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Protecting Sleep to Reduce Delirium in an Adult Intensive Care Unit

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Abstract

Practice Problem: Delirium is a common, yet often preventable complication in hospitalized patients. It is often caused by fragmented sleep, medications, environmental stimuli, and treatment therapies.

PICOT: The PICOT question that guided this evidence-based practice change project was: For patients in an adult Intensive Care Unit (ICU), does using a nurse-initiated, non-pharmacological sleep-enhancement protocol, versus no sleep-enhancement protocol, reduce the incidence of ICU-delirium over a period of 2 months?

Evidence: The reviewed literature supported the evidence for effective use of a nurse-initiated protocol in reducing delirium in the ICU. Sixteen articles met the inclusion criteria for the review of literature that supported the DNP project.

Intervention: A nurse-initiated sleep-enhancement protocol was implemented, which reduced interruptions during the hours between midnight and 0400.

Outcome: While there was a 50% reduction in delirious patients after the protocol was initiated, the data pool was small and was not proven to be statistically significant. Due to the Covid-19 outbreak, there were far fewer eligible patients than originally anticipated.

Conclusion: Although a clinically significant project outcome was not realized, staff felt that the protocol improved patient care and advocated for its use on all patients as a standard of care. Unit-based shared governance councils on other acute care floors have also adopted the sleep enhancement protocol

Protecting Sleep to Reduce Delirium in an Adult Intensive Care Unit

Sleep, a critical factor in health recovery, has been noted to be fragmented in critical care settings, resulting in a correlative effect between sleep deprivation and delirium (Faraklas et al., 2013). Delirium is defined as a temporary syndrome of cognitive disability characterized by disorganized thinking and accompanied by a decreased ability to maintain attention (American Psychiatric Association, 2013). Sometimes even fatal, delirium is the most frequent complication affecting hospitalized patients over 65 years of age (Inouye et al., 2014).

Sleep deprivation in the intensive care unit (ICU) can be attributed to loud noises, bright lights, monitors, frequent assessments, mechanical ventilation, and sedative or analgesic medications (Patel et al., 2014). Delirium, while often preventable, is prevalent in the ICU and is detrimental to restoration of health (Pessoa et al., 2019). Some negative outcomes caused by ICU delirium are increased mortality, increased hospital length of stay (LOS), increased financial cost of care, and long-term cognitive impairment (Barr et al., 2013; Inouye et al., 2014). Researchers have found a correlation between the length of time a patient suffered delirium and the level of functional disability for up to a year after discharge (Altman et al., 2018). Reducing the incidence of delirium has even been found to decrease the number of patient falls (Ferguson et al., 2018). Involving willing family members of ICU patients in delirium-prevention measures and decreasing the frequency of neurological assessments have been offered as feasible interventions to reduce delirium in the ICU (McLaughlin et al., 2018; Smithburger et al., 2017). Guidelines and protocols supporting protected rest periods in ICUs are ideal (Li et al., 2011). Each of the aforementioned studies looked at different interventions regarding their effect on delirium, and all acknowledged that lack of sleep is known to exacerbate it. This evidence-based practice change project implemented guidelines that promote noise and light control, and the

reduction of non-emergent interventions during “quiet time” to maintain circadian rhythm and reduce sleep deprivation and fragmentation, thereby reducing ICU-associated delirium.

Significance of the Practice Problem

The effects of protected sleep in the ICU may positively impact patients’ outcomes by reducing delirium, LOS, and overall mortality (Irwin et al., 2016). The impact on the healthcare system may be profound because shortened LOS reduces the financial cost of recovery to the patient and the healthcare system. Families may also be positively impacted because they may be able to avoid the distress of seeing their loved ones in a state of delirium and confusion.

The financial burden of treating delirium in the United States is a staggering $164 billion per year (Ferguson et al., 2018). In 2010 the average daily cost of an ICU stay was $4,300 (Society of Critical Care Medicine, n.d.). More recent data suggested an initial-day ICU expense of $10,794, which levels out to $3,968 by day 3, depending on whether the patient requires mechanical ventilation (Cunningham et al., 2020). Longer ICU LOS increases morbidity and mortality (Altman et al., 2018). There is a reliable association between sleep fragmentation and delirium (Irwin et al., 2016; Patel et al., 2014). One study, conducted in a neurological ICU, suggested the de-escalation of neuro-status checks after a patient has been there for more than 48 hours. The authors acknowledge that although the frequency of neurological assessment is initially done to avoid missing a key finding, after a certain time, it causes more harm than good (McLaughlin et al., 2018). The strength of this recommended practice change comes from the algorithm wherein sleep hygiene is a key recommendation in the diagnosis of ICU delirium, based on patient-oriented evidence and not opinion, consensus, or usual practice (Ebell et al., 2004).

The hospital where this project was implemented has not historically collected data specifically related to ICU delirium, but they do closely monitor LOS. Compared with national benchmarks, this facility has higher than expected LOS for several diagnoses. The Strategic Analytics for Improvement and Learning (SAIL) Value Model is a system used within the organization for data collection and quality improvement project analysis (SAIL, n.d.).

PICOT Question

This project sought to answer a practice question using the PICOT format, which means that for a certain population (P), the implementation of an intervention (I), compared with not doing the intervention (C), leads to an outcome (O) over time (T). For this project, the following PICOT question was addressed: For patients in an adult ICU, does using a nurse-initiated, non-pharmacological sleep-enhancement protocol, versus no sleep-enhancement protocol, reduce the incidence of ICU-delirium over 2 months?

This hospital is unique in that there are two divisions, Uptown and Downtown, separated by approximately 4 miles. Uptown houses nursing homes, rehabilitation units, and many outpatient clinics. Downtown houses the Spinal Cord Injury Unit (SCIU), three acute care units, and a Critical Care Unit (CCU), which comprises the Intensive Care Unit (ICU) and the Step-down Unit (SDU).

A single team governs both facilities and reports to the organization's Integrated Service Network (VISN). Local leadership is led by a facility director who has a chief of medicine and a chief of nursing as direct reports, supported by many service line chiefs, then the unit managers and assistant managers.

In order to ensure consistent application of the protocol, bedside nurses and physicians were trained by PowerPoint-supported inservices regarding the detriment of delirium and the

importance of protected rest periods. Staff members were post-tested on the purpose of the project and rationale in the hopes of gaining buy-in as to the importance of it. Once all were inserviced on the sleep enhancement protocol a firm start date was determined. Ancillary departments were notified of the practice changes, so they were able to adapt their workflow as needed. All CCU patients received the intervention, but those that were admitted for fewer than 24 hours or were comatose at the time of admission have been excluded from data collection. Because chemical paralysis would preclude an accurate assessment of delirium presence, those patients have also been excluded from the data.

Evidence-Based Practice Framework and Change Theory

Using a three-step process called PET (practice question, evidence, and translation), the Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) model framed the quality improvement initiative for this project. Each of the PET steps are supported by sub-steps intended to facilitate project success. For instance, in the practice question phase, a problem was identified, and the team recruited. In the evidence phase, literature supporting the practice change was synthesized and a recommendation for change was made. In the translation phase, the action plan was created and implemented, then evaluated and reported. The goal of this model was to expeditiously apply research into bedside practice (Dang & Dearholt, 2017). The JHNEBP model was the best fit for this project because it is an uncomplicated model for implementation of best practice (Schaffer et al., 2013). The PET process (see Appendix A) details the steps of implementation. See Appendix B for permission letter to use the PET tool.

The theory that best fit this practice change is Lewin's Change Theory, which has three phases: unfreezing, movement, and refreezing (Hussain, 2018; Lewin, 1947). This process is prevalent in practice literature (Stouten et al., 2018). The initial phase, unfreezing, is intended to

allow time to develop a vision and a plan for change. Unfreezing will identify the problem and possible cause. Garnering support from stakeholders in this phase, or earlier, bolsters the chance of success for the project (Hussain, 2018). The second phase involves the movement of applying the change. In this case, movement is where the protocol implementation happens, and measurement begins and is evaluated in terms of improvement (Lewin, 1947, as cited in Hussain, 2018). Refreezing, the final phase, entails making the change or new processes permanent by solidifying it in the organization (Lewin, 1947, as cited in Hussain, 2018; Stouten et al., 2018). Lewin's Change Model applied to this project because it spoke to the simplicity of the process of movement while also acknowledging the difficulty of it. Unless nurses understood the negative impact of the status-quo, and were included in the process of change, they may have abandoned the project or, worse, never supported it at all.

Evidence Search Strategy

A review of literature was conducted using the following databases: The University of St. Augustine for Health Sciences' Library, EBSCO, Cumulative Index to Nursing and Allied Health (CINAHL), MEDLINE, Google Scholar, PubMed, and Ovid. The basic search began, unfiltered, with "non-pharmacologic sleep protection in the ICU." This search yielded 1605 results over several decades. Initial exclusions included articles that were not written in English, not immediately available as a full document, or that were pediatric based. Subsequent exclusions included articles focused on delirium in patients with head injuries, brain tumors, or other pre-existing neurological disorders. Applying filters using the Boolean operators, including "AND" and "OR" to form relevant statements that included prevention of delirium, reduction of delirium, non-pharmacologic, nursing protocols, and ICU reduced the results to 201 citations and articles. The following Medical Subject Headings ("delirium," "delirium AND nurses," "nurses

AND initiated," "initiated AND nonpharmacologic") were added to narrow the selection of articles Comparative words ("reduction" and "intervention") were also included. This reduced the number of articles to 68. The time frame was limited to 2013-2020, which brought the results to 16 articles. See Table 1 for complete inclusion and exclusion criteria.

Table 1

Article Selection Criteria

Inclusion Criteria Applied	Exclusion Criteria Applied
Full-text articles	Unpublished article or report
Within date range of 2013 to 2020	Publication with no MeSH indexing
Qualitative and Quantitative study method	Publications outside date range
Includes ICU delirium	Articles without author or unclear
Includes nonpharmacologic order set / protocol	Abstracts or full-text unavailable
Includes nurse-initiated orders / protocols	Pediatric
	Pharmacotherapeutic interventions

Evidence Search Results

The Strength of Recommendation Taxonomy (SORT) grading tool was used to categorize recommendations in the clinical review articles (Ebell et al., 2004). Articles represented a variety of methods and designs including prospective-retrospective, quasi-experimental, randomized, systematic review, and descriptive. The qualifying articles were included based on the JHNEBP grading from levels I to V for project use. Figure 1, the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), illustrates the summary of results.

