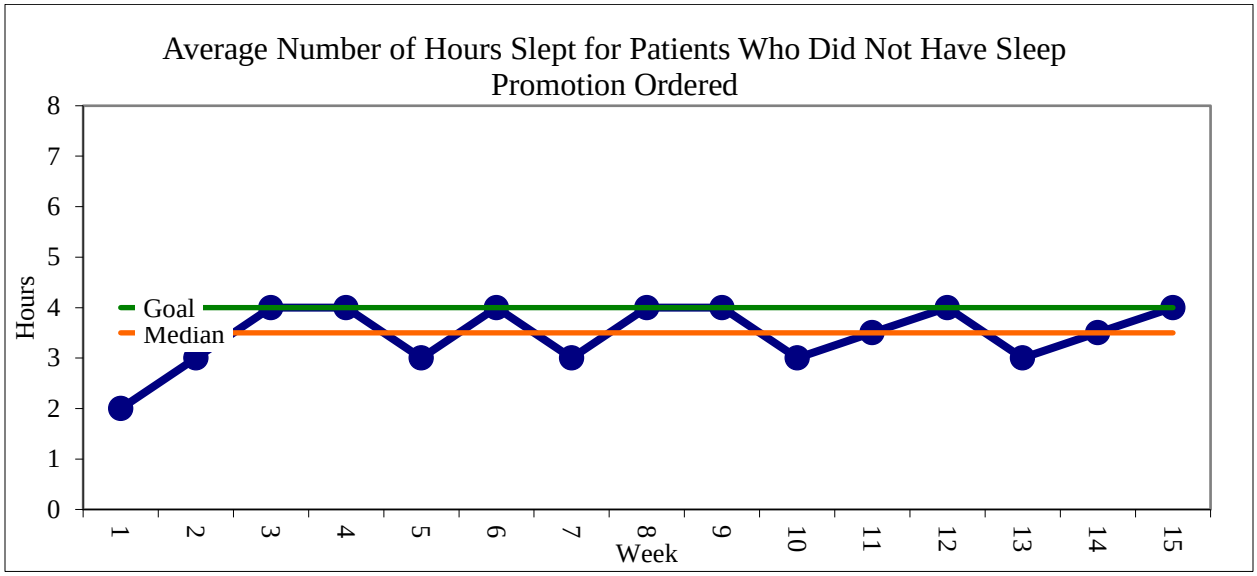
***Average Number of Hours Slept for Patients Who Had Sleep Promotion Ordered***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29, Week 11: 25/29, Week 12: 28/29, Week 13: 27/29, Week 14: 29/29, Week 15: 29/29.

**Figure 11**

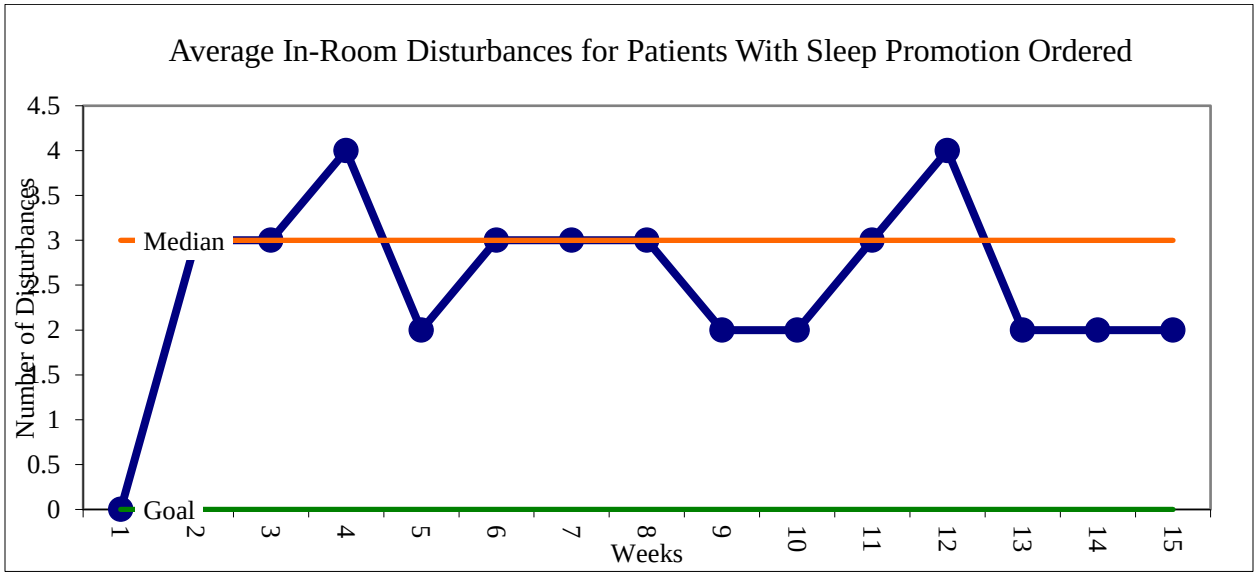
***Average Number of Hours Slept for Patients Who Did Not Have Sleep Promotion Ordered***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29, Week 11: 25/29, Week 12: 28/29, Week 13: 27/29, Week 14: 29/29, Week 15: 29/29.

