A Multifaceted Approach to Improving Sedation Practices in the Cardiovascular Intensive Care Unit

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Abstract

Purpose: Sedation protocols have been positively correlated with improved patient outcomes in the intensive care unit (ICU). Therefore, healthcare leaders should direct efforts to improving protocol compliance through evidence-based strategies. The purpose of this study was to evaluate the impact of a multifaceted intervention, consisting of educational outreach, point of care (POC) reminders, and audit and feedback (A&F), on nurse compliance with an ICU sedation protocol. A secondary data analysis was performed to evaluate the impact of the intervention on patient outcomes.

Methods: This was a before/after comparative analysis. A Research Electronic Data Capture (REDCap) pre-survey (n=58) was distributed to cardiovascular intensive care unit (CVICU) nurses (n=139) via a modified email listserv. An educational PowerPoint session via Zoom was delivered to staff during two non-mandatory unit council meetings. A modified post-survey evaluated (n=43) was distributed to nurses who completed the pre-test and attended at least one of the educational sessions. The post-survey evaluated the impact of the educational session on nursing knowledge, attitudes, and perceived barriers to protocol utilization. A series of multiple-choice questions were incorporated in the survey to evaluate nursing knowledge of evidence-based guidelines and protocol components. Attitudes were scored using an attitude-specific component of the Nurse Sedation Practices Scale (NSPS). Barriers were identified through true or false, multiple response, or open response questions. A secondary multifaceted intervention was implemented over three months to improve sedation protocol compliance and patient-related health outcomes. Sedation practices, mechanical ventilator (MV) duration, delirium, and reintubations were compared before (n=92) and after (n=82) the intervention by performing a retrospective chart review.
**Results:** There was a significant improvement in knowledge scores and NSPS scores post-educational intervention (p<0.001). The educational intervention resulted in a significant increase in knowledge scores pertaining to current guidelines, protocol components, and protocol implementation (p<0.001). MV days were significantly reduced with the implementation of the multifaceted intervention (p= 0.0134). There were no significant reductions in the incidence of delirium or reintubation. There was no significant improvement in protocol compliance during the intervention period.

**Conclusion:** This study demonstrated the positive impact of a multifaceted educational approach on nursing knowledge and attitudes regarding an evidence-based sedation protocol. Furthermore, this study suggests that a multifaceted intervention may improve quality of care by reducing MV duration. Future research should focus on applying this strategy to vulnerable populations who are susceptible to prolonged MV. Furthermore, future research should evaluate strategies to improve the feasibility of this approach.
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Dedication

I dedicate this accomplishment to my beloved wife who has providing me with unconditional love, support, and understanding needed to meet this goal. I dedicate this achievement to my son, Silas, who has been one of God’s greatest blessings in my life. I dedicate this work and give special thanks to my mother and father, Charles and Regina Mingua, and my mother-in-law, Kelly Patterson, who sacrificed their time for my success. Their continued support and encouragement were instrumental in the completion of this goal. I could not have completed this project without the guidance and strength from the Lord, and I promise to use my success to give him glory and continue his work here on earth.
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Background and Significance

More than 36 million people in the United States were admitted to the hospital in 2017 (AHA, 2019). Of these, approximately 5 million people are admitted to the ICU each year with 20-40% (or more than one million) of those admitted requiring MV (SCCM, 2017). Roughly 85% of mechanically ventilated patients will receive some form of sedation to provide comfort and alleviate anxiety (Grap et al., 2013). Sedation administration should be evidence-based and carefully titrated to the individual needs of the patient since inappropriate administration of sedative drugs may result in oversedation (Balas et al., 2018).

It has been estimated that as many as 32-57% of patients are sedated to deeper levels than required (Bugedo et al., 2013). According to Maison et al. (2019), the occurrence of oversedation remains elevated in critically ill patients. Oversedation is associated with an increased risk for ventilator associated pneumonia (VAP), delayed patient healing, prolonged MV, increased ICU length of stay (LOS), and increased hospital costs (Kayir et al., 2018). Furthermore, oversedation may be associated with an increased risk of delirium, post-traumatic stress disorder, long term cognitive dysfunction, and post-intensive care syndrome (PICS, Fernandes et al., 2019; Patel & Kress, 2012).

Inappropriate sedation administration may mask the nonverbal signs of pain and prevent adequate pain management. Pain is a common symptom for critically ill patients, and one that is often associated with MV (Pearson & Patel, 2020). Studies suggest as many as 70% of ICU patients will experience unrecognized or untreated pain (Alderson & McKechnie, 2013). Moreover, untreated pain may have short term consequences, such as an increased risk for “atelectasis, respiratory infection, myocardial ischemia, infarct or cardiac failure, and thromboembolic disease” (King & Fraser, 2013, p. 1). Unrelieved pain in the ICU may result in
long lasting psychological complications, such as post-traumatic stress disorder, and is a significant risk factor in the development of chronic pain (Barr et al., 2013; Sinatra, 2010).

Lastly, inappropriate sedation practices may increase the risk of delirium, or mask its early signs and symptoms, leading to delayed recognition and treatment. Delirium affects up to 80% of mechanically ventilated patients and is associated with increased mortality, hospital LOS, and costs, long term cognitive impairment, and PICS (Barr et al., 2013; Fernandes et al., 2019). Evidence-based sedation administration likely improves delirium outcomes by promoting early recognition and treatment (Barr et al., 2013; Devlin et al., 2018).

**Sedation Protocols**

The Society of Critical Care Medicine (SCCM) has been a leader in the movement to improve sedation practice in the ICU. One of the many ways in which SCCM has encouraged practice change is through the development and dissemination of the 2013 and 2018 Pain, Agitation, and Delirium. Clinical Practice Guideline (Barr et al., 2013; Devlin et al., 2018). The purpose of the Clinical Practice Guideline is to promote the translation of evidence-based practice to the bedside and provide a roadmap for the development of integrated protocols in the management of pain, agitation, and delirium. It is recommended by SCCM that health care institutions implement sedation protocols or guidelines to address the gaps in care related to inappropriate sedation administration (Barr et al., 2013). Sedation protocols provide “a structured framework that guides sedation administration and monitoring” (Hughes, McGrane, & Pandharipande, 2012, p. 56). In many cases, sedation protocols are nurse-driven, and nurses are provided with standing orders to make autonomous decisions pursuant to a pain and agitation related target. Protocols may range from simple guidelines to comprehensive algorithms (Sessler & Pedram, 2009). Sedation protocols identify a sedation goal or target, incorporate valid and
reliable scoring tools, and direct the titration of medications to defined end points (Hughes, McGrane, & Pandharipande, 2012). A common theme of protocols is the goal of reaching and maintaining light levels of sedation (Devlin et al., 2018).

**Light Targeted Sedation**

In most cases, MV patients should be sedated to a light depth when medically appropriate unless contraindicated. Barr et al. (2013) define light sedation as a depth at which the patient is easily arousable, interactive, and purposefully responding to commands. Tanaka et al. (2021) characterize a lightly sedated patient as calm, comfortable, and collaborative. Light sedation may be quantified using the Richmond Agitation Sedation Scale (RASS) or the Riker Sedation Agitation Scale (SAS). The RASS and SAS are validated, objective, and reliable tools used to measure sedation depth (Barr et al., 2013; Devlin et al., 2018). Light sedation may be identified as a RASS score between +1 and -2 and a SAS score of 3 or 4 (Shehabi et al., 2018; Tanaka et al., 2021). Light sedation may improve patient outcomes by reducing the duration of MV, risk for delirium, tracheostomy rate, ICU LOS and 180-day mortality (Barr et al., 2013; Devlin et al., 2018; Shehabi et al., 2018; Shehabi et al., 2012; Stephens et al., 2018). Analgosedation and daily sedation interruption (DSI) are additional sedation strategies incorporated into sedation protocols to promote light sedation and improved outcomes. These sedation strategies are discussed in the paragraphs that follow.

**Analgosedation**

Bugedo et al. (2013) states that analgesia is the “first step toward improving comfort in mechanically ventilated patients” (p. 189). The terms analgosedation and analgesia-first sedation (AFS) are interchangeable. AFS is a sedation management strategy that prioritizes the use of analgesics in the management of agitation and discomfort associated with MV (Faust et al.,
Barr et al. (2013) states that “providing analgesia first sedation for many ICU patients is supported by the high frequency of pain and discomfort as primary causes of agitation” (p. 290). AFS ensures that pain management is adequate prior to the addition of sedatives, since sedation can mask the nonverbal signs and symptoms of pain (Faust et al., 2016). The Critical-Care Pain Observation Tool (CPOT) and the Behavioral Pain Scale are valid and reliable tools used to assess pain in those who are unable to self-report (Barr et al., 2013; Devlin et al., 2018) Some patients may not require additional sedation when pain is the primary cause of discomfort; however, 18-70% of patients receiving AFS will require additional sedatives (Barr et al., 2013). AFS strategies have been shown to promote lighter levels of sedation and reduce overall sedation consumption (Bugedo et al., 2013; Faust et al., 2016).

**Spontaneous Awakening Trial**

Several studies have demonstrated the positive impacts of spontaneous awakening trials (SAT) on MV duration, delirium, and LOS (Balas et al., 2014; Klompas et al., 2014; Pun et al., 2019). The terms daily sedation interruption (DSI) and SAT refer to a temporary hold or suspension of continuous infusion sedatives in patients meeting a specific set of criteria (Balas et al., 2014). Burry et al. (2014) claim that the purpose of the interruption is to “limit drug bioaccumulation; promote a more awake state; and permit assessment of neurological status, patient tolerance of drug discontinuation, and readiness for liberation from mechanical ventilation” (p. 5). Girard, Hargett, and Singh (2020) state that sedation interruption was designed primarily to assess the need for sedation and should therefore be implemented on a day-to-day basis. Prior to implementing an SAT, nurses should perform a safety screen to ensure that the patient is appropriate. The SAT is considered failed if the patient exhibits any of the failure criteria: persistent anxiety, agitation, or pain; respiratory rate greater than 35 breaths per minute;
oxygen saturation of less than 88%; signs of respiratory distress; and/or acute cardiac arrhythmia (Girard et al., 2008). If the patient fails, the nurse restarts the sedative infusion at half the previous dose (Girard et al., 2008). If the patient passes, a screen is performed for a spontaneous breathing trial and the patient is assessed for ventilator liberation readiness (Girard et al., 2008).

**Barriers**

It is essential that efforts to facilitate protocol adoption focus on identifying and addressing barriers. Several common barriers to protocol use have been identified in qualitative studies (Sneyers et al., 2014; Guttormson et al., 2019). The primary barriers to protocol utilization can be placed into three categories: healthcare professional characteristics, guideline characteristics, and system characteristics (Sneyers et al., 2014). Health care professional characteristics can be classified as: insufficient knowledge, lack of conceptual agreement with guidelines, poor outcome expectancy, and lack of motivation. Insufficient knowledge may be defined as a lack of awareness, familiarity, or self-efficacy (Sneyers et al., 2014). A lack of conceptual agreement may be evident in the attitudes of health care providers towards evidence-based sedation practice. Guttormson and colleagues (2019) found that “nurses’ attitudes toward sedative medications’ effectiveness in relieving patients’ symptoms or distress were positively correlated with their intention to administer these medications to all patients receiving MV and with self-reported sedation practices” (p. 6). Physicians, on the other hand, often feel that protocols are not applicable to all patients and may fear that standardized measures may limit clinical judgement (Sneyers et al., 2014). Characteristics of the guideline may create barriers to adherence. Sneyers et al. (2014) dissected the category of “guideline characteristics” into five subgroups: compatibility, trialability, observability, poor strength of evidence, and exception ambiguity. Sedation protocols may be complex, difficult to follow, or create logistical issues that
lead to increased workload and confusion. Lastly, system characteristics may be the single most influential category on protocol adherence. It is exceptionally difficult to overcome an organizational culture that does not embrace evidence-based practice. Local leaders, teamwork, communication, and staffing are system characteristics that may significantly impact the adoption of protocols (Sneyers et al., 2014). SCCM recommends that unit leaders identify barriers, provide education, employ change agents, provide A&F, and implement POC reminders to facilitate the adoption of sedation protocols (Barr et al., 2013).