Themes with Practice Recommendations

The literature was assessed and synthesized for common themes (see Appendices C and D). Reliable evidence was found supporting nurse-initiated, nonpharmacologic promotion of sleep for the purpose of reducing or preventing delirium. The Society of Critical Care Medicine (SCCM) stated in its latest revision of the Clinical Practice Guidelines for the Management of Pain, Agitation, Delirium and Immobility (PADI): "We recommend promoting sleep in adult ICU patients by optimizing patients' environments, using strategies to control light and noise, clustering patient care activities, and decreasing stimuli at night to protect patients' sleep cycles" (Barr et al., 2013, p. 266). To that end, each of the following themes supports a quality change initiative.

Intentional Quiet Time

Intentional quiet time includes several simple, but often overlooked interventions like noise reduction by turning off televisions, closing doors when safe and appropriate to do so, eliminating overhead pages, and turning down nonessential monitor volume (Faraklas, et al., 2013; Kram et al., 2015; Patel et al., 2014). McLaughlin et al. (2018) suggested that for the non-neurologic patient, serial neurologic checks may be unnecessary once baseline is established.

Clustered Care

Avoiding fragmentation of sleep included care clustering, where disruptions for the resting patient are limited (Kram et al., 2015; Rivosecchi, et al., 2016). An example would be doing med pass, lab work, and chest x-ray all in the same interaction instead of three separate interactions. This required intentional coordination with ancillary departments.

Environmental Manipulation

Dimming of overhead lights at night and during quiet time can promote patients' natural circadian rhythm (Faraklas et al., 2013; Kamdar et al., 2014; Patel et al., 2014; Smith & Grami, 2017). Wake cycles are enhanced by opening blinds or turning on overhead lights, avoiding caffeine, and limiting excessive daytime naps (Faraklas et al., 2013; Kram et al., 2015; Patel et al., 2014). Birge and Aydin (2017) emphasized comfortable positioning to enhance sleep.

Reorientation

Constant reorientation measures included updating whiteboards, clocks, and calendars (Birge & Aydin, 2017; Faraklas, 2013). Consistent presence of family members may help mitigate the incidence and duration of delirium in the ICU (Smithburger et al., 2017).

Improved Outcomes

Evidence from the literature revealed improved outcomes when sleep protocols were implemented (Avendaño-Céspedes et al., 2016; Kamdar et al., 2014, Kram et al., 2015; Martinez et al., 2017; Patel et al., 2014; Rivosecchi et al., 2016; Smith & Grami, 2017). The use of standardized, reliable assessment tools (CAM-ICU or ICDSC) strengthened the validity of sleep bundles to reduce ICU delirium (Faraklas et al., 2013; Kamdar et al., 2014; Kram et al., 2015; Patel et al., 2014; Rivosecchi et al., 2016; Smith & Grami, 2017).

Practice Recommendations

The specific aim of this project was to reduce the incidence of delirium in the ICU. Evidence from the literature suggested a direct link between improving sleep and reducing delirium (Irwin et al., 2016; Li et al., 2011; Patel et al., 2014). Some suggestions for improved sleep were utilizing protocolized care bundles that include clustering of care to provide

intentional rest periods, avoiding benzodiazepines, manipulating the physical environment, and reorienting the patient frequently (Farklas et al., 2013; Irwin et al., 2016; Li et al., 2011).

Delirium causes increased LOS and mortality and reduced functional ability for up to a year after discharge (Altman et al., 2018; Faraklas et al., 2013; Ferguson et al., 2018). Evidence further suggested that utilizing a nurse-initiated sleep enhancement protocol in the ICU may have a positive financial impact to the organization, since the average increase in cost of ICU care once delirium develops is 39% (Vasilevskis et al., 2018). This project sought to follow best practices to reduce delirium by nonpharmacologically reducing fragmentation of sleep; the cost to implement was negligible. The greatest investment was that of time: on the front-end training nurses about the project and reinforcing the standard assessment tools; on the back end the analysis and dissemination of data. The organization already had a comprehensive training manual for using the CAM-ICU which was embedded into one of the computer-based training platforms (Elsevier) and tracked for compliance (Boehm et al., 2016). The practice change recommendation was to check each shift for ICU-associated delirium using an evidence-based assessment tool, the CAM-ICU (Boesen et al., 2015; Li et al., 2011; Patel, et al., 2014). Nurses were uniquely positioned to assess for and recognize delirium, since they spend much of their work time at the bedside (Pessoa et al., 2019). Expected outcomes included the implementation of a facility-approved, nurse-initiated protocol (NIP) which resulted in a slightly reduced rate of delirium in this ICU population.

Setting, Stakeholders, and Systems Change

Project Setting

This project took place in the 20-bed Critical Care Unit (CCU) of a hospital in eastern Georgia. Ten CCU beds are designated as Intensive Care Unit (ICU) beds and ten are Stepdown Unit (SDU) beds. The pre-pandemic average daily hospital census was 78-85 % total capacity,

with occasional community diversions when the unit was at capacity (Hospital website, n.d.). On the ICU side, nurse to patient ratio was 1:2 except for high-acuity procedures (e.g., continuous dialysis, targeted temperature management, or balloon pump). On the SDU side the nurse-to-patient ratio was 1:3. Ever-present in the CCU is tele-ICU, which represents 24/7 nursing coverage, and board-certified physician coverage during off-tour hours when attending physicians were not in-house. Resident physicians were always in the facility, but tele-ICU serves as a second set of eyes for nurses and providers. Other support staff necessary for the project's success included pharmacists, respiratory therapists, nurses' aides, students, and unit clerks.

Organizational Structure

The hospital where this project was implemented is a two-division facility with three affiliated community-based outreach centers. The downtown division houses the CCU, as well as 156 acute care and Spinal Cord Injury Unit (SCIU) beds. It also contains an invasive cardiology suite with two cardiac catheterization laboratories and a fully operational 16-bed Emergency Department (ED).

Organizational Culture

Organizational core values of this hospital system are Integrity, Commitment, Advocacy, Respect, and Excellence (I-CARE) which encapsulates the vision and supports the organization's mission to fulfill President Lincoln's (1865) promise "to care for him who shall have borne the battle, and for his widow, and his orphan" (p. 4). The organization is led by the director, the associate director, the assistant director, associate director of patient care services, and the medical director. This team is known locally as "The Pentad." The next tier of leadership includes service line chiefs, followed by managers, and then the front-line care staff.

Organizational Need

At the outset of this project, there were no standard operating procedures or protocols for CCU staff to follow or fall back on when delirium was suspected. The same was true at the end of the project. Delirium occurrence in this ICU follows national trends with as much as 80% of the patients experiencing some level of delirium during their stay (M. Stipsits, Nurse Manager, personal communication, December 2018). Therefore, the recommendation for improvement remains the implementation of a nurse-driven, non-pharmacologic sleep protocol for the purpose of avoiding the development of delirium whenever possible.

Stakeholders

Project stakeholders included the aforementioned pentad, nursing and physician leadership, tele-ICU, ancillary department members, and patients and their family members in the CCU. The medical director, nurse manager, and assistant nurse manager are key stakeholders, alongside front-line nursing staff. Given the interdisciplinary team approach of CCU from physician providers, nursing staff, and supporting ancillary departments (including but not limited to the laboratory, chaplaincy, radiology, physical therapy, occupational therapy, speech therapy, nutrition, hospital education, and wound care consultants) this project was set to become a successful practice improvement initiative. And then a pandemic struck.

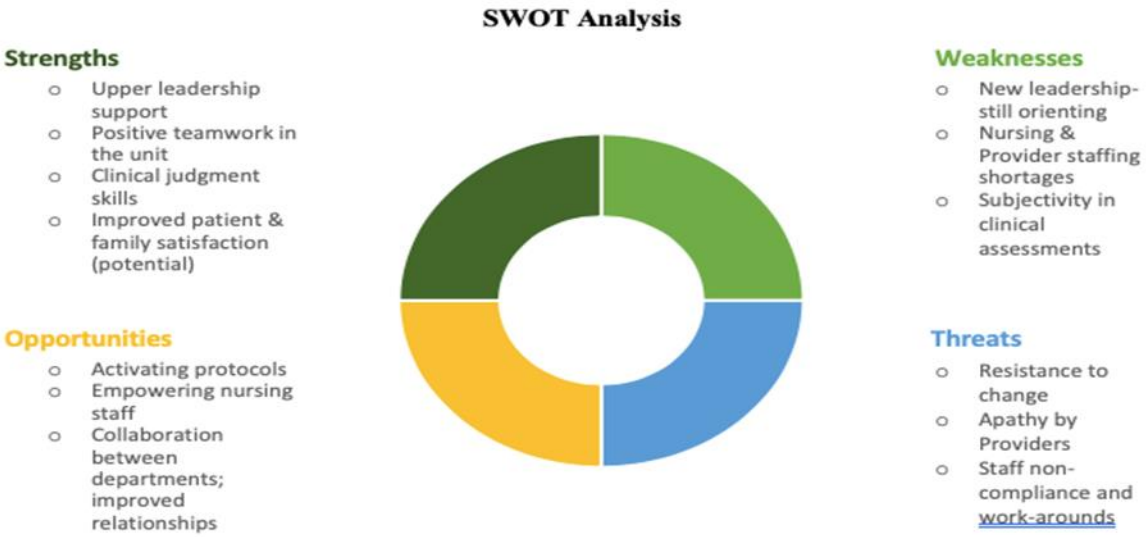
Strengths, Weaknesses, Opportunities, and Threat Analysis

A strengths, weaknesses, opportunities, and threats (SWOT) analysis was done to assess and mitigate potential barriers to project success. See Figure 2 for a visual representation of the SWOT. Strengths included the support of upper leadership, CCU teamwork, and the potential for increased patient and family satisfaction. Weaknesses included the newness of the CCU

leadership team. The medical director had been on board about 1 year at the time the project gained facility approval, and the nurse manager had been there for a shorter period of time. He is the 11th nurse manager in 8 years. There was a new assistant nurse manager (hired September 2020), and no clinical nurse leader. The CCU educator transferred from a related facility in May 2020. Opportunities included the standardization of delirium care and prevention. Since this protocol was nurse-driven, nursing staff experienced autonomy in recognition and implementation of best practices. Threats included resistance to change, non-compliance, and the incredible ingenuity of nurses to invent "workarounds" as a result. In-servicing was planned to help lessen these weaknesses and threats. The biggest threat was one that could not have been anticipated, which was the COVID-19 global pandemic. This worldwide threat changed nearly everything about critical care delivery.

