2017

Using Mixed Methods to Identify Delirium Bundle Care in the Intensive Care Unit

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A dissertation submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Graduate Studies

2016

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Acknowledgements

I must recognize those who supported me during this journey, starting with my family. First, I would like to acknowledge my parents Dawn and Larry Goers who believed in me and supported me through my journey. Thank you for modeling the importance of a graduate degree and providing me with support to be successful. You were only a phone call away and knew exactly what to say during both the difficult and successful times. I would also like to recognize my father Randy Tindle who believed in me more than I did. Next, I must recognize my amazing partner Alexis Rankey. Thank you for being my greatest supporter and accepting my constant need to explore and gain knowledge.

Aside from my family, the person that contributed the most to my education was Dr. Teresa Kelechi PhD, RN, FAAN. I feel fortunate to have an advisor who was adventurous and open to my topic changing over the previous six years. I would like to thank Dr. Kelechi for encouraging me to explore on my own, and at the same time provide guidance. Her patience and support helped me overcome many crisis situations and finish this dissertation. I hope that one day I would become as good of a mentor to my students as Dr. Kelechi has been to me.

Besides my advisor, I would like to thank my dissertation committee members: Dr. Elaine J. Amella, PhD, RN, FAAN, Dr. Lynne Nemeth PhD, RN, FAAN, Dr. Martina Mueller PhD, MS, RN and Brenda T Pun, RN, MSN for their expertise and encouragement. I am grateful for Dr. Amella's dedication to my research topic and success. I am also thankful for Dr. Nemeth's mentorship and opening my eyes to qualitative research. Likewise, I am thankful for Dr. Mueller's patience and always being available for guidance. Brenda, I am honored you agreed

to be my content expert. I have always been amazed by your knowledge, application and public speaking. Thank you for taking time to provide mentorship and editing recommendations.

I would also like to thank numerous other faculty members in the College of Nursing at Medical University of South Carolina for challenging me throughout the doctoral program.
I also must recognize Hollie Caldwell, Julie Basler and my Platt College family who supported me during this journey. Thank you for taking a risk and always believing in me.

Finally, I need to acknowledge several friends, colleagues and family. First I would like to thank my colleagues, PhD candidates Melinda McCusker and Rebecca Walker. We studied together, supported each other, and grew as scholars. I am grateful for your friendship and encouragement during this journey. Last, I have to acknowledge several friends and family who for always believing in me and cheering me on along the way.
I owe my gratitude to all these people who have made this dissertation possible, thank you.

Abstract

Delirium is a serious complication experienced by patients in the intensive care unit (ICU). Over the past 15 years, researchers have identified risk factors, assessment techniques, pharmacological, and nonpharmacological interventions. Despite the current literature, there is a gap regarding delirium bundle care provided by an interprofessional team. This dissertation, a compendium of three manuscripts, delineates delirium bundle care by the interprofessional team in the ICU. The first manuscript details Rodgers' Evolutionary Concept Analysis to identify attributes, antecedents, consequences, surrogate concepts, and related terms of bundled delirium care in the ICU. The second manuscript utilized the Social Ecological Model to identify factors that prevent or facilitate delirium bundle care in the ICU based on behavioral determinants and environmental factors. The third manuscript details a convergent parallel mixed-method study guided by Consolidated Framework for Implementation Research to explore clinical perceptions, roles, and practices of the surgical ICU interprofessional team regarding delirium bundle implementation. Findings from the first study used Rodgers' Evolutionary View of Concept Analysis to identify attributes, antecedents, and consequences of delirium bundle care. Results from the second manuscript identify the facilitators and barriers based on the Social Ecological Model for implementing the ABCDEF bundle and PAD guidelines for managing delirium in the ICU. The findings from the convergent parallel mixed-method study identified factors associated with domains from the Consolidated Framework for Implementation Research. Results from this study showed that structural and cultural elements of an ICU need to be considered when exploring how the interprofessional team of nurses, physicians, pharmacists, respiratory therapists, and physical therapists implements the ABCDEF

bundle. The findings of the three manuscripts are integrated in the conclusion of this dissertation.