**Education**

Education is a key element in all four phases of the evidence-based practice implementation process identified by Cullen and Adams (2012). Research has shown that education is an effective strategy to promote change, but insufficient when used alone or without support (Arlinghaus & Johnston, 2018; Titler, 2008). Educational strategies are most effective when they are interactive, combined with additional change reinforcing strategies, and targeted to identified knowledge deficits (Arlinghaus & Johnston, 2018; Titler, 2008). In other words, education is most influential when a lack of knowledge is identified as a primary barrier to change (Titler, 2008). Education should focus on promoting awareness of an issue and producing interest in the audience by highlighting the positive attributes of the change (Cullen & Adams, 2012). Tailored education can be defined as educational strategies targeted at the individual learning needs of the audience. This educational strategy focuses on identifying and addressing knowledge deficits within an individual or a group (Powell et al., 2015). In addition, education should seek to improve self-efficacy by ensuring that the individual has the necessary skills to perform the evidence-based practice. Educational outreach, also referred to as academic detailing, is a strategy used by change agents that incorporates one on one instruction and
individualized feedback (Titler, 2008).

Change Agents

Lunenburg (2010) defines a change agent as an “individual or group that undertakes the task of initiating and managing change in an organization” (p. 1). The change agent may function in three roles: opinion leader, change champion, and/or core group member (Cullen & Adams, 2012; Tucker & Melnyk, 2019). Titler (2008) claims that “few successful projects to implement innovations in organizations have managed without the input of identifiable opinion leaders” (p. 118). Opinion leaders are colleagues who rely on expertise, interpersonal skills, and peer influence to promote evidence-based change (Carpenter & Sherbino, 2010). Opinion leaders are “viewed as a respected source of influence, considered by associates as technically competent, and trusted to judge the fit between the innovation and the local situation” (Titler, 2008, p. 118). Change champions, on the other hand, are expert clinicians who are dedicated to improving healthcare quality (Titler, 2008; Miech et al., 2017). Cullen & Adams (2012) claim that the role of the change champion is to review available evidence, design evidence-based guidelines, develop resources for implementation, and provide orientation to the practice change. Lastly, a core group is a select group of health care professionals with a shared goal of implementing change. Core groups are often trained by champions and work in conjunction with these agents to disseminate information and facilitate practice change (Cullen & Adams, 2012). Cullen & Adams (2012) stress the importance of “identifying change agents early, obtaining their support, providing education regarding the practice change, and clarifying their roles” (p. 225).

Audit and Feedback

Audits may be defined as a “systematic review of professional performance based on specific criteria or standards” identified in evidence-based guidelines (Jamtvedt, Flottorp, &
Audits are ongoing processes that use, access, and evaluate performance information or data (Titler, 2008). Performance information can be gathered from computer databases or direct observation. The aim of a clinical audit is to stimulate behavior change by highlighting discrepancies between actual and perceived practice and comparing performance information with national standards (Esposito & Canton, 2014). Feedback, on the other hand, is the dissemination of performance data to a target audience with the intent of motivating behavior change (Titler, 2008). Feedback should be actionable, timely, delivered in cycles, and nonpunitive (Borgert et al., 2016; Colquhoun et al., 2017; Jolliffe et al., 2019; Sinuff et al., 2015). Several studies have suggested the significance and need for one-on-one feedback (Borgert et al., 2016; Colquhoun et al., 2017; Smiddy et al., 2019). Audit and feedback (A&F) is often paired with a performance gap analysis (PGA) (Titler, 2008). The PGA is a preliminary audit that serves to raise awareness of an existing practice gap. A&F, when combined with PGA, has consistently demonstrated a positive correlation to behavior change and evidence-based implementation (Titler, 2008).

**Point of Care Reminders**

Point of care (POC) reminders or practice prompts can be defined as “patient or encounter specific information, provided verbally, on paper, on a computer screen, which is designed or intended to prompt a health professional to recall information” (Grimshaw et al., 2012, p. 8). Practice prompts may serve as a reference guide, decision aide, or clinical reminder to promote evidence-based care. POC reminders can range from sophisticated clinical information system notices to simple pocket guides prompting health care professionals to practice in a particular manner (Cullen & Adams, 2012). Titler (2008) claims that” computerized decision support and prompts that support practice (e.g., decision making algorithms, paper
reminders) have a positive impact on knowledge translation” (p. 117). In most cases, practice prompts are combined with other evidence-based strategies to promote knowledge translation (Ranzani et al, 2014).

**Cost Analysis**

In Kentucky, there are more than 5,000 admissions to the ICU each year (Weismann et al., 2019). According to SCCM (2017), an estimated 20-40% of ICU admissions will receive MV. This calculation results in 1-2,000 patients who will undergo MV during their admission. MV costs an additional $1000-$2,000 per day in the US (Chlan et al., 2018). Therefore, a one-day reduction for every patient could reduce state healthcare spending by 1-4 million dollars per year. A one-day reduction in every other patient could reduce state healthcare spending by $500,000-$2 million annually.

In the United States, more than 5 million people are admitted to the ICU each year (SCCM, 2017). If these same statistics are applied, 1-2 million people will receive MV in the ICU. A one-day reduction could save the United States 1-4 billion dollars annually in healthcare spending. A one-day reduction in every other patient could reduce national spending by $500 million-$2 billion each year. It is important to understand that these reductions do not include costs associated with complications of prolonged MV.

**National Gap**

In 2013, Barr et al. (2013) claimed that 60% of the ICUs in the United States had a standing sedation protocol. Guttormson et al. (2019) suggest that sedation protocol implementation has significantly increased over the past decade. For instance, Guttormson and colleagues surveyed members of the American Academy of Critical-Care Nurses and found that 86% of nurses practiced in a unit or facility with an implemented protocol. However, protocols
are of little benefit if adherence is poor. Despite the positive trend in protocol implementation, there have been minimal improvements in utilization and adherence remains poor (Barr et al., 2013). Several studies have indicated that adherence continues to be a significant issue and protocol utilization may be less than 50% in most cases and as low as 25% in some cases (Guttormson et al., 2019; Sacco & LaRiccia, 2016; Yan et al., 2019).

Local Gap

The issue of protocol compliance was apparent in the CVICU at the University of Kentucky (UK) Chandler Hospital. The primary investigator (PI), a Registered Nurse on the unit of study, became aware of the issue through peer conversations and direct observation of nurse practices during working hours. The PI met with Dr. Komal Pandya, a lead pharmacist and local opinion leader in evidence-based sedation administration, to validate and address concerns. Dr. Pandya presented to the PI compliance data obtained by the ICU Pain, Agitation, Delirium, Immobility, and Sleep (PADIS) work group in 2020. The core group extracted patient data through retrospective chart review and found the following sedation practices:

1. RASS was documented per protocol 69.6% of time
2. Sedation titrated as ordered 17.4% of time
3. Sedation bolus administered per protocol 4.3% of the time
4. Analgesia titrated per protocol 21.7% of the time
5. Analgesia bolus administered per protocol 13% of the time
6. Sedation held per protocol 15-17% of the time

Purpose

Sedation protocol compliance continues to be identified as an issue at the local and national level. This issue should be addressed with a multifaceted evidence-based approach. This
The purpose of this study was twofold:

1. Evaluate the impact of an evidence-based multifaceted intervention on nursing compliance with an existing ICU sedation protocol
2. Evaluate the impact of a multifaceted intervention on patient outcomes that contribute to increased length of stay and cost

Aims

The specific aims of this study were to:

1. Identify perceived nursing barriers that prevent sedation protocol implementation
2. Identify and address nursing knowledge deficits through an educational intervention
3. Positively impact nursing attitudes towards evidence-based strategies found in sedation protocol
4. Increase the percentage of time in which patients receive light levels of sedation
5. Reduce MV days during intervention period

Theoretical Framework

The Knowledge to Action Framework (KTA) was developed in Canada by Graham and colleagues (2006) to improve health and health outcomes. It is a well-known theoretical framework that is applied during the implementation of evidence-based practice. Furthermore, the framework has been defined as a “conceptual framework intended to help those concerned with knowledge translation deliver sustainable, evidence-based interventions” (Field et al., 2014, p. 2). The components of the framework are grounded in 31 nursing and interdisciplinary
planned action theories (Field et al., 2014). The framework is dynamic, lacks a defined structure, and does not follow a sequential order or pattern. It consists of two distinct but associated components: the knowledge creation funnel and the action cycle (Malone and Bucknall, 2010).

The knowledge creation funnel, located in the inner potion of the framework design, represents the refinement of research through a three-step process: knowledge inquiry, knowledge synthesis, and knowledge tools/products (Graham et al., 2006). Graham and colleagues (2006) claim that “as knowledge moves through the funnel, it becomes more distilled and refined and presumably more useful to stakeholders” (p. 18). Knowledge inquiry is a phase that focuses on identification and review of primary studies and lower quality evidence. Knowledge synthesis, on the other hand, focuses on aggregating and combining primary research into systematic reviews or meta-sources. The tip of the funnel, identified as knowledge tools/products, represents the analysis of synopses such as practice guidelines, decision aids, and care pathways (Graham et al., 2006). Knowledge creation remains an influence and may be resourced or drawn upon during the action cycle.

Yan et al. (2019) defines the action cycle as a “series of phases that ultimately leads to the implementation and application of the knowledge discovered” during knowledge creation (p. 176). The action cycle is comprised of the activities needed for knowledge translation or application (Graham et al., 2006). The cycle consists of 7 distinct actions or phases: identifying a clinical problem; identifying and reviewing relevant research; applying knowledge to local context; assessing knowledge barriers; selecting tailored interventions; monitoring knowledge use; evaluating outcomes; and sustaining knowledge use. During the first phase of the cycle, a practice gap is identified and relevant research addressing the gap is collected and reviewed. The subsequent phase focuses on tailoring research strategies to the unique setting in which the
practice is being implemented. The third phase involves the evaluation of barriers and facilitators to the uptake of knowledge. The next phase focuses on tailoring interventions to address identified barriers and meet the individual needs of the local group. The 5th and 6th phases concentrate on developing strategies and/or tools to measure knowledge use or knowledge application and system outcomes. Lastly, the final phase focuses on developing strategies to ensure sustainability of the change. Graham et al. (2006) recommends evaluating barriers to sustainability, targeting interventions to identified barriers, and monitoring ongoing knowledge use and system outcomes.