Figure 2

SWOT Analysis



Implementation Plan with Timeline and Budget

Mission, Vision, and Objectives

Mission statements convey the purpose of businesses while vision statements describe a project's anticipated goals (Meyer, 2019). The mission statement of this facility is to serve our patients with care, compassion, and commitment (Facility Volunteer Handbook, n.d.). The vision of this project was to use nurses' intervention via a standardized protocol to affect a reduction in incidence of delirium in the CCU over 2 months. Anticipated anecdotal benefits were shortened overall LOS and earlier liberation from mechanical ventilation for patients on life support. At implementation, all CCU nurses understood the sleep enhancement protocol, were able to articulate its benefits, and properly apply it.

Short- and Long-term Objectives of the Project

Short-term goals for this project included obtaining stakeholder support and implementation through training and allowing time for questions and answers, which included reference to similar successful projects. Within 5 days of initial training, there was > 90% use of the protocol. This was verified by a 100% audit per the project manager.

The long-term goal of this project was to reduce delirium in the CCU. Sustained use of the sleep enhancement protocol was evidenced by the adoption of it into standard practice in the CCU. Ongoing clinical training will be accomplished with annual assessment of competence using the CAM-ICU tool. To sustain stakeholder buy-in, quarterly status reports of delirium rates will be provided to the staff so they can continue see the direct results of their efforts.

Risks and Unintended Consequences of the Project

Mitigating pitfalls and barriers is crucial to the success of this or any future project to be implemented in the CCU. The primary barrier to this project was the COVID-19 pandemic and its effect on patient flow, treatment, and outcomes. This hospital experienced a second wave of the pandemic in November 2020 which resulted in the majority of patients being intubated and sedated, with many being placed in the prone position for maximum oxygenation. Proning requires chemical paralyzation, which means that those patients were unable to participate in delirium assessment. This factor alone reduced the sample size markedly.

Nursing staff who completed the pre-implementation training early and demonstrated competence in the use of the assessment tool (CAM-ICU) served as subject matter experts. These experts helped encourage their peers who either had not done the training or did not initially buy in to the protocol. Data, essential to understanding intervention efficacy, was collected twice weekly, and analyzed weekly. Unintended negative effects were mitigated via regular communication with the CCU staff throughout the length of the project. While it was known that a large data pool would not be realized because of the pandemic, the project manager proceeded with the project and communicated as originally planned.

Project Plan (Method)

For this project, a pre- and post- assessment was done to compare CAM-ICU scores in CCU patients before and after implementing the nurse-initiated sleep enhancement protocol. A chart review using the Computerized Patient Record System (CPRS) was done to compare CAM-ICU scores at baseline (pre-implementation) and post-implementation of the sleep enhancement protocol. Total number of patients with positive CAM-ICU was assessed in retrospective patient populations during the 30 days before implementation and compared to those receiving the nurse-driven protocols over a period of 30 days. The goal was to reduce the

incidence of ICU-delirium in that time frame. As evidenced by assessing the number of delirious patients divided by the total number of patients in the CCU on a random day, the initial rate of delirium was 60-70%. Lewin's Change Theory was the framework for this project alongside the JHNEBP model for implementing change.

Project Steps

Leadership in CCU and the Hospital Education Department supported this project to decrease delirium in the unit and see it as an important evidence-based practice change initiative for the organization overall. Implementation of this project began with the planning phase followed by training by inservice for the nursing and provider staff regarding delirium as an effect of sleep fragmentation. Use of the CAM-ICU tool was reinforced using an already-published, system-wide how-to manual embedded in, and tracked by, one of the computer-based training systems of the facility. Staff members were able to download it to their cloud drive for reference. All training was done using the Donna Wright method, which emphasized lateral training with three main components of understanding: a) competencies are collaborative, b) the learner is the central focus of competency evaluation, and c) leaders create a dual-focused (employee, organization) culture of success (Wright, 2005).

Implementation occurred in the following order:

1. Planning for the implementation of an evidence-based, nurse-initiated sleep enhancement protocol was formally approved by the CCU medical director, nurse manager, and DNP preceptor.
2. Staff training was done (utilizing Donna Wright method) on the detriment of delirium, use of the CAM-ICU tool, and sleep enhancement protocol.
3. Dry-run evaluations were completed prior to go-live.

4. Implemented the sleep enhancement protocol in November 2020.
5. Periodic data collection and PDSA cycling were done.
6. Data analysis was conducted using Intellectus, and MS-Excel spreadsheets.
7. Dissemination of project results.

A detailed timeline of the project is included (see Appendix E) and represents the schedule for this quality improvement process.

Budget and Resource Needs

Training classes on delirium, CAM-ICU, and sleep enhancement protocols were provided by the project manager, founded on emailed PowerPoint presentation, rounding inservices, and wall posters. The information was reinforced by super-trainers. Initial delirium and CAM-ICU training took place by email blast of the CAM-ICU Training Manual which was used for cross-referencing throughout the project. The manual is a preexisting system-wide document accessible to all facility staff. Protocol training was in the form of 15-30-minute in-services with time following for questions and concerns. Thirty-minute training sessions for 40 CCU nurses either before or after their tour-of-duty cost the facility approximately $700 given that the average hourly salary for the CCU nurses is $35. Approval for this expense came from the chief financial officer and the nursing chief of medicine. Once training took place, protocol implementation became part of the normal workflow of the bedside nursing staff, and no additional equipment or supplies were needed for implementation.

The benefit of reducing fragmented sleep in the CCU was intended to be less delirium, with secondary benefits being shorter LOS and improved overall outcomes. The pandemic impacted this project significantly, however, data from 2010 indicated the average cost-per-day of an ICU stay is $4300, depending on acuity and use of resources (Critical Care Statistics, n.d.).

This figure represented a 61% increase in cost from 2000 data, so the current ICU-cost-per-day is likely much higher now (Critical Care Statistics, n.d.). A table representing the project budget (Appendix F) is included.

Evaluation

The project evaluation tool (see Appendix G) facilitated measurement of changes in the rate of delirium in the CCU after 4 weeks of the sleep enhancement protocol implementation. An analysis of pre- and post- sleep enhancement protocol implementation has determined only a slight reduction in delirious patients in CCU after the 4-week timeline. EMR review included all non- proned or paralyzed patients admitted to the CCU during the 4-week total review.

CAM-ICU (Appendix H) is the defined measurement tool to assess for delirium for this project. Richmond Agitation Sedate Scale (RASS) (see Appendix I) assesses for sedation and is completed with the CAM-ICU to ensure patients are not too sedated to accurately assess for delirium; it is not completed on alert patients. Preventing delirium can positively impact overall patient outcomes (Devlin et al., 2018). Based on this knowledge, practice changes from implementing a sleep enhancement protocol provided: a). autonomy for nursing staff to intervene with protocolized measures to avoid delirium b). empowerment of nursing staff to use their assessment findings to apply a new protocol c). pride of the nursing staff at trying to reduce delirium and its associated sequelae of negative events that often accompany it.

Team Specifics

The team involved in the work of this project consisted of the project manager, CCU nursing leadership, and the bedside nursing staff. Support staff included the resident and attending physician group, the pharmacy and other ancillary departments (for medication and therapy scheduling purposes). Family members and other surrogates would have been recruited

to help minimize the incidence of ICU delirium by engaging them in protecting the sleep of their loved ones, but at the time of this project all visitations were on hold as a result of COVID-19 safety recommendations. Families are largely willing to be involved in helping to prevent delirium (Smithburger et al., 2017) so the fact that they could not be included was disappointing. For nurses, the non-COVID care they delivered did not change, only the timing of it did. The effort of the team was supported by stakeholders, and the project will be revisited house-wide after the pandemic in hopes of realizing greater benefit for patients at every level of acuity.

Inclusion and Exclusion Criteria

Initial inclusion criteria for participants in this project were as follows: a) 18 years of age, b) conscious, as indicated by any RASS other than -4 or -5, c) non-delirious as indicated by a negative CAM-ICU score, d). able to communicate in English, e) length of CCU stay >24 hours. Exclusion criteria for participation were: a) age younger than 18 years, (b) exhibition of primary dementia, (c) unconscious as indicated by a RASS score of -4/-5, or (d) refusal to participate. Ultimately, the chemically paralyzed and proned patients were also excluded. Also, as a result of the pandemic, CCU had to be expanded into the adjoining 8-bed, open- bay Post Anesthesia Care Unit. The only partition between beds were curtains, and there was no buffer for noise or light in that area. Those patients could not be included in the project because there was no way to alter the environment for one without altering it for all.

Data Collection Details

Throughout the project, all patients meeting the criteria for the sleep enhancement protocol implementation were tracked and trended by the project manager/ graduate student. A pre-implementation rate of delirium was determined by calculating the rate for 30 days prior to implementation to provide a baseline measurement. After implementation, for 30 days, the rate

was calculated again to ascertain change. The outcome was a slight reduction in delirium for patients in the CCU.

The collection phase answered the measures associated with the PICOT. Outcome measures that were collected include a reduction in positive CAM-ICU scores and, anecdotally, LOS in the CCU. (LOS is calculated by subtracting the date of admission from the date of discharge.)

Types of Measures

For any quality improvement project, measurements validate the project results (Institute for Healthcare Improvement [IHI], 2020). The measures chosen for studying processes and outcomes of the intervention are the CAM-ICU and the RASS, which are valid and reliable delirium assessment tools recommended by the SCCM in its 2013 Pain, Agitation, and Delirium PADI guidelines (see Appendices H and I). The independent variable of this project is the sleep enhancement protocol implementation. The dependent variable is the rate of delirium. Table 2 includes details for each category of measure for the project with the type of statistical test to be used for each measure.

Table 2

Measures, Goals, and Statistical Analysis

MEASURE	CATEGORY	DEFINITION	GOAL	STATISTICAL TEST/ DATA TYPE
CAM-ICU	Outcome	Negative score= no delirium present. Current rate is 80% positive CAM-ICU	≤ 80%	Continuous data/ unpaired t-test
LOS in CCU	Outcome	Length of time admission to discharge or transfer from CCU	≤ 3 days	Ratio data/measures of frequency
Number of staff to complete SEP training	Process	Number of clinical staff to successfully complete SEP training. Numerator is number of staff completing training & denominator is total number of staff.		Categorical data / X^2
Cost of Training	Financial	Total number of clinical staff multiplied by hourly rate x 1 hour.	$700.00 with average hourly rate of $35.00	This figure is also represented in Appendix F

Outcome Measures

The primary outcome measure for this project was reduced incidence of delirium pre- and post-implementation. Secondary outcome measure was CCU LOS. Average LOS was calculated by dividing the total days of ICU stay for all patients included in the data collection pool by the number of discharges. There was a pre- and post- intervention pool. A smaller number in the post-implementation data pool would have indicated a shorter ICU LOS, but this did not occur. At staff meetings and daily huddles, the nurse manager and project manager provided updates, opportunities for improvement, and progress related to the initiative.