Introduction

Delirium is a complication that is acquired or accelerated in the intensive care unit (ICU). By definition, delirium is an acute fluctuating change in consciousness and cognition (Association, 2013). In the ICU, delirium can occur in 80% of mechanically ventilated patients (Esteban et al., 2004). Delirium is associated with increased time on a mechanical ventilator, longer ICU stays, and cognitive decline (Ely, Gautam, et al., 2001). Based on data assessed in the early 2000s, the total hospital expenditure for a patient who developed delirium in the ICU was $41,836 in comparison to $27,106 for those who never developed delirium during an admission (Milbrandt et al., 2004b). Additionally, 56.2% of patients who were mechanically ventilated and experiencing delirium died after six months of hospitalization; and of the remaining patients, 73.8% were discharged to a nursing home or another acute care hospital due to a new onset of cognitive impairment (Ely, Gautam, et al., 2001; Nelson et al., 2006). Delirium in the ICU is a widespread problem, making patients more likely to experience complications that may result in disability and even death (Maldonado, 2008).

In 1999, multicomponent interventions were established to prevent and reduce delirium (Inouye et al., 1999). This was the first attempt at a multicomponent intervention of bundle delirium care. Risk factors associated with delirium were identified to help guide implementation research that would prevent, detect, and manage risk factors of delirium. Pre-existing risk factors were identified as previous medical illnesses, organ failure, chronic stress, and cognitive changes (Marmot, Wilkinson, & Oxford University Press, 2006). Additional,

predisposing risk factors of delirium were established as age greater than 65, hypertension, dementia, transfer from nursing home, alcohol and drug abuse, smoking, visual impairment, hearing loss, history of stroke, epilepsy, congestive heart failure, history of depression, and injury severity score (Arend & Christensen, 2009).

The precipitating factors in response to hospitalization were identified as infections, sepsis, metabolic abnormalities, electrolyte imbalances, dehydration, use of intravenous lines, bladder catheters, physical restraints, pharmacological agents, and trauma (Arend & Christensen, 2009). Additionally, pharmacological agents such as anticholinergic and sedative agents were considered to have an exacerbating effect on the development of delirium (Robinson et al., 2008). In addition to risk factors, mechanical ventilation was identified as an independent predicator of delirium and poor patient outcomes in the ICU (Ely et al., 2004).

Further research was conducted to identify evidence based-practices to decrease the amount of time a patient is mechanically ventilated. Intervention such as daily spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT) were recommended to decrease the duration of mechanical ventilation for patients in the ICU (Girard et al., 2008). Patients who are mechanically ventilated are unable to verbally respond to delirium assessment tools. Therefore, the confusion assessment method for the intensive care unit (CAM-ICU) was established to assess delirium (Ely, Inouye, et al., 2001). In 2010, Vasilevskis recommended awakening the patient daily (SAT), breathing or daily interruptions of mechanical ventilation (SBT), coordination of daily awaking and daily breathing, delirium monitoring, and early mobility (ABCDEF) bundle to prevent and manage delirium in the ICU (Vasilevskis et al., 2010). In 2013, a panel of interprofessional experts developed a three-component interdisciplinary

approach to delirium care in the ICU (Barr et al., 2013). The pain and analgesia, agitation, and delirium (PAD) guidelines were established as an evidence-based recommendation to guide the treatment and involved all the elements of the bundle. The ABCDEF bundle through successive clinical trials was revised, and interventions were added. The revised ABCDEF bundle now includes the following components: assess, prevent and manage pain; both spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium assessment prevention and management; early mobility and exercise; and family communication and involvement (Frimpong, Stollings, Carlo, & Ely, 2014). In general, the ABCDEF bundle and PAD guidelines have been used among interprofessional teams to address modifiable risk factors associated with delirium and to improve outcomes for their patients.(Brummel & Girard, 2013).