KTA was essential to the development and implementation of the intervention used in this study. A local practice gap was identified through peer observation and expert insight. Graham et al. (2006) states that “the first step can often involve a group or individual identifying that there is a problem or issue that deserves attention…” (p. 20). Next, an extensive literature review was performed to identify evidence-based strategies addressing the gap. The literature was refined by article relevance and quality. An initial survey was distributed and barriers to protocol compliance were assessed. Education was identified as a primary barrier, so an educational intervention was developed to address knowledge deficits of the protocol and evidence-based guidelines. Furthermore, nurse attitudes were identified as a potential barrier, so education focused on influencing opinions and creating cognitive dissonance by questioning practice norms. Despite numerous studies identifying barriers to protocol use, local barriers were assessed, since barriers may be unique to the individual, unit, or organization. A second multifaceted intervention was developed with the intent of addressing additional barriers to protocol adoption. Education continued to be a focus through multifaceted strategies implemented at the bedside. The impact of the intervention was assessed through the distribution
of a post-survey and retrospective chart review. At the conclusion of this study, plans were arranged to ensure sustainability and recommendations for future research were identified.

**Review of Literature**

A review of the literature was performed using the Cumulative Index of Nursing and Allied Health database at UK. The key search terms used in this review were: “sedation protocol,” “sedation algorithm,” “sedation guideline,” “pain, agitation, and delirium,” and “minimal sedation”. The significant terms “sedation protocol,” “sedation algorithm,” and “sedation guideline” were searched for in the abstracts and/or titles of research articles; “pain, agitation, and delirium” and “minimal sedation” were searched in article titles. The search was refined to academic journals with the intent of locating higher quality evidence. Lastly, the review included articles published during or after 2010. A total of 507 research articles were found in the primary search. Of the 507 articles identified, 20 were selected for inclusion in the review. Studies that did not focus on the implementation of sedation protocols were excluded from the review. Furthermore, included studies focused on sedation practices directed toward adults in the ICU. Studies selected incorporated protocols that closely mirrored the sedation protocol implemented on the unit of study.

Two of the studies selected for inclusion were systematic reviews (Qi et al., 2021; Jackson et al., 2010). One of the two reviews summarized results through meta-analysis (Qi et al., 2021). Three studies were identified as randomized controlled trials (Mansouri et al, 2013; Shehabi et al, 2013; Strøm, Martinussen, & Toft, 2010). Four of the twenty studies included were classified as quasi-experimental studies (Amaral, Kure, & Jeffs, 2012; Bugedo et al., 2013; Egerod et al., 2010; Ranzani et al., 2014). The remaining studies, majority of included studies, were observational, retrospective, and before/after cohort studies (Dale et al., 2014; Dale et al.,
2013; Faust et al., 2016; Frawley et al. 2019; Hahn et al., 2012.; Heim et al, 2019; Mahmoud et al., 2018; Reinaker & Frock, 2015; Sacco & LaRiccia, 2016; Tanios et al., 2014; Yan et al., 2019). Excluding systematic reviews, more than half of the primary studies were conducted in the United States. Four of the primary studies were identified as multicenter studies (Bugedo et al, 2013; Dale et al., 2013; Shehabi et al., 2013; Ranzani et al., 2014). All the primary studies implemented nurse-driven protocols focused on achieving and maintaining light levels of sedation which were achieved through AFS, DSI, and/or intermittent sedation strategies.

**Sedation Practices**

Sedation protocols have been shown to positively impact sedation practices by encouraging evidence-based sedation administration. Protocol implementation has resulted in overall lighter levels of sedation and a decreased incidence of deep sedation (Bugedo et al., 2013; Faust et al., 2016; Reinaker & Frock, 2015). Shehabi et al. (2013) found that the implementation of a sedation protocol resulted in significantly lighter levels of sedation during early (first three days) of MV. This is noteworthy considering that subsequent studies have indicated that early deep sedation is independently associated with increased mortality (Shehabi et al., 2013). Lighter levels of sedation may reduce the time required to perform a sedation interruption (Egerod et al., 2010).

In a systematic review by Jackson et al. (2010), sedation protocols were noted to significantly reduce sedation duration. This finding was replicated in a retrospective cohort study by Sacco and LaRiccia (2016), which revealed a significant reduction in total sedation days after protocol implementation. Furthermore, protocols have been shown to significantly reduce the administration of benzodiazepines (Dale et al., 2013; Heim et al., 2019; Ranzani et al., 2014). This is significant, as Ranzani et al. (2014) found midazolam consumption to be significantly
associated with increased MV duration. A couple of studies showed that sedation protocols encourage the use of dexmedetomidine for sedation as opposed to other agents (Heim et al., 2019; Shehabi et al., 2013). Lastly, sedation protocols, particularly those integrating AFS strategies, have been shown to increase analgesia administration, reduce sedation administration, and improve pain management (Faust et al., 2016; Mahmoud et al., 2018; Yan et al., 2019).

**Patient Outcomes**

Sedation protocols have been shown to have a significant impact on patient outcomes in the ICU. There is strong support to suggest that protocols significantly reduce the duration of MV (Amaral, Kure, & Jeffs, 2012; Dale et al., 2013; Dale et al., 2014; Faust et al., 2016; Frawley et al., 2019; Jackson et al., 2009; Mansouri et al., 2019; Qi et al., 2021; Ranzani et al., 2014; Strøm, Martinussen, & Toft, 2010). Several studies found reductions that were clinically significant despite not reaching statistical significance (Bugedo et al., 2013; Sacco & LaRiccia, 2016; Shehabi et al., 2013). Amaral and colleagues (2012) demonstrated that nonsignificant findings led to an estimated 502-day reduction in MV days per year. Other issues, such as increased self-harm and self-extubation, were not shown to be adversely impacted by protocol implementation (Egerod et al., 2010; Faust et al., 2016; Jackson et al., 2010; Mansouri et al., 2019; Qi et al., 2021). Two studies indicated that protocols may result in increased self-extubations; however, Tanios et al. (2014) and Strøm, Martinussen, & Toft, 2010 reviewed protocols that utilized a “no sedation” or intermittent sedation strategy. These strategies were not used as primary approaches in other studies evaluated in this review. Furthermore, there is strong evidence to support that sedation protocols may reduce ICU and hospital LOS (Dale et al., 2013; Heim et al., 2019; Jackson et al., 2010; Mansouri et al., 2019; Qi et al., 2021). Lastly, several studies indicate that protocols may reduce overall hospital costs despite the potential risk for
increased sedation medication costs (Amaral, Kure, & Jeffs, 2012; Heim et al., 2019; Jackson et al., 2010).

The association between sedation protocols and delirium is not well established. Two studies found that sedation protocols may significantly reduce the incidence of delirium (Dale et al., 2013; Qi et al., 2021). However, most studies did not measure delirium as an outcome measure and of those that measured delirium, results were insignificant. For instance, Shehabi et al. (2013) found a nonsignificant decrease in delirium days and an overall reduction in restraint use with an early goal directed protocol. Sacco and LaRiccia (2016) found a significant increase in the administration of antipsychotics for delirium but did not measure delirium as an outcome measure. These findings suggest that sedation protocols may improve recognition and early treatment. In addition to delirium, studies have inconsistently shown that sedation protocols may reduce the incidence of VAP (Jackson et al., 2010; Qi et al., 2021). As with delirium, most of the studies in this review did not evaluate VAP as an outcome. Furthermore, studies have inconsistently demonstrated that protocols may improve pain control, reduce vasopressor administration, or prevent tracheostomy placement (Egerod et al., 2010; Faust et al., 2016; Frawley et al., 2019; Ranzani et al., 2014; Shehabi et al., 2013; Qi et al., 2021). Lastly, there is mixed evidence to support the claim that protocolized sedation reduces mortality (Mansouri et al., 2019; Qi et al., 2021; Ranzani et al., 2014).

Implementation Methods

Of the 20 studies included in the review, 9 did not identify or detail protocol implementation strategies utilized. The remaining 11 studies elaborated on the implementation process to varying degrees. Several studies utilized theoretical concepts, such as KTA or the 4E’s Framework, to guide development and implementation of the intervention (Frawley et al., 2019;
Ranzani et al., 2014; Yan et al., 2019). Several studies incorporated an initial barrier assessment into the implementation process (Amaral, Kure, & Jeffs, 2012; Frawley et al., 2019; Ranzani et al., 2014; Sacco & LaRiccia, 2016; Yan et al., 2019). The findings were instrumental in the development of interventions tailored to the individual needs of the stakeholders. Three research teams performed a PGA via chart audits prior to protocol implementation (Bugedo et al., 2013; Ranzani et al., 2014; Sacco & LaRiccia, 2016). This data was presented to stakeholders to promote awareness and spark interest towards the issue. Education was identified as a key component of protocol implementation in all studies. Nearly all the studies focused on multidisciplinary education (Amaral, Kure, & Jeffs, 2012; Bugedo et al., 2013; Dale et al., 2013; Frawley et al., 2019; Heim et al., 2019; Ranzani et al., 2014; Sacco & LaRiccia, 2016; Yan et al., 2019). In many cases, education was multifaceted (Amaral, Kure, & Jeffs, 2012; Dale et al., 2013; Frawley et al., 2019; Heim et al., 2019; Ranzani et al., 2014; Sacco & LaRiccia, 2016; Yan et al., 2019). Several research teams implemented on-site skills training as an approach to improve self-efficacy (Amaral, Kure, & Jeffs, 2012; Bugedo et al., 2013; Mansouri et al., 2013; Ranzani et al., 2014). In numerous studies, education was delivered by a core group (Amaral, Kure, & Jeffs, 2012; Frawley et al., 2019; Ranzani et al., 2014; Sacco & LaRiccia, 2016). In some cases, education was mandatory (Reinaker & Frock, 2015; Sacco & LaRiccia, 2016). Several studies indicated the use of academic detailing or educational outreach at the POC (Amaral, Kure, & Jeffs, 2012; Dale et al., 2013; Frawley et al., 2019; Heim et al., 2019; Ranzani et al., 2014; Sacco & LaRiccia, 2016). Two studies highlighted the use of A&F in the implantation process (Frawley et al., 2019; Ranzani et al., 2014). Lastly, multiple studies implemented POC reminders, such as visual cues, checklists, and computerized order sets, to improve protocol compliance (Amaral, Kure, & Jeffs, 2012; Dale et al., 2013; Yan et al., 2019).
Methods

Design

The project was a single-center study that took place at UK Chandler Medical Center. The study design was a before and after comparative study with retrospective data collection. The study process was defined by two distinct interventions: a tailored educational intervention and a multifaceted educational intervention. Prior to the implementation of the educational intervention, a pre-survey was created using REDCap and distributed to unit nurses via a modified email listserv of 139 individuals. Twelve individuals were excluded from participation. The email consisted of a formal invitation, attached cover letter, and embedded survey link. The pre-survey was distributed on September 20th and closed on October 4th, 2021. The pre-survey was anonymous; however, upon completion of the pre-survey, participants were directed to a secondary survey in which email addresses could be voluntarily provided for consideration of a prize drawing. Contact information obtained from the secondary survey was not used to link anonymous data in any way.

The results of the pre-survey were evaluated, and an educational intervention was developed and tailored to the individual needs of the staff. The educational intervention was constructed in PowerPoint format and delivered to staff via Zoom. The intervention was delivered on October 20th and November 16th, 2021 during a non-mandatory council meeting. Sessions were recorded and the presentation was distributed via email to those unable to attend. Education was delivered by the PI and focused on raising awareness of the practice gap, addressing knowledge deficits, transforming attitudes, and reviewing strategies to address identified barriers (Barr et al., 2013, Devlin et al., 2018). At the conclusion of the intervention, questions and feedback were encouraged by the PI. A post-survey link was distributed via email.
to all staff who completed the pre-survey and attended one of the educational sessions. The post-
survey excluded four questions (15-18) from the pre-survey since a high proportion of nurses
answered the questions correctly in the pre-survey and the content was not identified as a
knowledge deficit. Three individuals who completed the pre-survey but did not attend an
educational session. These participants were emailed the recorded presentation and instructed to
watch the presentation prior to completing the survey. The post-survey link was dispersed on
November 17th and open until December 8th, 2021.