Process Measures

Process measures are defined as the steps that lead a project to its outcome (IHI, 2020). The process measure for staff completion of the sleep enhancement protocol inservice was done by assessing the percentage of staff that attended inservices before the roll-out date. The goal was 90%. Proper use of the CAM-ICU was reinforced to staff nurses in the ICU and evaluated using occasional direct observation and random chart review. The Donna Wright model of competency assessment helped to identify champion staff that were able to reinforce and support the use of the protocol during the implementation phase and beyond (Wright, 2005).

Balancing Measures

A balancing measure asks whether changes designed to improve one part of a system causes new problems in other parts of the system (IHI, 2020). The balancing measure for this project was the percentage of the staff that find satisfaction with the use of the sleep enhancement protocol. The project manager assessed staff satisfaction by way of random interviews following the completion of the project. The question asked was “Do you feel as though the Sleep Enhancement Protocol was helpful for our patients?” Staff members were

invited to provide specific feedback in an email reply, but it was not required. All of the 25 staff who were interviewed saw value in the protocol and agreed that it will be an easy intervention to provide in the future.

Financial Measures

The direct and indirect expenses of a project are indicated as financial measures (IHI, 2020). They helped to determine any monetary requirements for the project and were approved by the organization before implementation. For the purpose of this project, financial measures (see Appendix F**)** include the cost of training the clinical staff in the form of a half-hour inservice on the detriment of delirium and reinforcement of the proper use of the CAM-ICU tool. The PowerPoint presentation used for in-servicing is included (see Appendix J), and the protocol is embedded in it (see Appendix K).

Validity and Reliability

Validity confirms that the data results represent the proposed measure for the project (reduction of delirium) and reliability demonstrates stability and consistency over time (Sylvia & Terhaar, 2018). The project manager, alongside the statistics team, both played an active role in data collection, evaluation, and chart reviews. The RASS (see Appendix I) is a 10- point scale for measuring sedation, with four grades of anxiety or agitation above 0 (“restless” to “combative”), and five levels of sedation below zero (“drowsy” to “unarousable”) (Sesser et al., 2002). A score of zero indicates a calm and alert state. A score > -3 means the patient can be CAM-ICU assessed. A score of -4 or -5 means the patient is too sedate to assess for delirium. This data will be measured both pre- and post-intervention. The CAM-ICU (see Appendix H**)** is the most commonly used instrument for diagnosing delirium (Devlin et al., 2018; Ely et al., 2002). It takes about 2 minutes to complete and can be used with both verbal and non-verbal

patients (Ely et al., 2002). Typically, RASS and CAM-ICU are used together: the former to assess sedation and latter to assess delirium. The CAM-ICU is well-validated and showed high-interrater reliability ($k=0.94$, $p<0.001$) (Devlin et al., 2018; Ely et al., 2002). The CAM-ICU tool included four parts, which assess in order: mental status changes, inattention, disorganized thinking, and level of consciousness (Ely et al., 2002). Patients were either positive, negative, or unable to be scored. Deficits in features judgement or attentiveness indicate that the patient was delirious (Ely et al., 2002). These have been measured pre- and post- implementation of the sleep enhancement protocol.

Data Analysis

The data collection tool (see Appendix F) is a descriptive table and provides each data collection point for the project: the date, numeric patient code, admission and discharge dates, LOS, CAM-ICU scores for each shift, RASS score, protocol initiation time, whether there were any interruptions, and a block for extraneous notes.

Data collection originated from CPRS, a reliable and valid EMR utilized by all medical centers in this healthcare system. Descriptive statistics were used to measure the frequency of delirium (Sylvia & Terhaar, 2018). Random chart audits were completed for the sleep enhancement protocol usage among the nursing staff with a goal of $\geq 90\%$ which was the measurement of compliance for the hospital. Pre-implementation data was collected using chart audits during the four weeks prior to starting the protocol. All qualified CCU patient charts were reviewed and CAM-ICU scores were collected daily during the post-implementation phase. Table 2 provides a complete explanation of the measures of frequency, central tendency, and inferential statistics that were utilized.

Project Results

Data were collected by the project manager, according to timeline and plan. It was collected on the attached data collection tool, then shredded after being imported into Excel. A security chip-accessed federal computer was used, which is in an interior, locked office. Data were evaluated in collaboration with a statistician at Intellectus, using their proprietary software.

Chi-square Test of Independence

A Chi-square Test of Independence was conducted to examine whether Time and CAM_ICU were independent. There were 2 levels in Time: Pretest and Posttest. There were 2 levels in CAM_ICU: Yes and No.

Assumptions

The assumption of adequate cell size was assessed, which required all cells to have expected values greater than zero and 80% of cells to have expected values of at least five (McHugh, 2013). All cells had expected values greater than zero, indicating the first condition was met. A total of 50.00% of the cells had expected frequencies of at least five, indicating the second condition was violated. When the assumptions of the Chi-square test are violated, Fisher's exact test can be used to produce more reliable results with small sample sizes. Logit models such as binary logistic regression can be used for larger sample sizes.

Chi-square Results

The results of the Chi-square test were not significant based on an alpha value of 0.05, $\chi 2(1) = 0.95$, $p = 0.329$, suggesting that Time and CAM_ICU could be independent of one another. This implied that the observed frequencies were not significantly different than the expected frequencies. Four out of 10 patients exhibited signs of delirium pre-intervention, and only two of 10 showed signs of delirium post-intervention. While this looks like a reduction of

50%, it is not statistically significant due to the small sample sizes both before and after the sleep enhancement intervention. Table 3 presents the results of the Chi-square test.

Table 3

Chi-square Test Results of Observed and Expected Frequencies

	CAM_ICU				
Time	Yes	No	χ^2	*df*	*p*
Pretest	4[3.00]	6[7.00]	0.95	1	.329
Posttest	2[3.00]	8[7.00]			

Note. Values formatted as Observed[Expected].

Two-Tailed Independent Samples t-Test

A two-tailed independent samples t-test was conducted to examine whether the mean of LOS-in-days was significantly different between the pre-test and post-test categories of time.

Assumptions

Shapiro-Wilk tests were conducted to determine whether LOS-in-days could have been produced by a normal distribution for each category of Time (Razali & Wah, 2011). The result of the Shapiro-Wilk test for LOS-in-days in the pretest category was significant based on an alpha value of 0.05, W = 0.77, p = 0.006. This result suggested that LOS-in-days in the pre-test category is unlikely to have been produced by a normal distribution. The result of the Shapiro-Wilk test for LOS-in-days in the post-test category was significant based on an alpha value of 0.05, W = 0.82, p = 0.022. This result suggested that LOS-in-days in the post-test category is unlikely to have been produced by a normal distribution. The Shapiro-Wilk test was significant for both the pre-test and post-test categories of time, indicating the normality assumption is violated.

Levene's test was conducted to assess whether the variance of LOS-in-days was equal between the categories of time. The result of Levene's test for LOS-in-days was not significant based on an alpha value of 0.05, F(1, 18) = 0.21, p = 0.653. This result suggests it is possible that

the variance of LOS-in-days is equal for each category of time, indicating the assumption of homogeneity of variance was met.

T-test Results

The result of the two-tailed independent samples t-test was not significant based on an alpha value of 0.05, t(18) = 0.01, p = 0.993, indicating the null hypothesis cannot be rejected. This finding suggested the mean of LOS-in-days was not significantly different between the pre-test and post-test categories of time, and the sleep enhancement protocol did not have any impact on LOS. The results are presented in Table 4. A bar plot of the means is presented in Figure 3.

Table 4

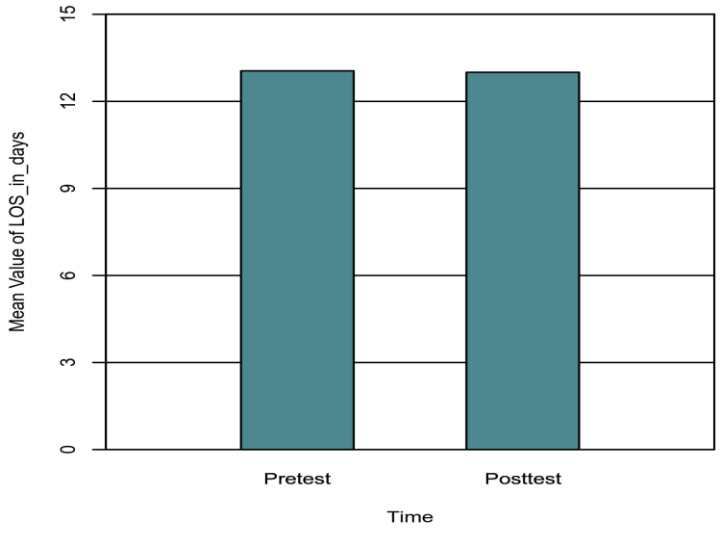
Two-Tailed Independent Samples t-Test for LOS-in-days by Time

	Pretest		Posttest				
Variable	*M*	*SD*	*M*	*SD*	*t*	*p*	*d*
LOS-in-days	13.05	14.52	13.00	11.93	0.01	.993	0.00

Note. N = 20. Degrees of Freedom for the *t*-statistic = 18. *d* represents Cohen's *d*.

Figure 3

The Mean of LOS-In-Days by Levels of Time



Missing Data and Storage

Data regarding the interventions of the project have been thoroughly documented and followed daily through the entirety of the project timeline. When noncompliance with the assessment tools threatened the project, staff members were reminded in person to complete them. All relevant information has been added to the database at twice weekly intervals in the form of an Excel spreadsheet. The need for accurate data and consistency with CAM-ICU assessment and the sleep enhancement protocol implementation was reinforced to the project team members at huddle twice weekly. Data was obtained from the electronic health record and stored on a computer physically located inside an interior office with two locked doors and accessible only with a key card and passcode. The collection tool reflected numeric codes in lieu of actual patient identifiers.