**Figure 12**

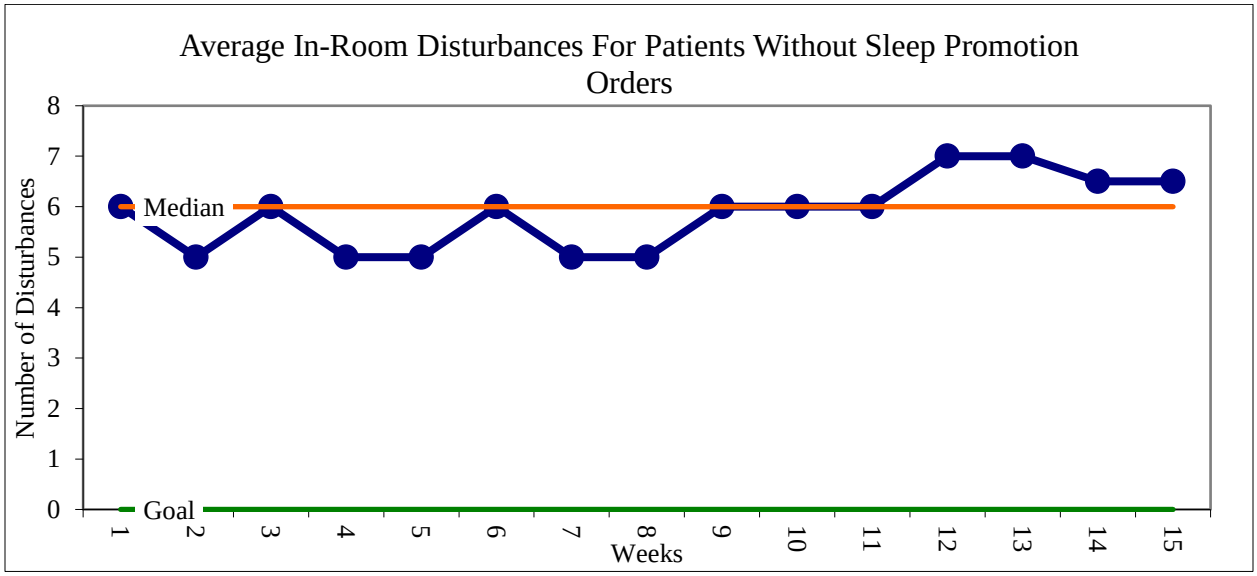
***Average In-Room Disturbances for Patients Utilizing the Sleep Promotion Protocol***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29, Week 11: 25/29, Week 12: 28/29, Week 13: 27/29, Week 14: 29/29, Week 15: 29/29.

**Figure 13**

***Average In-Room Disturbances for Patients Not Utilizing the Sleep Promotion Protocol***




*Note.* Actual participants/eligible participants for each week were as follows. Week 1: 26/26, Week 2: 29/29, Week 3: 27/27, Week 4: 28/28, Week 5: 28/28, Week 6: 26/26, Week 7: 28/28, week 8: 29/29, Week 9: 29/29, Week 10: 29/29.