A secondary multifaceted intervention was developed and implemented December 15th
and ending on February 28th, 2022. The aim of the multifaceted intervention was to address
remaining barriers not influenced by the educational intervention and promote protocol adoption
at the POC. The second intervention continued to concentrate on the knowledge and attitude
barriers addressed in the initial intervention. The PI functioned as a change agent, more
specifically a nurse champion or opinion leader, on the unit of study. The nurse champion
identified patients who potentially met inclusion criteria (a goal of light sedation) and audited the
sedation practices of the primary nurse caring for these patients. Audits were performed using
the chat function of Epic, the electronic health record at UK, or through bedside evaluation by
the champion on both night and dayshift. Audits were standardized consisting of a series of
questions implanted in a REDCap survey (Appendix E) evaluating sedation practice and protocol
compliance. Education and feedback were provided by the PI through peer-to-peer conversation
via chat or in-person. Audit data was recorded using REDCap software and unit performance
feedback was provided via email and during council meetings monthly (Appendix D). In
addition to audits, POC reminders were dispersed on the unit (Appendix C). Printed protocols
were placed at workstations and in the direct sight of nursing staff. Badge buddies, outlining the
protocol, were distributed to nursing staff (Appendix B). Lastly, Dr. Pandya, a lead pharmacist on the unit, functioned as an opinion leader by educating fellow colleagues on the protocol and leading sedation discussions during multidisciplinary rounds.

**Setting**

UK Albert B. Chandler Hospital is a 945-bed academic medical center located in Lexington, Kentucky. The institution is the only Level I trauma center in Central and Eastern Kentucky, and is Magnet recognized for nursing excellence by the American Nurses Credentialing Centers. The CVICU is the largest adult ICU in the institution and houses 44 inpatient ICU beds. The ICU is split into two subunits: CVICU Main (32 bed) and CVICU North (12 bed). The patient population may be categorized as: cardiology, cardiac surgery, thoracic surgery, vascular surgery, and patients required extracorporeal membrane oxygenation. The PI is a full-time Registered Nurse in the unit of study and serves as a team leader, preceptor, and resource nurse.

UK embraces a culture of innovation. The mission of UK Healthcare is a commitment to patient care, education, and research. The institution is driven by the DIReCT values: diversity, innovation, respect, compassion, and teamwork (UKHealthCare, 2021). These five values are essential to securing the vision of “a healthier Kentucky”. This study was congruent with the mission, vision, and values of the organization (UKHealthCare, 2021). The primary objective of the research study was to improve patient outcomes and was therefore, patient centered. The study ensured that education was a priority since knowledge drives practice change. Furthermore, the study process was non-discriminatory, and all qualifying patients were considered for inclusion. The study employed innovative strategies with the intent of improving quality of care. Evidenced based strategies, identified in the literature, were adapted to the local
context through the application of innovative approaches. The intervention was individualized and tailored to the individual needs of the stakeholders. Additionally, patients, families, and peers were respected and shown compassion during the research process. Lastly, teamwork was an essential component of all steps of the research process.

Sample

Nurses were required to meet a specific set of criteria to be eligible for participation in the study. The first requirement was that nurses were involved in direct patient care and held the title of staff nurse. Approximately 151 individuals were employed as staff nurses and suitable for inclusion at the time of the study. Full-time, part time, weekend part time, and as needed employees were eligible for inclusion. Those on family medical leave and/or other forms of leave were eligible for inclusion on the condition that the individual worked at least three shifts in the prior year. Nurses were excluded from participation if: hired on with a traveling agency or a new hire/orientee with less than a month’s experience on the unit.

The patient sample was identified by the UK Center for Clinical and Translational Science (CCTS) through retrospective chart review and subjects were required to meet a strict set of inclusion/exclusion criteria. Archived data were included of patients who: were greater than 18 years of age, receiving endotracheal MV for greater than 12 hours from arrival time (time transferred to unit of study) or time of intubation, and had a RASS goal of 0 to -2 throughout the intubation event. Data was excluded if patients arrived with a tracheostomy or received a tracheostomy, had an active COVID 19 diagnosis, received mechanical circulatory support (Extracorporeal Membrane Oxygenation, Impella, or Left Ventricular Assist Device support), were terminally extubated, or expired prior to successful extubation.
Data Collection

Unit manager support was given through a recommendation letter to the Institutional Review Board (IRB) at the UK in July 2021 (Appendix F). The IRB granted approval for the study in September of 2021 (Appendix G). This project was approved by the UK Nursing Research Council in September 2021 (Appendix H).

Survey participants were recruited through a unit-based email listserv. A cover letter outlining the purpose, methodology, risk/benefits, survey process, and investigator contact information was sent with an embedded REDCap survey link to all participants. Clicking on the survey link and completing the survey was considered implied consent, or the participant’s acknowledgement of their willingness to participate in the study. The informed consent process was waived considering that the survey presented minimal risk to subjects. Participants were informed that they were not required to respond if they did not wish to answer. The initial survey was anonymous and IP addresses were not collected from participants. At the completion of the initial survey, subjects were redirected to a secondary survey to input their email address to be eligible for prize drawing at the conclusion of the study. The secondary survey was in no way linked or associated with the responses in the primary survey; therefore, anonymity was guaranteed. Two participants, who completed the survey and attended one of the two educative sessions, were randomly selected by the PI to receive one of two $100 Amazon gift cards. The recipients were contacted via email or in-person to receive their prize.

The pre-survey focused on assessing baseline knowledge, attitudes, and perceived barriers regarding an organization specific ICU sedation protocol. Demographic data such as age, gender, experience, degree, and shift were gathered. Knowledge was assessed through a series of multiple-choice questions, six total, formatted by the research team. Knowledge was measured as
the total number of correct responses to questions 13 through 18. Knowledge was related to evidence-based guideline recommendation and protocol components/procedures. Attitudes, on the other hand, were assessed by incorporating component of the NSPS into the survey (Guttormson et al. 2019). Attitudes were measured using a five-point Likert scale and higher scores indicated “a [more] positive attitude of sedation medications for relieving the distress of mechanically ventilated patients” (Guttormson et al., 2019). Attitudes were measured as a sum of responses to questions 6 through 11 with a possible range of 6 to 30. The final variable, perceived barriers, was evaluated through true/false, multiple choice (select all that apply), and open response questions. The post-survey was nearly identical to the pre-survey and measured the same variables.

A request was made to waive consent for the patient population, since data collection was retrospective in nature. Furthermore, it would be extremely difficult to obtain informed consent from patients who were discharged at time of data retrieval. For those admitted at the time of data collection, it was not feasible to obtain informed consent due to the severity of their critical illness. To facilitate the review of patient data, the PI made a request to the CCTS in February 2022. Patients were identified by CCTS based on the inclusion/exclusion criteria defined by the research team. Data was obtained by CCTS through a thorough review of the EPIC database and administrative data. Pre-intervention subjects were recruited during the time frame of September 1st and November 10th, 2021. The intervention group was recruited from December 15th and February 28th, 2022. Data was transferred between CCTS and the PI through an email secure, password protected Excel file. All private health information was removed from the document by assigning a study in place of the patient’s medical record number. The original data with private health information was placed on lock and key in a OneDrive file with two-factor identification.
The research team identified outcome variables and the PI and CCTS collaborated on the process to ensure that data was accurate and reliable. Outcomes were related to protocol compliance and patient outcomes relevant to sedation practice. Outcome data was sorted by intubation event as opposed to patient or subject. Therefore, patients could represent multiple data sets or multiple subjects. Protocol compliance was measured by the median RASS score and the median percent of RASS assessments at goal. Furthermore, the median number of CPOT documentations and as-needed pain medication administrations were compared between groups.

Patient outcomes focused on calculating the median MV days, total number of reintubations, and incidence of delirium. Total MV time was measured from the time of intubation or arrival to the unit to the time of successful extubation. A successful extubation was defined as an extubation without reintubation for greater than 48 hours. If the subject was reintubated within 48 hours, the time extubated was considered additional MV time and the event was considered a reintubation. Delirium was defined as a documented positive Confusion Assessment Method (CAM) ICU score during the intubation period.

**Data Analysis**

Data analysis was conducted using IBM’s SPSS, version 25 with an alpha level of 0.05. Descriptive statistics, including means, medians, standard deviations, and frequency distributions were used to review study variables. Frequency distributions were used to summarize nurse demographic data. A pooled t-test of equal variances was performed to compare pre- and post-education knowledge and attitudes. Furthermore, the t-test of equal variances was used to compare baseline attitudes scores between demographic variables. Chi-square tests were performed to compare responses to true or false statements. Regarding patient data, a pooled t-
test of equal variances was performed to compare the mean age between groups. Chi-square tests were used to compare gender, race, reintubation, and delirium. A Kruskal-Wallis t-test was used to compare the lower quartile, upper quartile, and median of remaining variables (Elixhauser Index, RASS score, RASS at goal, intubation days, CPOT documentation, and pain medication administration).

**Results**

**Sample Characteristics**

A total of 58 (n=58) nurses completed the pre-survey and 43 (n=43) nurses completed the post-survey. The same individuals (n=43) completed the pre-survey and post-survey. There were 15 nurses who completed the pre-survey but failed to complete the post. The majority of those included were between the ages of 20 and 39 (90.7%) and female (72.1%; Table 3). The bulk of participants had a BSN degree (83.7%) and greater than 2 years of ICU experience (72.1%; Table 3). DNP was the highest degree represented in the sample. Most of the nurses were dayshift (76.7%; Table 3). The pre-survey population was compared regarding baseline attitude scores. Nurses with a doctoral degree/DNP had significantly lower baseline attitude scores than those with other degrees (p=0.05; Table 5). No differences were found when comparing by shift (night or day) or years of experience (< 2 or > 2; p=0.43; p=0.35; Table 5).

A total of 88 patients were included in the pre-intervention and 80 in the intervention group. There were no significant differences found between demographic data (age, gender, race, and comorbidity index; Table 4). The mean age of patients was between 55 and 60 (p=0.128; Table 4). Most patients were male (>65%) and Caucasian (>88%; p=0.3561; p=0.1963; Table 4). The median Elixhauser Index was 7 for both pre- and post-groups (p=0.1812; Table 4).
**Nursing Knowledge and Attitudes**

Knowledge scores were significantly improved with the educational intervention (p<0.001; Table 7). A significantly higher proportion of nurses felt that they were more knowledgeable of the sedation protocol and evidence-based guideline recommendations following the educational intervention (p<0.001; Table 8). Furthermore, there was a significant improvement in the proportion of nurses who felt well-educated on how to use the protocol (p<0.001; Table 8). In addition to knowledge, attitude scores were significantly improved post-education (p=0.003; Table 7). This suggests that nurses were more favorable of evidence-based sedation practice and protocol recommendations.