Protection of Human Rights

The project proposal was presented to the University of St. Augustine's EPRC committee for approval prior to institutional review board (IRB) submission via this hospital's affiliated university. Final review by the facility's research and development committee has also verified that no human subject data is involved in the project prior to granting their final approval. Letters of support and approval are included (see Appendix L). Consent was not required for this project because delirium assessment is standard practice in the CCU. No patient harm occurred.

Impact

This evidence-based practice project could not be determined to be successful in terms of reliable reduction of ICU delirium, nor did it show any correlating reduction in LOS. The project has addressed the problem of ICU delirium by applying an evidence-based intervention, and while the data pool was reduced by the Covid pandemic, the protection of sleep has become a standard

of care in the ICU as well as the acute care areas of this facility. Implementation occurred according to plan; it was measurement that was hindered by the pandemic, in that there were very few patients who met inclusion criteria. This huge reduction in qualifying patients secondary to Covid-19 posed the biggest limitation to the success of this project. ICU nurses reported satisfaction with the autonomy of applying the protocol, and they conveyed a sense of empowerment in using it. Several nurses reported ideas for other potential projects involving nurse-initiated protocols.

Future implications of this project include the alteration of practice across the facility by the addition of sleep enhancement measures for all patients, not just the critically ill. To further improve the practice problem, sleep enhancement will be included in annual unit education, as well as the onboarding and orientation processes. To sustain this project, chart audits will continue to be done by unit peer leaders. Plans are in place to include "sleep enhancement as a nursing intervention to reduce delirium" in an upcoming journal club discussion for continuing nursing education credit. The ICU nursing staff has been supportive of this project, and fully compliant in implementing the protocol on qualifying patients. The process measure reflecting 90% or better compliance with inservice training was met. Because super-trainers educated their peers, and advocated for sleep enhancement, they reported a deeper interest in the project outcome. One nurse said, "This wasn't another mandate; it wasn't done to us, it was done with us." Another said, "This feels like the most normal thing we have done since the pandemic began." All seem hopeful that a post-pandemic reimplementation will be successful.

Dissemination

Project culmination included a comprehensive review and evaluation of strengths, weaknesses, and opportunities for refining future use of nurse-initiated protocols in the ICU.

Internal dissemination of the project results within the institution happened at several levels. Initially, results were presented in the unit, to nurses at their shift huddles, and then at their monthly staff meeting. First string attendees included bedside nursing staff, resident physician staff, and the nurse managers. Results were presented to facility leadership remotely using Microsoft Teams. The ICU leadership team included (in ascending order) the assistant nurse manager and manager, the chief nurse of medicine, the medical director, and the facility director. An all-staff email invitation was sent facility-wide so that every interested employee was able to attend the presentation on Teams. Results were also published in the facility newsletter.

The project manager disseminated results at their local AACN chapter monthly meeting. Even though the project did not demonstrate statistical significance the value of Clinical Significance is realized for planning future projects and the staff recognized its essentialness for patient care to reduce the potential for delirium. Journal submission provides an opportunity to disseminate information validating the benefits of NIPs and to corroborate that evidence-based practices can improve patient outcomes (Wolf, 2015). A full text will be submitted to the SOAR@USA institutional repository as a part of the DNP program completion requirements, which will also enhance the discoverability of this EBP project. Final submission to the Sigma Repository will be completed in an effort to distribute the project material worldwide.

Conclusion

The intention of this paper has been to introduce the rationale behind and the plan for an evidence-based practice change project to reduce delirium by protecting sleep and rest in an ICU. As indicated in the literature, utilizing a well-organized, evidence-based sleep enhancement protocol should reduce fragmentation of sleep and decrease the incidence of delirium with all its

negative sequalae for this patient population. The protocol is simple and includes favorable environmental manipulation, frequent reorientation, and clustered care. There were no earplugs, eye masks, aromatherapy, or medications used in this project, though there are several published articles that advocate for them. This project sought to facilitate a protocol for the consistent use of sleep enhancement interventions in hopes of promoting uninterrupted sleep in ICU patients as evidenced by improved CAM-ICU scores and a decreased incidence of delirium. Unfortunately, the global COVID-19 pandemic erupted which severely restricted the pool of eligible patients and interrupted the expected outcome. Thankfully, the facility plans to implement the Sleep Enhancement Protocol on every floor going forward. They will reassess the effectiveness after the pandemic ends.

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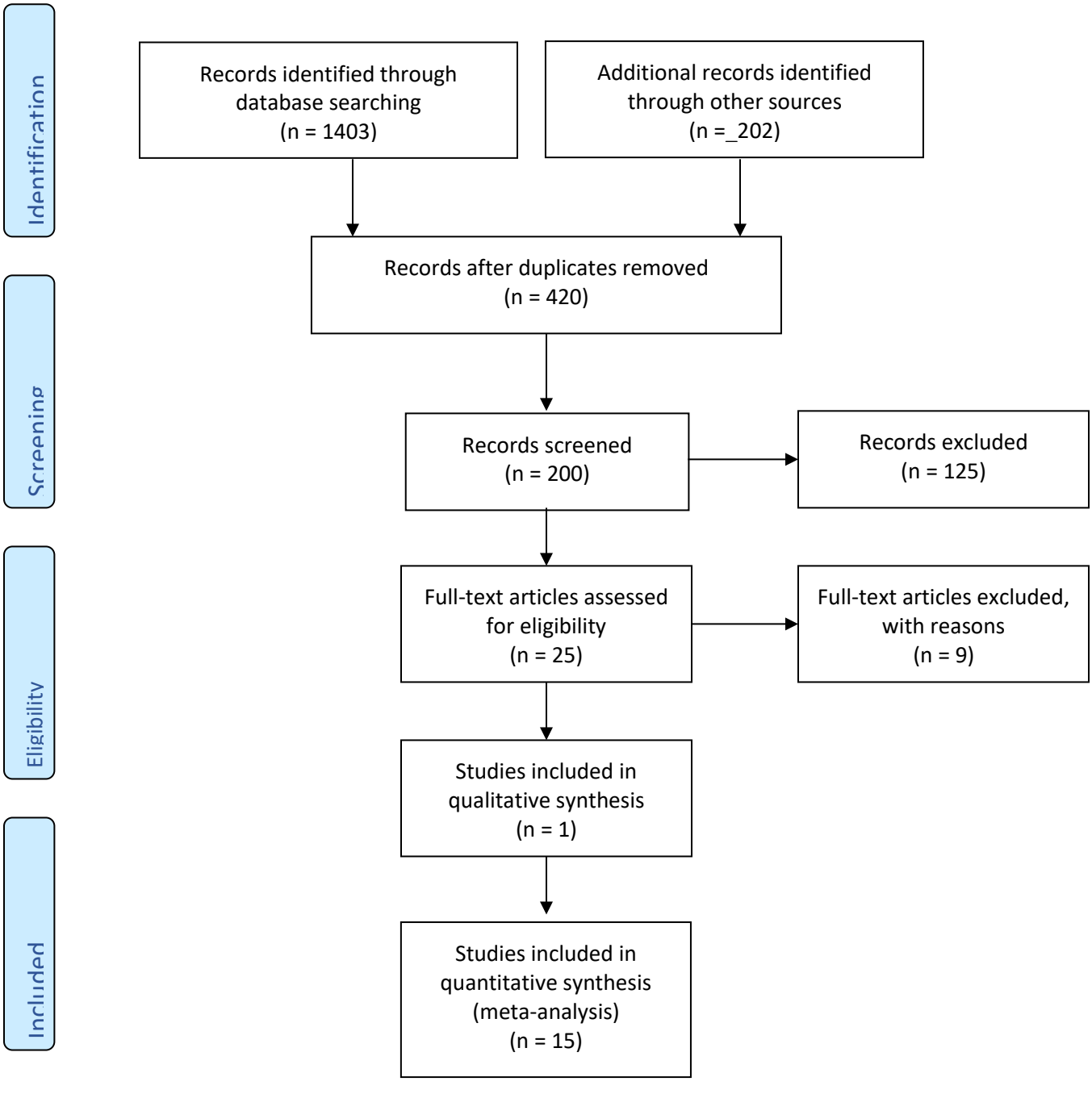
Figure 1

PRISMA Summary



Note. Prisma flow chart diagram from "Preferred Reporting Items for Systematic Reviews and Meta-analyses: The PRISMA Statement," by D. Moher, A. Liberati, J. Tetzlaff, & D. G. Altman, 2009, *Annals of Internal Medicine, 151*(4), p. 267 (http://dx.doi.org/10.7326/0003-4819-151-4-200908180-00135). Copyright 2009 by The American College of Physicians

Appendix A
PET Diagram

PRACTICE QUESTION

Step 1: Recruit interprofessional team
Step 2: Define the problem
Step 3: Develop and refine the EBP question
Step 4: Identify stakeholders
Step 5: Determine responsibility for project leadership
Step 6: Schedule team meetings

EVIDENCE

Step 7: Conduct internal and external search for evidence
Step 8: Appraise the level and quality of each piece of evidence
Step 9: Summarize the individual evidence
Step 10: Synthesize overall strength and quality of evidence
Step 11: Develop recommendations for change based on evidence synthesis

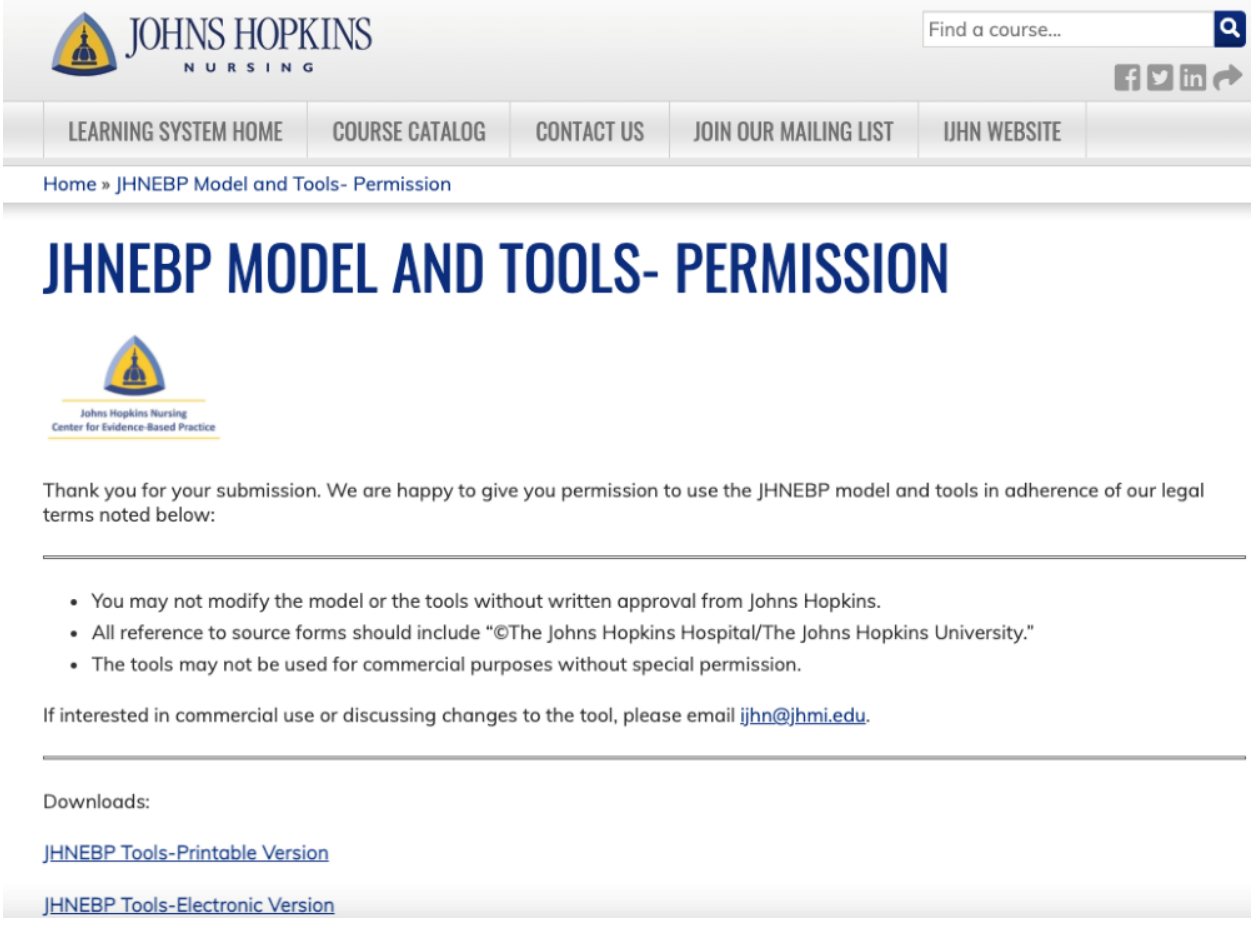
- Strong, compelling evidence, consistent results
- Good evidence, consistent results
- Good evidence, conflicting results
- Insufficient or absent evidence

TRANSLATION

Step 12: Determine fit, feasibility, and appropriateness of recommendation(s) for translation path
Step 13: Create action plan
Step 14: Secure support and resources to implement action plan
Step 15: Implement action plan
Step 16: Evaluate outcomes
Step 17: Report outcomes to stakeholders
Step 18: Identify next steps
Step 19: Disseminate findings

Note. PET flow chart diagram by D. Dang & S.L. Dearholt, 2017, *Johns Hopkins Nursing Evidence-Based Practice: Model and Guidelines* (3rd ed.) (https://www.hopkinsmedicine.org/evidence-based-practice/ijhn_2017_ebp.html). Copyright 2017 by The Johns Hopkins Hospital/ The Johns Hopkins University.

Appendix B
PET Permission Letter



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Appendix C
Summary of Primary Research Evidence

Citation	Design, Level Quality Grade	Sample type Sample size	Intervention Comparison (Including tools used along with reliability & validity)	Data Analysis	Limitations	Usefulness Results Key Findings
Faraklas et al., 2013	3B	A total of (n=130) patients were surveyed, pre- (n= 81) and post-implementation (n=49) in a burn-trauma ICU, but not all patients were burned. Quasi-experimental study using a pretest-posttest design (non- randomized).	Validated Richards–Campbell Sleep Questionnaire was the survey tool used for patients to describe their quality of sleep		Patients would have to be alert and somewhat oriented (without signs of delirium) to use the questionnaire. May be useful in non-delirious patients participate in the project.	Post-implementation patients reported falling asleep faster (P = .022) with significant improvement in falling asleep (9 vs 4, P = .002) and being able to go back to sleep if woken up (8.5 vs 5, P = .033). Post-implementation patients complained less often than pre-implementation patients did about sleep.
Patel et al., 2014	3B	Mixed ICU, *n*=338, 24-bed ICU, academic hospital in UK	CAM-ICU, RCSQ, sleep efficiency index	Mixed methodology	Nonrandomized cohorts and single-center design (selection bias), tools used relied	Improvements in all components of RCSQ ($p<0.05$); improved sleep time ($p<0.001$) and >3hr of sleep

		Pre/post cohort			upon self-assessment	window (p=0.029); improved sleep efficiency index (p<0.001);
Altman et al., 2018	2B	**Sample Size:** This observational cohort sample was made up of patients with an expected ICU length of stay >24 hours. 422 were enrolled, of which 327 were eligible for follow-up for up to 1 year post-discharge. Observational cohort study	CAM-ICU, PSQI, BADLs/ IADLs	**Data Analysis:** Linear regression analysis was used to assess change in disability from baseline to follow-up.		ICU, sleep disturbances and functional disability were greatly increased. The greater number of days patients experienced delirium in the ICU, the worse sleep quality was on follow-up. Patients who experienced ICU delirium had greater prevalence of disability on follow-up.
Ferguson et al., 2018	1B	**Research Design:** A retrospective cohort study using chart reviews was done to assess the prevalence of delirium-associated inpatient falls.	**Research Tools Used:** JHFRAT, CAM, CAM-ICU, LDT	**Data Analysis:** Comparison of pre- and post-intervention was done using t-test. Interrupted time series regression was graphed. All data analysis was	Specific to falls; speaks to importance of nurses' involvement and to other negative outcomes associated with development of delirium. This	Nurses are integral to the success of a delirium screening/ prevention/ treatment program. Delirium screening and prevention reduces patient falls. (0.91 per thousand patient days,

				done by STATA v. 12.0	could be an anecdotal QI measure.	down to 0.50 in this study)
Smithburger et al., 2017	3B	**Research Design:** Two surveys (one for MDs and RNs, the other for the patients' surrogates) were designed and given. For the MDs and RNs the goal was to determine current practice and opinion regarding delirium prevention and family involvement. For the surrogates, the goal was to determine willingness to be involved in the same. **Sample Size:** Over a 9 month period, surrogates who spoke English, and whose loved ones had been in the ICU at least 48	**Research Tools Used:** Surveys using a combination of Likert scale, yes/no answers, and fill-in-the-blanks were administered.	**Data Analysis:** Descriptive statistics using the Mann-Whitney *U* test compared MD and RN responses to the survey.	Study focuses on the intervention of family members, now part of the ABCDEF bundle, for the purpose of reducing delirium in ICU.	Patient surrogates are willing to be involved in nonpharmacologic prevention of delirium. One of their fears is inadvertently pulling out a catheter or tube. Another is physically being in the way of the nurses. Healthcare providers should involve patients' families in delirium prevention measures. CAM-ICU results should be included in ICU daily rounds because while RNs frequently assess for delirium, MDs rarely use the information rendered.

		hours were invited to participate by completing a 20-question survey. There were 60 respondents. RNs and MDs were invited to complete a 19-question survey.				
McLaughlin et al., 2018	2B	**Research Design:** This was a prospective observational cohort design without a convenience sample, using chart reviews. **Sample Size:** All patients admitted to this NICU over a 6-month period were included if their GCS was >8, they stayed in the NICU longer than 48 hours, were not prisoners or pregnant, were not both deaf and	**Research Tools Used:** CAM-ICU, GCS, APACHE II,	**Data Analysis:** Demographics were put into a REDCap database for analysis	Based in Neuro-specific ICU	Hourly neuro checks after the 48th hour render limited useful data and may be harmful due to resulting sleep deprivation leading to delirium, which increases morbidity and cost. Implement de-escalation protocol for neuro exam frequency in the NICU.

		blind, and could consent. 99 patients were screened and 20				
Kram et al., 2015	5B	Retrospective quality improvement study Total charts reviewed= 159 (80 pre, 79 post	Patients were assessed for delirium using the ICDSC.		Lowest strength of evidence Did not use CAM-ICU	Use of the ABCDE bundle led to significant decreases in the prevalence (from 38% to 23%, P = .01) and duration (from 3.8 to 1.72 days, P < .001). The number of patients without delirium increased significantly after ABCDE (from 62% to 77%; P = .01).
Rivosecchi et al., 2016	2B	Prospective observational study; pre/post implementation design (230/253 patients respectively)	Intensive Care Delirium Screening Checklist (ICDSC) given every 4 hours	Statistical data managed via RedCap and analyzed with SPSS online. Mann-Whitney and x2 were used to describe and compare the two groups.	Described inability to track nursing adherence to the protocol	Protocol reduced the odds of delirium development by 57% Heavily involved unit-level leadership facilitated project success.
Kamdar et al., 2016	5B	N=300 medical ICU patients, sleep- promoting interventions	Daily RCSQ, Patients were assessed twice daily for delirium using the CAM-	Systematic review/ editorial	Lowest strength of evidence	Improved daily noise ratings (p=0.001), incidence of delirium, (p=<0.02), no significant LOS findings

		Quality Improvement project	ICU, and sedation using RASS			
Smith & Grammi, 2017	1A	RCT (Control group: no delirium protocol in an 18 bed ICU. Intervention group: 10 bed ICU) 447 patients total	Outcomes measures: ventilator days, days in restraints, and LOS in ICU. RCT found Intervention group experienced highly significant (78%) reduction in relative risk for delirium (odds ratio, 0.22; 95% CI, 0.08-0.56; P = .001).	Analyzation via linear regression model	Randomization was by unit, not by patient. Lack of daily sedation-vacation protocol was a study limitation as well	Delirium is associated with increased LOS in the ICU, longer use of mechanical ventilation, and use of restraints. A delirium prevention bundle was effective in this ICU
Birge & Aydin, 2017	3B	Non-randomized quasi-experimental study using a pretest-posttest design There were patients (n=95) and nurses (n=19) in a Medical ICU in a academic/ teaching hospital.	The patients were evaluated using the Patient Introduction Form, Delirium Risk Factors Form, and (CAM)- ICU. The nurses were evaluated using the Nurse Introduction and the	Statistical analysis using SPSS v21. Non-parametric Chi-square test or Fisher's exact tests were used to assess quantitative variables. Logistic regression	Lack of randomization	Delirium was identified in 26.5% of patients in the pre-test phase and 20.9% of the patients in the post-test phase. Patients with delirium had a longer LOS in ICU ($p < 0.05$) There was an increased incidence of using nonpharmacological

			Nonpharmacological Interventions in Delirium Prevention forms. Delirium recognition rate, ICU LOS, patient GCS rating, and number of medications patient received daily were also measured.	analysis determined the effect of significant variables.		interventions for delirium prevention in the post- training phase. Ultimately, no significant difference in rate of delirium was realized, the training on nonpharmacological interventions for delirium prevention did increase the delirium recognition rate of nurses.
Avendaño - Céspedes et al., 2016	1A	Parallel-group double-blind randomized clinical trial (pilot Study).	Daily delirium screening using CAM - ICU, and severity assessment using the Delirium Rating Scale-Revised- 98 (DRS).	Outcome measures: delirium incidence/ prevalence/ severity/ and length of time spent delirious, mortality, LOS, use of physical limb restraints, and whether or not medications were used to control delirium.	Assessed using CAM scores, but not specifically ICU. Pilot study was done in an Adult-geriatric unit in Spain.	Delirium prevalence (33.3% vs 48.3%) and incidence (14.3% vs 41.4%; $p = 0.039$) were decreased in the intervention group compared to the control group. Total delirium severity was decreased in the intervention group compared to the control group (35.0 vs 65.0; $p = 0.040$).