**Nursing Barriers**

There was a large reduction in the proportion of nurses who identified knowledge as a barrier to protocol use (Table 6). After education, less nurses reported they did not agree with minimal sedation or the components of the sedation protocol (Table 6). Also, there was a reduction in the number of nurses who felt the sedation protocol was difficult to use (Table 6). There were numerous additional barriers identified through open response. These barriers were similar before and after intervention and a common theme was a lack of physician support or buy-in. Nurses claimed that sedation goals and strategies were often determined by the physician and tended to deviate from protocol procedures. Several nurses stated that they were more likely to adhere to physician orders and would use the protocol more often if physician orders were congruent with the sedation protocol. Furthermore, nurses identified practitioner communication as a barrier to protocol implementation. Participants stated that sedation goals are not always clearly communicated in rounds and orders do not always reflect goals. Lastly, nurses did not feel that physicians placed significance on the issue or encouraged evidence-based strategies.
System characteristics were also frequently identified as barriers. Inadequate staffing and protocol accessibility was frequently noted. Nurses claimed that they would more likely use the protocol if it was more readily available. Some nurses stated that they would be more likely to adopt the protocol if there was a stronger peer influence and more nurses were using it. In addition, several nurses claimed that the protocol was not applicable to all patients. Interestingly, a couple of nurses indicated that protocols would be followed more closely if non-verbal communication tools were more readily available.

**Patient Outcomes**

There were no significant improvements in sedation and analgesia practice during the intervention. Although there was a slight decrease in median RASS score, the difference was not statistically significant (p=0.2094; Table 9). The percent of RASS scores at goal improved from baseline, but not significantly (p=0.1367; Table 9). Surprisingly, CPOT documentations decreased significantly in the intervention group (p=0.0424; Table 9). There was no significant change in the as needed administration of pain medication (p=0.0857; Table 9).

However, patient outcomes may have been influenced by the intervention. There was a significant decrease in the median days of MV (p=0.0134; Table 9) corresponding to a greater than one day difference in upper quartile values. Reintubation rates were higher during intervention, but findings were not statistically significant (p=0.2524; Table 9). The incidence of delirium, on the other hand, was reduced but not of statistical significance in the intervention group (p=0.1508; Table 9).

**Discussion**

This intervention resulted in a significant improvement in nursing knowledge scores related to the components of an existing sedation protocol and evidence-based guidelines. The
use of education alone is not sufficient to drive change (Titler, 2008). However, education is necessary and an essential component of the process of knowledge translation and a key element of nursing behavioral change theory (Graham et al., 2006). Education has been cited as a key component of all four phases of the evidence-based implementation process (Cullen & Adams, 2012). Alatawi et al. (2020) identified a lack of knowledge as a common barrier to the implementation of evidence-based practice. More specifically, Kydonaki et al. (2019) identified education as a primary barrier to optimum sedation-analgesia practice. Therefore, education should be an essential element of interventions addressing sub-optimal sedation practice.

This intervention resulted in significantly lower attitude scores indicating that nurses were more favorable of evidence-based sedation practice. Attitudes and knowledge may be interrelated, and educational interventions likely promote positive attitudes towards behavioral change (Cullen & Adams, 2012). Attitudes should be accessed prior to evidence-based practice implementation, since negative attitudes can be a significant barrier to behavior change and evidence-based practice adoption (Farokhzadian et al., 2015). There is a positive correlation between nurse sedation practice and nursing attitudes (Guttormson et al., 2010; Guttormson et al., 2019). Guttormson et al. (2019) found that nurses who held a more positive attitude towards the need for sedation were more likely to administer sedation to all mechanically ventilated patients. Therefore, nurse attitudes must be considered and targeted when attempting to optimize sedation practices at the bedside (Guttormson et al., 2019).

MV days were significantly reduced with the multifaceted on-site intervention. This is consistent with the findings of a multitude of studies that analyzed the impact of sedation protocols on MV duration (Amaral, Kure, & Jeffs, 2012; Dale et al., 2013; Dale et al., 2014; Faust et al., 2016; Frawley et al., 2019; Jackson et al., 2009; Mansouri et al., 2019; Qi et al.,
2021; Ranzani et al., 2014; Strøm, Martinussen, & Toft, 2010). Sedation protocols likely reduce MV duration by facilitating the implementation of spontaneous breathing trials through reduced levels of sedation, improved pain management, and awakening trials (Barr et al., 2013; Hooper & Girard, 2011). MV days are an important outcome measure, considering that each day of MV places the patient at a greater risk for the development of complications associated with MV (Haribhai & Mahboobi, 2021). Reducing the time of ventilator exposure may significantly reduce the risk of ventilator associated events such as pneumonia, fluid overload, atelectasis, and acute respiratory distress syndrome (Klompas, 2015; Klompas, 2019). Light sedation and DSI, essential components of sedation protocols, are known strategies to reduce the risk of ventilator associated events (Klompas, 2019).

There was a non-significant reduction in the incidence of delirium in the intervention group. Delirium may be reduced through the implementation of sedation protocols (Dale et al., 2014; Qi et al., 2021). This may be explained by the fact that sedation protocols reduce deep sedation/coma and reduce benzodiazepine consumption, which are known risk factors for delirium (Zaal et al., 2015). There are several explanations for why the reductions in this study did not reach statistical significance. For one, benzodiazepines are rarely prescribed for sedation in the CVICU. Secondly, a large portion of mechanically ventilated patients in the CVICU, cardiovascular surgery patients, are at increased risk based on a multitude of factors not associated with sedation practice such as age, type of surgery, and the need for perioperative blood administration (Gosselt et al., 2015). Therefore, improvements in sedation practice may not be sufficient to produce significant reductions. Lastly, physicians, particularly surgeons, were not accepting of the push for AFS and discontinued orders for analgesia on several patients. These actions hindered adequate pain management, and likely reduced the benefits of this
intervention, since unmanaged pain is a known risk factor for delirium (Reade et al., 2014).

There were nonsignificant improvements in documented sedation levels. Several studies found significant reductions in sedation depth and consumption with the implementation of a protocol (Bugedo et al., 2013; Faust et al., 2016; Reinaker & Frock, 2015; Shehabi et al., 2013).

In this study, documented sedation levels were often within goal range, so it was perceived that there was little room for improvement. However, documented sedation levels may not always be the most reliable indicator of nurse sedation practices. This was evident by the inconsistencies between perceived and actual practice at the bedside. Although documented results were insignificant, there was a noticeable reduction in sedation level observed by the PI during audits.

There was no evidence that pain management improved with the intervention. CPOT scores and as needed pain medications were documented significantly less in the intervention group. This is incongruent with the findings of Faust et al. (2016) demonstrating improved pain management with the implementation of an analgosedation protocol. There may be several explanations for this finding. For one, this study did not measure the use of continuous analgesia drips which may have increased during the intervention period. Furthermore, analgesia pump boluses, from continuous drips, are not always accounted for or documented in the medical record. This may have explained the difference in CPOT documentations since nurses are prompted to provide a CPOT score when scanning pain medications. Lastly, physician push back may have negatively influenced analgesia administration during the intervention.

There was a nonsignificant increase in the number of reintubations during the intervention. This finding was congruent with the literature (Egerod et al., 2010; Faust et al., 2016; Jackson et al., 2010; Mansouri et al., 2019; Qi et al., 2021). Health care providers should always strive to extubate patients early but should do so carefully and meticulously. Reintubation
has been shown to potentially increase the risk of mortality by 25 to 50% (Ahmad et al., 2021). Furthermore, reintubation may lead to increased LOS, hospital costs, and morbidity (Ahmad et al., 2021). Interventions, focused on improving sedation practice, must not increase reintubation or self-extubation rates, since both are associated with poor health outcomes (Berkow & Kanowitz, 2020).

**Limitations**

There were numerous limitations recognized in this study. For example, outcome data were acquired through retrospective chart review and may be skewed as result of missing information or charting inaccuracies. Also, it is possible that data were inaccurately abstracted from the electronic health record since data retrieval was not double checked for accuracy. This study did not compare samples by admission diagnosis. This may be a confounding variable that should be addressed in future studies. This study was observational, so cause and effect cannot be determined or established. Survey fatigue was likely a barrier to survey participation. Furthermore, the survey was extensive, which may have discouraged nurse participation.

The results of this study should not be generalized to all ICU patients. This study focused on patients who did not require a tracheostomy. In addition, the sample consisted primarily of Caucasian males. Staffing was poor during the study time frame which may have influenced nurse sedation practices. Staffing ratios have been acknowledged as a potential barrier to evidence-based sedation practice. The patient sample was limited due to the influx of COVID 19 patients during the study period. Due to this influx, there was an associated flood of travel nurses to meet patient demand. The travel nurses did not receive the initial education and were likely unfamiliar with the unit sedation protocols. Furthermore, the PI may have been less influential to these nurses. Travel nurses may not view the change agent as a leader since the leadership role is
often developed over time. Furthermore, travelers may be less invested in organizational outcomes. Lastly, several important outcome variables were not evaluated such as VAP, deep vein thrombosis, self-extubation, and ICU-acquired weakness.

**Recommendations for Future Research**

In the future, the recorded educational content on the use of sedation protocols should be incorporated as a required component of the orientation process. For returning staff, the educational content should be converted into a web-based training and completion should be required annually. Future research should focus on skill development in relation to the management of agitation and providing care for awake intubated patients. Also, research should focus on strategies to improve communication with nonverbal patients or facilitate the implementation of other tools such as the Responsive Index to measure sedation depth. To sustain or greaten the impact of this project, unit leaders should focus on assembling a multidisciplinary core group to address sedation and analgesia practices. This core group should recruit bedside nurse leaders as nurse champions to serve as unit resources and positive role models to peers. Physicians must be a part of this multidisciplinary group, and future work should emphasize the importance of securing physician buy-in since it has been identified as a significant barrier to protocol compliance. The strategies used in the project should be used to target vulnerable populations who are more likely to suffer the consequences of prolonged MV. The PI will disseminate the findings of this study to the unit of study, the institution, and the public through journal publication.

**Conclusion**

Sedation protocols have been positively correlated with improved patient outcomes in the ICU. Therefore, healthcare leaders should direct efforts to improving protocol compliance
through evidence-based strategies. This study demonstrated the positive impact of a multifaceted educational approach on nursing knowledge and attitudes regarding an evidence-based sedation protocol. Furthermore, this study suggests that a multifaceted intervention may improve quality of care by reducing MV duration. Future research should focus on applying this strategy to vulnerable populations who are susceptible to prolonged MV.
References


https://doi.org/10.33940/med/2020.3.2


decreased duration of mechanical ventilation in cardiovascular surgery patients. *Crit Care Med*, 41(11), 2610-2617. doi: 10.1097/CCM.0b013e31829a6ee7


Preventability of Ventilator-Associated Events: The CDC Prevention Epicenters’ Wake Up and Breathe Collaborative. *Open Forum Infectious Diseases, 1*(suppl_1), S46. doi: 10.1093/ofid/ofu051.123


https://www.sccm.org/Communications/Critical-Care-
Statistics#:~:text=More%20than%205%20million%20patients%20are%20admitted%20annually