Martinez et al., 2017	3B	Non-randomized quasi-experimental study using a pretest-posttest design. N=287 patients (60 pre, 227 post)	Delirium incidence was measured twice per day with CAM-ICU.	Descriptive statistics, Fisher exact test. Comparisons by Mann-Whitney with multivariate logistic regression to correct for potential confounders.	Lack of randomization and possibility of imbalances between study groups	During the interventional period, delirium developed in 55 of 287s patients (24%; 95% CI, 19.0%-30.7%), a significant reduction when compared with the diagnostic phase (RR, 0.64; 95% CI, 0.43-0.95; P = .03). The intervention significantly reduced delirium (from 38% to 24%; relative risk, 0.62; 95% CI, 0.40-0.94; P = .02) Nurse-led interventions had the highest adherence rates (>85%), and interventions led by family members had the lowest compliance.
Boesen et al., 2015	2B	**Research Design:** Prospective observational study **Sample Size:** 14 patients from a mixed ICU	**Research Tools Used:** PSG, CAM-ICU, SAS	**Data Analysis:** The presence of sleep was scored using semi-quantitative analysis, which the authors	Small sample size PSG is expensive and cannot be used in this project. This article was to reference quality	There is a link between sleep quality and occurrence of delirium in non-sedated, ventilated patients in the ICU.

		containing five beds. Ventilated patients 18+ years old, without structural neurological illnesses, not receiving Propofol or benzodiazepines were included.		acknowledge to be inaccurate	over quantity of sleep as a predictor of delirium development. A new method for quantification of sleep is needed in order to study sleep hygiene interventions.	PSG is unable to measure sleep in most mechanically ventilated patients.

Legend:
ABCDE/ ABCDEF bundle: Awakening Breathing Circulation Delirium Early mobility Family
APACHE II: Acute Physiology and Chronic Health Disease Classification System II
BADLs: Basic Activities of Daily Living
CAM: Confusion Assessment Method
CAM-ICU: Confusion Assessment Method in the Intensive Care Unit
GCS: Glascow Coma Scale
IADLs: Instrumental Activities of Daily Living
ICDSC: Intensive Care Delirium Screening Checklist
JHFRAT: Johns Hopkins Fall Risk Assessment Tool
LDT: the Language of Delirium Tool
MD: Medical Doctor
NICU: Neurological Intensive Care Unit
NIHSS: National Institutes of Health Stroke Scale
PSG: Polysomnography
PSQI: Pittsburg Sleep Quality Index
QI: Quality Improvement
RCSQ: Richards- Campbell Sleep Questionnaire
RN: Registered Nurse
SAS: Sedation Agitation Scale
SORT: Strength of Recommendation Taxonomy (Ebell, et al., 2004)

Appendix D
Summary of Systematic Reviews

Citation	Design, Method	Sample size, setting	Data Analysis	Key Findings	Quality & level of evidence
Barret al., 2013	Practice-guidelines, based on systematic review of RCTs.		The Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) are the most valid and reliable delirium monitoring tools in adult ICU patients (A).	These guidelines provide a guide for developing evidence-based, best practice protocols for integrating the management of pain, agitation, and delirium (PAD) in critically ill patients. Also recommend routine (feasible) monitoring of delirium in adult ICU patients and optimizing their environments, using strategies to control light and noise, clustering patient care activities, and decreasing stimuli at night to protect patients' sleep cycles. Outcomes associated with delirium: increased mortality, prolonged ICU and hospital LOS in adult ICU patients (A). It is associated with the development of post-ICU cognitive impairment in adult ICU patients (B).	SORT 1A

Pessoa et al., 2019	Integrative literature review which asked," What is the evidence from the literature about nursing care measures for prevention, detection and management of delirium in elderly patients admitted to Intensive Care Units?"	Six articles: three qualitative, three quantitative were included in the review Most studies were excluded due to their focus on the general adult population rather than the elderly population.	Data collection from 12/1 thru 12/31, 2018. CAM-ICU ICDSC were the delirium assessment tools represented in the articles reviewed.	Of 271 articles in four databases only 6 were selected. Content Analysis technique was applied and the following categories emerged: 1) Prevention, identification and management of delirium by the nursing team in elderly patients admitted to ICUs; and 2) Nursing teams in ICU Nurses do not routinely use CAM-ICU in their assessments. Nurses are more likely to recognize hyperactive delirium.	SORT 1A
Trogrlic et al., 2015	Systematic review of 21 studies which looked at implementation strategies for assessment, prevention, and management of ICU delirium and their	Of the 21 studies, 17 were RCTs and four were prospective/ retrospective studies. All were set in ICUs.	Outcomes such as mortality and LOS were measured. Mortality and ICU LOS decreases were	Multi- component implementation programs (ie bundles) have better outcomes than single implementation interventions regarding ICU delirium.	SORT 1A

	effects on clinical outcomes		realized in 10 studies. One study found decrease in LOS, but not mortality.		

Appendix E
Project Timeline

	NUR 7801	NUR 7802								NUR 7803							
Activity	7801 Wk15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15	Week 1	Week 3	Week 5	Week 7	Week 9	Week 11	Week 13	Week 15
Meet with preceptor	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Prepare project proposal	X																
Plan: Meet with CCU manager, medical director to lay out project plan		X															
Sleep Enhancement activities/ protocol/ bundle approved by CCU team (NM, Medical Dir., staff advocates)		X															
Staff training: Inservice (see PPT) on delirium Reinforce importance of CAM-ICU use as indicator of delirium status			X	X													
Dry-run evaluation of CAM-ICU use prior to go-live				X													
Collect CAM-ICU scores for pts over 30 days					X	X											
Protocol go-live							X										
Huddle/ staff meeting check ins for Q&A					X	X	X	X									
Data collection x 30 days post-implementation								X	X								
Data analysis										X	X						
Dissemination												X	X				
Write for publication													X	X		X	
CELEBRATE SUCCESS															X	X	X

Appendix F
Projected Budget

Project Costs			
Item	**Description**	**Total Cost**	**Comments**
Salaries for CCU RNs (40 total)	Expense for training: sleep enhancement protocol	$700.00	Total projected expense for a 30 minute training session per RN. Average hourly rate = $35.00.
Revenue			
Decreased delirium	Amount potentially saved with reduced incidence of delirium (though this project does NOT focus on LOS, should it be reduced, there would logically be a cost-savings realized.)	$4300.00/patient= average cost of ICU day	Average cost/day for ICU inpatient stay. Average ICU LOS=3.8days ($16340) Average daily census=12 patients with about 70% delirium rate.

Appendix G
Data Collection Tool

Date -2020	Pt. #	Admit date	D/C date	LOS	CAM-ICU score(A.M.)	CAM-ICU score (P.M.)	RASS score	SEP initiated (time)	SEP inter-rupted- y/n	Notes comments

Appendix H
Confusion Assessment Method-ICU

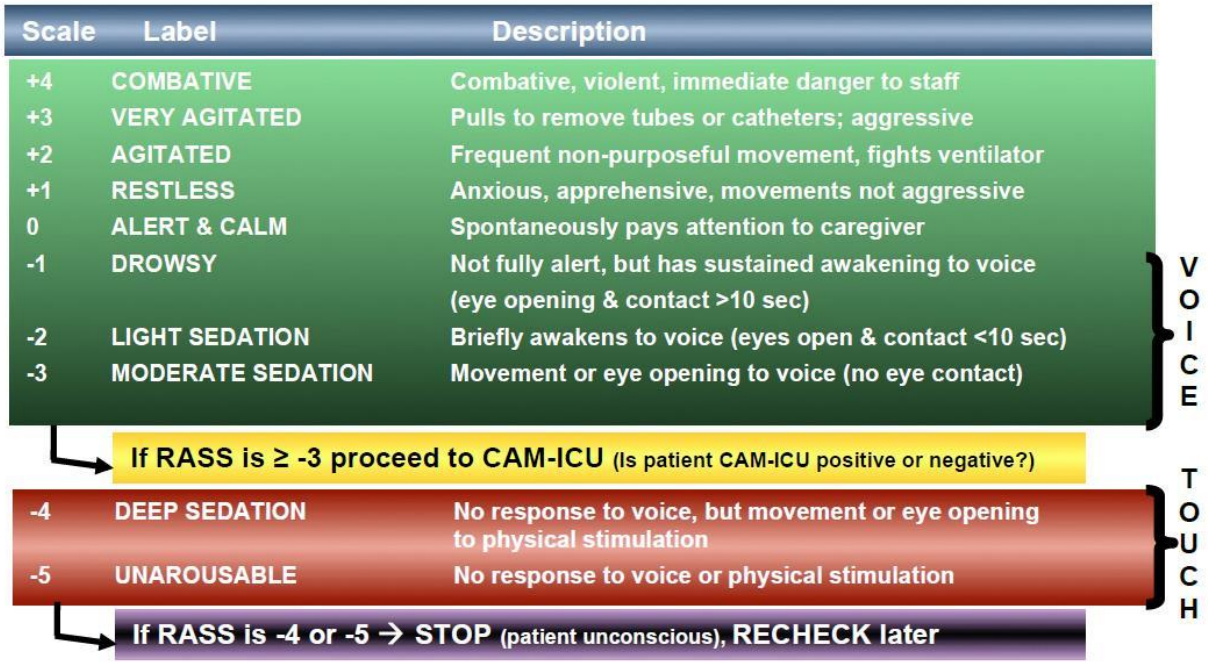
Feature 1: Acute Onset or Fluctuating Course	Score	Check here if Present
Is the patient different than his/her baseline mental status? OR Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation/level of consciousness scale (i.e., RASS/SAS), GCS, or previous delirium assessment?	Either question Yes →	☐
Feature 2: Inattention		
Letters Attention Test (See training manual for alternate **Pictures**) Directions: Say to the patient, *"I am going to read you a series of 10 letters. Whenever you hear the letter 'A,' indicate by squeezing my hand."* Read letters from the following letter list in a normal tone 3 seconds apart. **S A V E A H A A R T** or **C A S A B L A N C A** or **A B A D B A D A A Y** **Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."**	Number of Errors >2 →	☐
Feature 3: Altered Level of Consciousness		
Present if the Actual RASS score is anything other than alert and calm (zero)	RASS anything other than zero →	☐
Feature 4:Disorganized Thinking		
Yes/No Questions (See training manual for alternate set of questions) 1. Will a stone float on water? 2. Are there fish in the sea? 3. Does one pound weigh more than two pounds? 4. Can you use a hammer to pound a nail? **Errors are counted when the patient incorrectly answers a question.** **Command** Say to patient: "Hold up this many fingers" (Hold 2 fingers in front of patient) "Now do the same thing with the other hand" (Do not repeat number of fingers) *If the patient is unable to move both arms, for 2nd part of command ask patient to "Add one more finger" **An error is counted if patient is unable to complete the entire command.**	Combined number of errors >1→	☐