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<td>Randomized Controlled Trial (RCT) To compare outcomes between a protocol of no sedation versus sedation with daily interruption</td>
<td>University Hospital in Denmark, 18 bed ICU No sedation (NS) 55 patients &amp; DSI 58 patients</td>
<td>4.2 day increase in ventilator free days Significant reduction in ICU &amp; hospital LOS</td>
<td>II</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Setting</td>
<td>Sample Size</td>
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<tr>
<td>Faust et al. (2016)</td>
<td>Before/After Retrospective Cohort</td>
<td>MICU in Dallas, TX</td>
<td>65 Pre/ 79 patients postimplementation</td>
<td>Reduction in sedation level, improvements in pain management, &amp; significant reduction in duration of MV; reduction in continuous sedation usage</td>
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<tr>
<td>Sacco &amp; LaRiccia, (2016)</td>
<td>Pre/Post Comparison (Retrospective)</td>
<td>Trauma ICU New York, US</td>
<td>95 PRE and 145 patient POST</td>
<td>Significant decrease in sedation days, ICU LOS decreased by 4.16% and 17.81% reduction in average time on the ventilator following the initiation of weaning</td>
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<tr>
<td>Dale et al. (2013)</td>
<td>Retrospective Cohort</td>
<td>16 nonfederal Washington state hospitals USA</td>
<td>19,561 patients Cardiac Surgery Patients Multicenter</td>
<td>Lower mean MV days in higher quality protocol groups</td>
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<td>Study Authors (Year)</td>
<td>Study Design</td>
<td>Methods</td>
<td>Findings</td>
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<td>-------------------------------</td>
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<td>Qi et al. (2021)</td>
<td>Systematic Review/Meta-Analysis</td>
<td>Compare nurse led sedation protocols and physician led usual care</td>
<td>8 RCTs &amp; 6 pre-post comparison studies, English &amp; Chinese, Significant reduction in MV days, ICU LOS &amp; mortality, VAP, delirium, and extubation failure</td>
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<td>Ranzani et al. (2014)</td>
<td>Prospective Cohort</td>
<td>Evaluate the impact of minimal sedation protocol on MV duration and oversedation</td>
<td>12 ICUs, 11 hospitals in Sao Paulo, Brazil, Multicenter study, Decreased midazolam consumption, Decrease length of MV duration &amp; increase in 28 ventilator-free days</td>
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<tr>
<td>Shehabi et al. (2013)</td>
<td>Prospective Randomized Controlled Trial</td>
<td>Assess whether early goal-directed sedation (EGDS) with dexmedetomidine is feasible, safe, can be delivered in a timely fashion, and can achieve early light sedation more effectively than standard sedation</td>
<td>Six tertiary and regional ICUs in Australia and New Zealand, Multicenter Study, EGDS resulted in significantly more time at light levels of sedation &amp; significantly less restraint use</td>
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<td>Study Type</td>
<td>Setting</td>
<td>Patients (Pre/Post)</td>
<td>Results</td>
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<td>Heim et al. (2019)</td>
<td>Retrospective Before/After Study</td>
<td>24 bed medical-surgical ICU</td>
<td>1147/1270 Patients</td>
<td>Reduction in average MV days, and ICU &amp; hospital LOS</td>
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<td></td>
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<td>Significant reduction in use of midazolam infusions; increased use of continuous opioids</td>
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<tr>
<td>Frawley et al. (2019)</td>
<td>Before/After Retrospective Cohort</td>
<td>United Kingdom 16 bed ICU</td>
<td>359/359 pre &amp; 359 post</td>
<td>Significant decrease in mean duration of MV</td>
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<tr>
<td></td>
<td>Study</td>
<td></td>
<td></td>
<td>No significant decrease in ICU LOS</td>
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<td>Mahmoud et al. (2018)</td>
<td>Retrospective Cohort Study</td>
<td>Tertiary Care Medical Center Neuro ICU</td>
<td>1197: 576 patients before and 621 patients after</td>
<td>Resulted in increased use of analgesia, decreased use of sedation and decreased medication-associated costs, specifically propofol</td>
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<tr>
<td>Authors</td>
<td>Study Type</td>
<td>Setting</td>
<td>Participants</td>
<td>Findings</td>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>Amaral, Kure, &amp; Jeffs (2012)</td>
<td>Before/After Comparative Cohort Study</td>
<td>Sunnybrook Health Sciences Center in Canada, Level III Trauma MedSurg CCU</td>
<td>1556 Patients (753 Pre and 803 Post-Intervention) Single Center</td>
<td>Significant reduction in length of MV with decreased sedation levels</td>
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<td>Mansouri et al. (2013)</td>
<td>Randomized Controlled Trial (RCT)</td>
<td>Iran</td>
<td>2 mixed medical-surgical ICUs 201 patients Single Center</td>
<td>Reduction in MV days Reduction in ICU LOS and mortality</td>
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<td>Tanios et al. (2014)</td>
<td>Before/After Comparative Study</td>
<td>33 bed tertiary ICU Ca, USA</td>
<td>92 patients 3 groups (no intermittent, and continuous sedation)</td>
<td>No sedation or intermittent sedation are associated with higher rates of unplanned extubation as opposed to continuous sedation 73% of patients who had an unplanned extubation did not require reintubation</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Setting</td>
<td>Patient Characteristics</td>
<td>Findings</td>
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<td>------------------------------</td>
<td>-------------------</td>
<td>-------------------------------------------------------------------------</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Reinaker &amp; Frock (2015)</td>
<td>Before/After Comparative Study</td>
<td>500 bed Level I Trauma Center in Pa, USA</td>
<td>No differences in Ramsey Scores between groups; Decreased presence of oversedation in post-group; No difference in MV days or LOS</td>
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<tr>
<td>Egerod et al. (2010)</td>
<td>Non-Randomized Controlled Trial</td>
<td>14 bed Neuro ICU in Denmark</td>
<td>Significant reduction in use of propofol &amp; midazolam; Significant increase in administration of fentanyl &amp; remifentanil; Faster awakenings for DSI; Estimates of pain-free patients increased</td>
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<tr>
<td>Hahn et al. (2012)</td>
<td>Before/After Comparative Study</td>
<td>Saint Vincent’s Birmingham Hospital, 372-bed, USA</td>
<td>Non-significant reduction in MV days</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Setting</td>
<td>Population</td>
<td>Findings</td>
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<td>------------------------------</td>
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<td>-------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Dale et al. (2014)</td>
<td>Before/After Cohort</td>
<td>24 bed Trauma Surgical ICU at Harborview Medical Center</td>
<td>1483 Patients (703 before &amp; 780 after)</td>
<td>4-hour reduction in median duration of mechanical ventilation &amp; 1 day increase in median ventilator free days: 17.6% reduction in the median duration of MV</td>
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<tr>
<td></td>
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<td>Single Center</td>
<td>Shorter median duration of ICU stay and hospitalization</td>
</tr>
<tr>
<td>Jackson et al. (2010)</td>
<td>Sub study of Randomized Controlled Trial</td>
<td>St. Thomas Hospital in Nashville, TN</td>
<td>180 patients: 89 in intervention and 81 in control</td>
<td>Similar long-term cognitive, psychological, functional, and quality-of-life outcomes as those managed with usual care</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Single Center</td>
<td>Less likely to report significant functional decline 1 year after ICU discharge</td>
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### Table 2. Synthesis Table to Summarize Findings

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<td>↓S</td>
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**Legend:** ↑INCREASED ↓DECREASED  
S=Significant  NS=Non-Significant  NE=No Effect
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<tr>
<td>VAP</td>
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<td>Self-extubation</td>
<td>NE</td>
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<td>↑S</td>
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<td>ICU LOS</td>
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<tr>
<td>Hospital LOS</td>
<td>NE</td>
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<td>Mortality</td>
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</table>

| Legend: ↑INCREASED ↓DECREASED S=Significant NS=Non-Significant NE=No Effect |

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<td>MV Duration</td>
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<td>Delirium</td>
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<td>VAP</td>
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<td>ICU LOS</td>
<td>↓S</td>
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<td>Hospital LOS</td>
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<td>↓S</td>
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<td>Mortality</td>
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Table 3. Descriptive Summary of Nurse Demographics

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<tr>
<th>Characteristic</th>
<th>Pre (n=58)</th>
<th>Post (n=43)</th>
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<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
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<tr>
<td><strong>Age (years)</strong></td>
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<tr>
<td>20-29</td>
<td>30 (51.7)</td>
<td>20 (46.5)</td>
</tr>
<tr>
<td>30-39</td>
<td>22 (37.9)</td>
<td>19 (44.2)</td>
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<tr>
<td>40-49</td>
<td>6 (10.3)</td>
<td>3 (7)</td>
</tr>
<tr>
<td>&gt;49</td>
<td>0 (0)</td>
<td>1 (2.3)</td>
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<tr>
<td><strong>Gender</strong></td>
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<tr>
<td>Male</td>
<td>16 (27.6)</td>
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<tr>
<td>Female</td>
<td>42 (72.4)</td>
<td>31 (72.1)</td>
</tr>
<tr>
<td><strong>Degree (highest)</strong></td>
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<tr>
<td>ADN</td>
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<td>3 (7)</td>
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<tr>
<td>BSN</td>
<td>49</td>
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<tr>
<td>MSN</td>
<td>(84.48)</td>
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<tr>
<td>DNP</td>
<td>2 (3.45)</td>
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<tr>
<td>PHD</td>
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<td>0 (0)</td>
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<td><strong>Experience (years)</strong></td>
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<tr>
<td>&lt;1</td>
<td>7 (12.07)</td>
<td>2 (4.7)</td>
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<tr>
<td>&lt;2</td>
<td>11 (18.97)</td>
<td>10 (23.3)</td>
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<tr>
<td>2-5</td>
<td>18 (31.03)</td>
<td>15 (34.9)</td>
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<tr>
<td>&gt;5</td>
<td>22 (37.93)</td>
<td>16 (37.2)</td>
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<tr>
<td><strong>Shift</strong></td>
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<td>Day</td>
<td>42 (72.4)</td>
<td>33 (76.7)</td>
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<tr>
<td>Night</td>
<td>14 (24.1)</td>
<td>9 (20.9)</td>
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<tr>
<td>Other</td>
<td>2 (3.4)</td>
<td>1 (2.3)</td>
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Table 4. Descriptive Summary of Patient Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Post-intervention (n=80)</th>
<th>p value</th>
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<tr>
<td>Age (mean, SD)</td>
<td>56.39 (13.88)</td>
<td>59.46 (12.04)</td>
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<td>Gender (n, %)</td>
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<td>Male</td>
<td>58 (65.91)</td>
<td>58 (72.50)</td>
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<td>Female</td>
<td>30 (34.09)</td>
<td>22 (27.50)</td>
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<tr>
<td>Race (n, %)</td>
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<tr>
<td>Caucasian</td>
<td>78 (88.64)</td>
<td>75 (93.75)</td>
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<td>African American</td>
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<td>4 (5.00)</td>
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<td>Other</td>
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<td>Lower quartile</td>
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<td>5</td>
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<td>Median</td>
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Table 5. Statistical Comparison Between Pre-Survey Attitudes (n=58)

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<th>p value</th>
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</tr>
<tr>
<td>Day</td>
<td>42 (72.4)</td>
<td>23.97 (3.04)</td>
<td>0.43</td>
</tr>
<tr>
<td>Night</td>
<td>14 (27.6)</td>
<td>24.78 (4.00)</td>
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<tr>
<td>Experience (years)</td>
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<tr>
<td>&lt; 2</td>
<td>18 (31.03)</td>
<td>24.77 (3.33)</td>
<td>0.35</td>
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<tr>
<td>&gt; 2</td>
<td>40 (68.96)</td>
<td>23.92 (3.18)</td>
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<tr>
<td>Degree</td>
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<tr>
<td>&lt;DNP</td>
<td>55 (94.82)</td>
<td>24.38 (3.12)</td>
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<td>DNP</td>
<td>3 (5.18)</td>
<td>20.66 (3.78)</td>
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### Table 6. Comparison of Nursing Perceived Barriers

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<th>Pre-survey (n=58) (%)</th>
<th>Post-survey (n=43) (%)</th>
</tr>
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<tbody>
<tr>
<td>I need more education.</td>
<td>63.8%</td>
<td>16.3%</td>
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<tr>
<td>I do not agree with the use of minimal sedation.</td>
<td>19%</td>
<td>9.3%</td>
</tr>
<tr>
<td>The protocol is difficult to use or confusing.</td>
<td>20.7%</td>
<td>11.6%</td>
</tr>
<tr>
<td>I do not agree with the components of the protocol.</td>
<td>17.2%</td>
<td>9.3%</td>
</tr>
<tr>
<td>There is a lack of support from other healthcare providers.</td>
<td>60.3%</td>
<td>60.5%</td>
</tr>
<tr>
<td>The protocol increases workload.</td>
<td>22.4%</td>
<td>18.6%</td>
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<tr>
<td>Other</td>
<td>5.2%</td>
<td>16.3%</td>
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Table 7. Comparison of Survey Outcome Variables

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<th>Variable</th>
<th>Range</th>
<th>Pre-survey (n=58) Mean (SD)</th>
<th>Post-survey (n=43) Mean (SD)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>0 to 6</td>
<td>2.12 (1.21)</td>
<td>3.30 (1.54)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Attitudes</td>
<td>6 to 30</td>
<td>24.18 (3.23)</td>
<td>21.95 (4.20)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 8. Comparison of True/False Survey Responses

<table>
<thead>
<tr>
<th>Statement</th>
<th>Pre (n=58) True (%)</th>
<th>Post (n=43) True (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I use the protocol to titrate sedation and analgesia.</td>
<td>70.6%</td>
<td>87.1%</td>
<td>0.06</td>
</tr>
<tr>
<td>I am knowledgeable of current evidence-based guidelines for pain and sedation management in the ICU.</td>
<td>53.45%</td>
<td>90.70%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I am knowledgeable of the pain and sedation protocol that has been instituted in the CVICU.</td>
<td>51.72%</td>
<td>97.67%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I am well educated on how to use the pain and sedation protocol that has been instituted in the CVICU.</td>
<td>43.10</td>
<td>95.35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Outcome variables</td>
<td>Pre-intervention (n=92)</td>
<td>Post-intervention (n=82)</td>
<td>p value</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>RASS score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower quartile</td>
<td>-0.44</td>
<td>-0.33</td>
<td>0.2094</td>
</tr>
<tr>
<td>Median</td>
<td>-0.22</td>
<td>-0.14</td>
<td></td>
</tr>
<tr>
<td>Upper quartile</td>
<td>-0.07</td>
<td>-0.06</td>
<td></td>
</tr>
<tr>
<td>RASS at goal (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower quartile</td>
<td>81.48%</td>
<td>85.98%</td>
<td>0.1367</td>
</tr>
<tr>
<td>Median</td>
<td>90.48%</td>
<td>93.31%</td>
<td></td>
</tr>
<tr>
<td>Upper quartile</td>
<td>96.23%</td>
<td>99.23%</td>
<td></td>
</tr>
<tr>
<td>MV duration (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower quartile</td>
<td>0.77</td>
<td>0.57</td>
<td>0.0134</td>
</tr>
<tr>
<td>Median</td>
<td>1.16</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Upper quartile</td>
<td>2.92</td>
<td>1.77</td>
<td></td>
</tr>
<tr>
<td>Reintubation (n, %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14 (15.22%)</td>
<td>18 (21.95%)</td>
<td>0.2524</td>
</tr>
<tr>
<td>No</td>
<td>78 (84.78%)</td>
<td>64 (78.05%)</td>
<td></td>
</tr>
<tr>
<td>Delirium (n, %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24 (26.09%)</td>
<td>14 (17.07%)</td>
<td>0.1508</td>
</tr>
<tr>
<td>No</td>
<td>68 (73.91%)</td>
<td>68 (82.93%)</td>
<td></td>
</tr>
<tr>
<td>CPOT documentations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower quartile</td>
<td>2</td>
<td>1</td>
<td>0.0424</td>
</tr>
<tr>
<td>Median</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Upper quartile</td>
<td>16</td>
<td>13</td>
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</tr>
<tr>
<td>PRN pain medications</td>
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<td></td>
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</tr>
<tr>
<td>Lower quartile</td>
<td>0</td>
<td>0</td>
<td>0.0857</td>
</tr>
<tr>
<td>Median</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Upper quartile</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Appendix A. Pre and Post-Survey

PRE and POST-SURVEY

1. What is your age?
   a. Less than 20
   b. 20-29
   c. 30-39
   d. 40-49
   e. >49

2. What is your gender?
   a. Male
   b. Female
   c. Other

3. How many years of ICU experience do you have?
   a. Less than 1 year
   b. Less than 2 years
   c. 2-5 years
   d. >5 years

4. What is your highest nursing degree?
   a. ADN
   b. BSN
   c. MSN
   d. DNP
   e. PHD
5. What shift do you currently work?
   a. Night
   b. Day
   c. Other

6. All patients receiving endotracheal mechanical ventilation should receive continuous sedation.
   a. Strongly Disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly Agree

7. I would prefer continuous sedation if I were receiving endotracheal mechanical ventilation.
   a. Strongly Disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly Agree

8. Endotracheal mechanical ventilation is uncomfortable.
   a. Strongly Disagree
   b. Disagree
   c. Neutral
   d. Agree
   e. Strongly Agree

9. Endotracheal mechanical ventilation is stressful.
   a. Strongly Disagree
   b. Disagree
c. Neutral
d. Agree
e. Strongly Agree

10. Sedation (continuous) should be used to limit recall of ICU experiences.
   a. Strongly Disagree
   b. Disagree
c. Neutral
d. Agree
e. Strongly Agree

11. It is easier to care for alert mechanically ventilated patients.
   a. Strongly Disagree
   b. Disagree
c. Neutral
d. Agree
e. Strongly Agree

12. Intermittent sedation is inappropriate and insufficient for patients receiving endotracheal mechanical ventilation.
   a. Strongly Disagree
   b. Disagree
c. Neutral
d. Agree

13. Which of the following is NOT a recommendation PAD guideline in the treatment of pain in critically ill patients?
   a. Opioids, administered oral route, should be first line therapy for non-
neuropathic pain

b. Low dose IV Ketamine should be used in addition to opioid therapy in the treatment of post-surgical pain
c. Acetaminophen should be used as an adjunct to decrease opioid consumption
d. Vital signs should be used as a cue to prompt pain assessment

14. Which of the following is NOT a recommendation PAD guideline in the treatment of agitation in critically ill patients?
   a. Implementation of daily sedation interruption (DSI)
b. Light “targeted” levels of sedation
c. Analgesia-first sedation
d. BIS monitoring as primary assessment of sedation level

15. Which of the following is NOT a recommendation PAD guideline in the treatment of delirium in critically ill patients?
   a. Administration of haloperidol in the treatment of delirium
   b. Avoidance of benzodiazepines and blood transfusion since these are known modifiable risk factors
c. Early rehabilitation and mobility may be beneficial in prevention
d. Implementation of ICDSC and CAM ICU as delirium monitoring tools

16. Which of these is an exclusion criteria for SAT?
   a. Open heart surgery <24 hours post-op
   b. Levophed gtt at 0.2 mcg/kg/min
c. Patient on VV ECMO for ARDS
d. History of seizures
17. Which of these situations would be considered a failed SAT?
   a. A patient who opens eyes, makes eye contact, and squeezes hand but does not put out tongue to nurse command
   b. A patient with an O2 saturation of 90% for greater than 5 minutes
   c. A patient who becomes noticeable diaphoretic during SAT without demonstrating other signs of respiratory distress
   d. A patient with sustained agitation or pain despite treatment

18. Which of these is an exclusion criteria for SBT?
   a. PEEP of 10
   b. O2 saturation of 90%
   c. Norepinephrine gt at 0.02 mcg/kg/min
   d. Ventilator fio2 at 40%

19. When is RASS assessed after a downward titration in sedation dose?
   a. 1 hour after
   b. 30 minutes after
   c. 1 hour and 2 hours after
   d. 30 minutes after and 2 hours after

20. What would be the RASS score of a patient who opens eyes and maintains eye contact for more than 10 seconds?
   a. 0
   b. -1
   c. -2
   d. -3
21. What would be the RASS score of a patient who opens eyes to voice but does not make eye contact?
   a. -2
   b. -5
   c. -4
   d. -3

22. Which of these statements correctly identifies the process of obtaining a CPOT score?
   a. Muscle tension should be assessed first during the CPOT assessment
   b. Observation should occur at rest and during turns and other nociceptive procedures
   c. The patient should be evaluated before and after the peak effect of analgesic agent
   d. B & C
   e. All the above

23. I use the protocol to titrate sedation and analgesia?
   a. True
   b. False

24. I am knowledgeable of the current evidence-based guidelines for pain and sedation management in the ICU.
   a. True
   b. False

25. I am knowledgeable of the pain and sedation protocol that has been instituted in the CVICU.
   a. True
   b. False
26. I am well educated on how to use the pain and sedation protocol that has been instituted in the CVICU?
   a. True
   b. False

27. Choose all that apply. Which of these are barriers to the sedation and analgesia protocol?
   a. I need more education
   b. I do not agree with the use of minimal sedation
   c. The protocol is difficult to use or confusing
   d. I do not agree with the components of the protocol
   e. There is a lack of support from other healthcare providers
   f. The protocol increases workload
   g. Other