Overall CAM-ICU Feature 1 plus 2 and either 3 or 4 present = CAM-ICU positive		
	Criteria Met →	☐ CAM-ICU Positive (Delirium Present)
	Criteria Not Met →	☐ CAM-ICU Negative (No Delirium)

https://www.icudelirium.org/medical-professionals/delirium/monitoring-delirium-in-the-icu "We have obtained copyright for the CAM-ICU and its educational materials and have deliberately made it unrestricted in terms of use. We ask that you include the copyright line below on the bottom of the pocket cards and other educational materials, but do not require you to obtain a written letter of permission for implementation and clinical use."

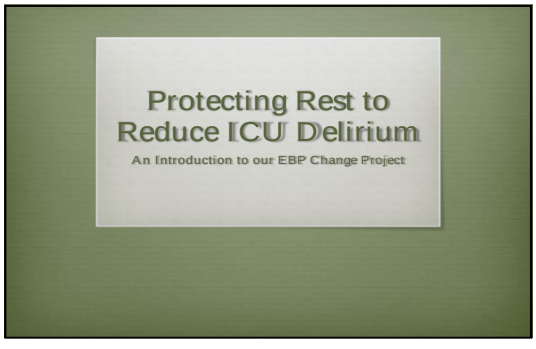
Note. CAM ICU diagram by E. Wesley Ely, MD, MPH, 2002 (http://icudelirium.org). Copyright by Vanderbilt University

Appendix I
Richmond Agitation Sedation Scale



Note. RASS diagram by E. Wesley Ely, MD, MPH, 2002 (http://icudelirium.org).

Appendix J
Staff Inservice PowerPoint



1

What is delirium?

- An acute change in mental status
- Cardinal signs: inattention, confusion, agitation
- A condition often made worse by benzo use (Dexmedetomidine is better for sedation.)

2

Why should we protect rest in the ICU?

- Sleep fragmentation can lead to
  - Delirium
  - Longer LOS
    - ICU
    - Hospital
  - Higher mortality rate
  - Long-term cognitive impairment

3

Did you know?

- CAM-ICU is our assessment/ screening tool for confirming the presence of delirium.
- Increasing sedation at night to promote sleep does not shorten the severity or duration of delirium.
- Even if they've had a stroke, have dementia, or are intubated, patients can be screened for delirium.
- There is no pharmacological agent specifically identified as superior for the treatment of delirium.
- Continuous sedation is not required to manage ventilated patients.

4

PICOT Question

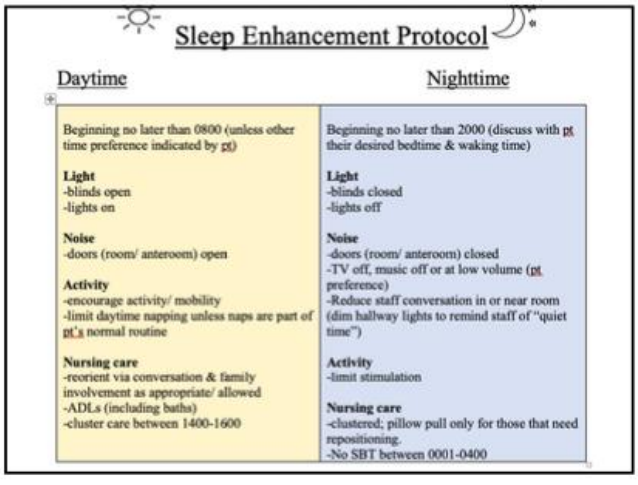
- For patients in an adult ICU (P), does using a nurse-initiated, non-pharmacological sleep-enhancement protocol (I) versus no sleep-enhancement protocol (C) reduce the incidence of ICU-delirium (O) over two months (T)?

5

How do we protect rest?
Sleep Enhancement Protocol

- Clustering of care for intentional rest periods/ care bundling (No SBT between 0001-0400)
- Avoiding benzodiazepines
- Reorienting frequently
  - Whiteboards can reinforce verbal reorientation
- Manipulating physical environments
  - Noise reduction Closing doors when safe
  - lowering volume on non-essential monitors

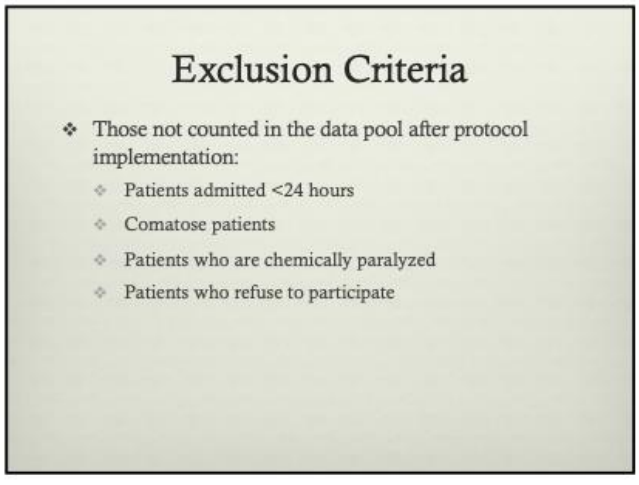
6



Sleep Enhancement Protocol

Daytime	Nighttime
Beginning no later than 0800 (unless other time preference indicated by pt) **Light** -blinds open -lights on **Noise** -doors (room/ anteroom) open **Activity** -encourage activity/ mobility -limit daytime napping unless naps are part of pt's normal routine **Nursing care** -reorient via conversation & family involvement as appropriate/ allowed -ADLs (including baths) -cluster care between 1400-1600	Beginning no later than 2000 (discuss with pt their desired bedtime & waking time) **Light** -blinds closed -lights off **Noise** -doors (room/ anteroom) closed -TV off, music off or at low volume (pt preference) -Reduce staff conversation in or near room (dim hallway lights to remind staff of "quiet time") **Activity** -limit stimulation **Nursing care** -clustered; pillow pull only for those that need repositioning. -No SBT between 0001-0400

7



Exclusion Criteria

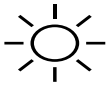
- Those not counted in the data pool after protocol implementation:
  - Patients admitted <24 hours
  - Comatose patients
  - Patients who are chemically paralyzed
  - Patients who refuse to participate

8

References & Contact Info

- Available in the project proposal
- Heather J. Thomas
  - Heather.thomas4@va.gov
  - 706.799.9141

Appendix K
Poster Representation of Sleep Enhancement Protocol



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Appendix L
Letters of Support

DEPARTMENT OF VETERANS AFFAIRS
Charlie Norwood VA Medical Center
1 Freedom Way
Augusta, Georgia 30904

In Reply Refer To:

September, 10, 2020

Sandra Swearingen

Chief of Hospital Education

Charlie Norwood VA Medical Center

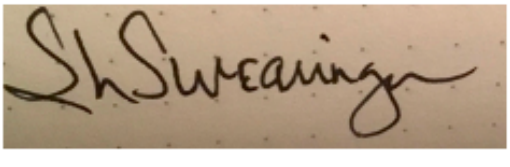
Augusta, GA

To whom it may concern:

Please consider this a letter of support for Heather Thomas and her project regarding delirium in the Adult ICU. This is a very timely project considering that our current climate, due to COVID, is one of familiar isolation, reduced touch, and decreased contact with other humans. This climate alone has a great potential to affect the delirium that many patients experience during hospitalization. Any improvement in patient outcomes will positively impact the lives of our Veterans.

If you have any questions, please feel free to contact me.

Thank you



Department of Veterans Affairs

Memorandum

Date: September 11, 2020

From: Sandra Swearingen, PhD, RN – Chief of Hospital Education

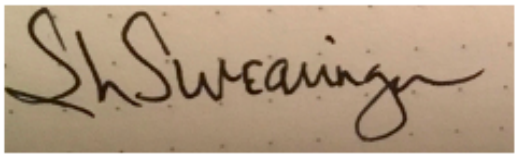
Subj: Letter of Support

To: Heather Thomas, RN, MSN

1. Please consider this as a letter of support for the DNP Project Delirium in Acute Care Patients

2. Due to the increasing amounts of delirium seen today in healthcare, this is felt to be an appropriate project topic for Charlie Norwood VA Medical Center and is supported by myself as her preceptor. Charlie Norwood strives to be a learning organization and is supportive of all educational tracks, especially those in nursing related fields.

3. If you have any questions, please feel free to contact me at 407-506-5524.



Sandra Swearingen, PhD, RN
Chief of Hospital Education
Charlie Norwood VA Medical Center
Augusta, Ga