28. I am aware of the sedation protocols but have not routinely use because: ________________

29. I would be more likely to use the protocols if: ________________
Appendix B. Unit Sedation and Analgesia Protocol

<table>
<thead>
<tr>
<th>Hydromorphone</th>
<th>Morphine</th>
<th>Fentanyl</th>
<th>Ketamine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Administer</strong> 0.5 mg IV bolus x 1. Begin infusion at 0.25 mg/hr. Maximum rate of 2mg/hr.</td>
<td><strong>Administer</strong> 4 mg IV bolus x 1. Begin infusion at 3 mg/hr. Maximum rate of 15 mg/hr.</td>
<td><strong>Administer</strong> 50mcg IV bolus x 1. Begin infusion at 50 mcg/hr. Maximum rate of 200mcg/hr.</td>
<td><strong>Begin infusion</strong> at 0.05 mg/kg/hr. Maximum rate of 2.5 mg/kg/hr.</td>
</tr>
<tr>
<td>CPOT &gt; 4: Administer 0.5mg IV bolus every 10 minutes (maximum of 3 bolus per hour). If CPOT is not at goal after bolus doses, increase infusion by 0.025mg/kg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
<td>CPOT &gt; 4: Administer 4mg IV bolus every 10 minutes (maximum of 3 bolus per hour). If CPOT is not at goal after bolus doses, increase infusion by 2mg/hr.</td>
<td>CPOT &gt; 4: Administer 50mcg IVP every 10 minutes (maximum of 3 bolus per hour); if no response then increase drip by 50 mcg/hr.</td>
<td>CPOT &gt; 3: Increase infusion by 0.025 mg/kg/hr</td>
</tr>
<tr>
<td>CPOT 3-4: Administer 0.25 mg IV bolus every 10 minutes (maximum of 3 bolus per hour). If CPOT is not at goal after bolus doses, increase infusion by 0.25 mg/hr.</td>
<td>CPOT 3-4: Administer 2mg IV bolus every 10 minutes (maximum of 3 bolus per hour). If CPOT is not at goal after bolus doses, increase infusion by 1 mg/hr.</td>
<td>CPOT 3-4: Administer 25mcg IVP every 10 minutes (maximum of 3 bolus per hour); if no response then increase drip by 25 mg/hr.</td>
<td>CPOT 0-2: Continue current infusion rate. If patient qualifies for SAT/SBT and CPOT is maintained at 0-2 for 8 hours, decrease rate by 12.5 mcg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
</tr>
<tr>
<td>CPOT 0-2: Continue current infusion rate. If patient qualifies for SAT/SBT and CPOT is maintained at 0-2 for 8 hours, decrease rate by 1mg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
<td>CPOT 0-2: Continue current infusion rate. If patient qualifies for SAT/SBT and CPOT is maintained at 0-2 for 8 hours, decrease rate by 0.25mg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
<td>CPOT 0-2: Continue current infusion rate. If patient qualifies for SAT/SBT and CPOT is maintained at 0-2 for 8 hours, decrease rate by 0.025mg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
<td>CPOT 0-2: Continue current infusion rate. If patient qualifies for SAT/SBT and CPOT is maintained at 0-2 for 8 hours, decrease rate by 0.025mg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</td>
</tr>
<tr>
<td>Propofol</td>
<td>Midazolam</td>
<td>Dexmetetomidine</td>
<td>Ketamine</td>
</tr>
<tr>
<td><strong>Start propofol drip at 10 mcg/kg/min unless otherwise ordered. Initially, titrate every 10 minutes to goal RASS.</strong></td>
<td><strong>Give 2mg IV push (if ordered) then start midazolam drip at 2mg/hr unless otherwise ordered. Titrate every 10 minutes. Maximum rate of 20mg/hr.</strong></td>
<td><strong>Give midazolam 2mg IV push (if ordered) then start dexmetetomidine drip at 0.4mcg/kg/hr. Titrate every 10 minutes per protocol to goal RASS. Maximum rate of 1.4mcg/kg/hr.</strong></td>
<td><strong>Titrated every 10 minutes per protocol to goal RASS. Max rate of 2.5 mg/kg/hr.</strong></td>
</tr>
<tr>
<td><strong>RASS (+4 to +1): give 2mg midazolam IV bolus x 2 (if ordered); if no response then increase rate by 5 mcg/kg/min. Reassess in 10 minutes.</strong></td>
<td><strong>RASS (+4 to +1): give 2mg IV bolus x 2 (if ordered); if no response then increase drip by 1 mg/hr</strong></td>
<td><strong>RASS (+4 to +1): give 2mg midazolam IV bolus x 2 (if ordered); if no response then increase rate by 0.2mcg/kg/hr. Reassess in 10 minutes.</strong></td>
<td><strong>RASS (+4 to +1): give 2mg midazolam IV bolus x 2 (if ordered); if no response then increase rate by 0.025 mg/kg/hr. Reassess in 10 minutes.</strong></td>
</tr>
<tr>
<td><strong>RASS (0 to -2): Reassess RASS every 2 hours. If patient qualifies for SAT/SBT and RASS is maintained at 0 to -2 for 8 hours, decrease rate by 2.5 mcg/kg/min every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</strong></td>
<td><strong>RASS (0 to -2): Reassess RASS every 2 hours. If patient qualifies for SAT/SBT and RASS is maintained at (0 to -2) for 8 hours, decrease rate by 1mg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</strong></td>
<td><strong>RASS (0 to -2): Reassess RASS every 2 hours. If patient qualifies for SAT/SBT and RASS is maintained at (0 to -2) for 8 hours, decrease rate by 0.2 mcg/kg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</strong></td>
<td><strong>RASS (0 to -2): Reassess RASS every 2 hours. If patient qualifies for SAT/SBT and RASS is maintained at 0 to -2 for 8 hours, decrease rate by 0.025 mg/kg/hr every 4h. If patient does NOT qualify for SAT/SBT, continue current rate.</strong></td>
</tr>
<tr>
<td><strong>RASS (-3 to -5): Decrease rate by 5mcg/kg/min and reassess in 30 minutes and 2h.</strong></td>
<td><strong>RASS (-3 to -5): Decrease rate by 1mg/hr and reassess in 30 minutes.</strong></td>
<td><strong>RASS (-3 to -5): Decrease rate by 0.2 mcg/kg/hr and reassess in 30 minutes and 2h.</strong></td>
<td><strong>RASS (-3 to -5): Decrease rate by 0.025 mg/kg/hr and reassess in 30 minutes and 2h.</strong></td>
</tr>
</tbody>
</table>
Appendix C. Example Point of Use Reminder

**PAIN**
- CPOT is used to assess pain in ventilated patients
- Target pain score should be ordered
- Reassess pain within 1 hour after intervention
- Use buddy analgesia before continuous infusion
- Treating pain often treats agitation

**USUAL GOAL CPOT: 0-2**

**AGITATION**
- Light sedation saves LIVES compared to deep sedation
- Needed to tolerate or BMI
- Uncomfortable position
- Needs, personal items, glasses, hearing aid
- Needs to see family
- Pressure
- Target RASS score should be ordered
- RASS goal must be changed in SCMI if deep sedation required ➔ Should match real-time score
- Use titration tables
- Available on Ganexweb under order sets/protocols
- Treat like vasoressors
- Goal is always lowest dose and to taper off ASAP
- Use bolus sedative before continuous infusion

**GOAL IS LIGHT SEDATION ➔ RASS: -2 TO 0**

**DELIRIUM**
- Defined as acute change in consciousness
- Delirium affects up to 80% of patients
- Associated with increased mortality
- Intensive Care Delirium Screening Checklist (ICDSC) used to assess
- Can only assess if awake (RASS > -3)
- ICDSC ideally completed at shift end (6am & 6pm)

**NON-PHARMACOLIC DELIRIUM TREATMENT**
- Avoid restraints
- Purposeful rounding
  - Reconnection to person, place, time
- Establish trusting relationship
  - Language such as “I will not be far away”
- Provide personal items
- Promote sleep
  - Lights on until 7pm
  - Sunlight during day
- Cluster care
- Early progressive mobility
Appendix D. Email Flyer

Every Intubated Patient, Every time

**Analgesia**
- Prioritize Analgesia
- Assess Pain Every 2 Hours (CPOT)
- Analgesia - first sedation
  - Add Sedation After Analgesia
- Advocate for Analgesia
- Administer PRN as needed (IV or IO)

**Breathing Trials**
- ABDEF flowsheet (screening)
  - sats & aHRs daily
- Begin Weaning Sedatives Before 7a
  - Collaborate with RT
  - Bring up in rounds

**Control Sedation**
- Consider Fentanyl First
- Discontinue Midazolam Drip
- Choose Lightest Tolerable Sedation (0 to -2)
- Confirm mAs goal every shift
- Calculate RASS score every 2 hours ± 30 minutes with titration
- Check MAR for titration table

**January Audits (19)**
- 57% (11/19)
  - No order for pain medication
- 81% (9/11)
  - Demonstrated signs of pain (CPOT >2)
  - 77% (7/9)
    - Of those with CPOT≥2, scored as 0

Goals for Feb.
- 75% of intubated patients have order for analgesia
- <25% scored 0 that demonstrate signs of pain

- Signs of nonverbal pain
  - Facial expression
  - Movements (agitation)
  - Coughing or vent alarms
  - Muscle Tension

Appendix E. REDCap Audit Tool

1. What is RASS goal?
2. Is the goal appropriate?
3. What is RASS score?
4. Can your sedation level be decreased at all?
5. What medications are being used for sedation?
6. How are you treating pain?
7. Is your patient agitated?
8. What is your CPOT score?
9. Have you performed SAT?
10. If not, why not?

11. Have you documented CPOT and RASS every two hours?

12. What is actual RASS score?

13. What is actual CPOT?
Appendix F: Recommendation Letter

July 23, 2021

Dear Institutional Review Board representative:

As an authorized representative of nursing practice at UK HealthCare, I submit this letter of support for Casey Mingua RN, the primary investigator, and his co-investigators, to collaborate with staff to conduct the project titled "Improving Sedation Practices in Mechanically Ventilated Patients in the CVICU". I understand that the purpose of this project is to improve patient outcomes by delivering a targeted intervention to optimize the sedation practices of nurses in the CVICU. I believe that the study can have a meaningful impact on nursing practice and most importantly, patient outcomes.

I understand this study will involve a short (less than 15 minutes) before and after voluntary electronic survey that will be sent to unit nursing staff via email. To support nursing staff involvement, I permit this survey link to be sent via an institutional listserv to all bedside nursing staff in the CVICU at UK HealthCare. I permit the primary investigator to send reminder emails to staff as needed to assist in data collection. I understand the target population is around 75 respondents. In addition to the survey, I agree to arrange a nursing staff meeting via Zoom in which the primary investigator can deliver an educational intervention. Furthermore, I agree to allow the primary investigator to function as a champion on the unit during nonscheduled hours since this will be instrumental in driving practice change. I understand that the primary investigator will be functioning as a champion during the months of December and January 2022. Please let me know if there are further questions.

Thank you for your valuable time!

Sincerely,

Demond E. Jackson
Patient Care Manager/Cardiovascular ICU/UKHC
Pavillon A 8th Tower 200 8.274
(859) 218-4142
dejack3@uky.edu
Appendix G: IRB Approval Letter

Modification Review

Approval End: 9/14/2022
IRB Number: 70422

TO: Casey Munger, BSN
College of Nursing
Phone: 502-384-0335
Email: casey.munger@uky.edu

FROM: Chairperson/Vice Chairperson
Medical Institutional Review Board (IRB)

SUBJECT: Approval of Modification Request
DATE: 3/8/2022

On 3/8/2022, the Medical Institutional Review Board approved your request for modifications in your protocol entitled:

A Multifaceted Approach to Improving Sedation Practices in the CVICU

If your modification request necessitated a change in your approved informed consent form(s), the new IRB approved consent form(s) to be used when enrolling subjects can be found on the approved application's landing page in E-IRB. [Note, subjects can only be enrolled using consent form(s) which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.]

Note that at Continuation Review, you will be asked to submit a brief summary of any modifications approved by the IRB since initial review or the last continuation review, which may impact subject safety or welfare. Please take that approved modification into consideration when preparing your summary.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "IRB Guidance to Investigators: Qualifications, Records and Documentation of Human Subjects Research" available on the online Office of Research Integrity’s IRB Survival Handbook. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI’s web site. If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at 859-257-6128.

Appendix H: NRC Approval Letter

September 08, 2021

Dear Casey Mingus,

Your proposal entitled, “A Multifaceted Approach to Improving Sedation Practices in the CVICU” was reviewed during our September 8th meeting of the Nursing Research Council at the University of Kentucky Medical Center, and we are happy to report that your proposal has been approved. If you have not yet obtained approval for your research through the University of Kentucky Institutional Review Board (IRB), you must complete this process as well.

The Nursing Research Council reviews all proposals to conduct scientific inquiry that involve UK nursing staff in an effort to assess for a number of indicators: to determine the feasibility of conducting the proposed research, to establish the level of support from nursing management or administration to conduct the research, to determine the applicability to nursing, to facilitate IRB review ensuring proper protections are present, and to assess the completeness of the proposal. If your proposal is amended in any way such that the methods or procedures are modified significantly, your proposal must be re-submitted for review by this Council. You are required to provide your IRB approval date, study status and completion date to this council for compliance with Magnet verification requirements.

Please contact me if you need further assistance, have questions, or wish to discuss anything.

Sincerely,

Jonathan High RN, BSN, CCRN, RN-BC
Chair, Nursing Research Council

Dirk A. Church, RN, BSN, CCRN
Co-Chair, Nursing Research Council

Office of the Executive Vice President for Health Affairs
University of Kentucky • 317 Wavertown Building • 100 South Limestone • Lexington, Kentucky 40536-0210
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