Delirium prevention and management in the ICU continues to be a significant challenge for the interprofessional team. Despite recent research on the topic of delirium in the ICU, its occurrence remains a problem. Several factors have been identified**,** including adherence to delirium evidence-based practices (Brummel et al., 2014). The first gap is the misunderstanding of how to prevent and manage delirium in the ICU with bundle care. Nurses have stated that assessing delirium is not considered the most important condition to evaluate in the ICU, as compared to assessing level of consciousness, neurological status, pain and sedation (Balas et al., 2012). A survey of 250 critical care pharmacists showed that less that 7% of participants use a delirium-screening tool, and 24% reported that delirium screening is believed to be a nursing role (Balas et al., 2012). Secondly, facilitators and barriers to implementing bundled care exist.

Therefore, ICUs should explore their own epidemiology, patient mix, and cultural elements to identify what is know about delirium bundle care and what is actually done (Balas et al., 2013).

Theoretical Framework

The following theoretical frameworks guided this dissertation: Rodgers' Evolutionary Concept Analysis, Bandura's Social-Ecological Method, and the Consolidated Framework for Implementation Research. The Evolutionary View of Concept Analysis is an inductive approach to identifying attributes and characteristics common to phenomena (Rodgers, 2000). The process of concept development using Rodgers' Evolutionary View is cyclic and composed of three phases: (a) significance, (b) use, and (c) application (Petri, 2010a). The Evolutionary View of Concept Analysis explored the critical attributes of interdisciplinary collaboration by identifying attributes, antecedents, and consequences of the concept (Petri, 2010a). Results form this concept analysis identified interprofessional education, role awareness, interpersonal relationship skills, deliberate action, and support as successful factors of interdisciplinary collaboration (Petri, 2010a). Rodgers' Evolutionary View and results from this study assisted with conceptualizing bundle care in the ICU. Next, the Social Ecological Model (SEM) was used to explore factors that facilitate or prevent implementing delirium care. Social ecological perspective is inherently interdisciplinary in its approach to organize and evaluate relationships among biological, behavioral, and environmental features that relate to health promotion (Stokols, 1996). The Social-Ecological Model (SEM) is rooted in core principles or themes concerning the interrelations among human behavior and the environment (Stokols, 1996). Lastly, this study used the Consolidated Framework for Implementation Research (CFIR).

In accordance with the guidance of the Agency for Healthcare Research and Quality (AHRQ), the CFIR framework was identified as a type of implementation research that focuses on the promoters and barriers of implementing a program as well as organizing constructs across theories into five domains (Damschroder & Lowery, 2013). For example, Balas (2013) applied the CFIR domains to explore factors that facilitated the ABCDEF bundle implementation by the interprofessional team in the surgical ICU. The manuscript chapters detail how the Rodgers' Evolutionary Concept Analysis, the Social Ecological Method, and the Consolidated Framework for Implementation Research were used to identify bundle care, factors that hinder or facilitate implementing delirium care, and interprofessional team perspectives and practices in a surgical ICU that use delirium bundle care.

This dissertation consists of three manuscripts: a concept analysis, an integrative review, and a mixed-methods study. The first manuscript details Rodgers' Evolutionary Concept Analysis to identify attributes, antecedents, consequences, surrogate concepts, and related terms of bundled delirium care in the ICU. The second manuscript describes the use of the Social Ecological Model to identify factors that prevent or facilitate the implementation of the ABCDEF bundle and PAD guidelines. The third manuscript details a Convergent Parallel Mixed Method design guided by Consolidated Framework for Implementation Research to explore clinical perceptions, roles, and practices of the surgical ICU interprofessional team regarding delirium bundle implementation.

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Manuscript 1

Concept Analysis of Bundled Delirium Care in the Intensive Care Unit

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Abstract

BACKGROUND: Delirium in the Intensive Care Unit (ICU) is a serious complication associated with several life-threatening outcomes to patients. Therefore, it is important to minimize, prevent, and treat delirium in the ICU. A main evidence-based intervention for delirium is bundled care.

METHODS: A literature search was undertaken to explore the context of bundled delirium care using Rodgers' Evolutionary Concept Analysis. The following keywords guided the literature search: *delirium, intensive care unit, ABCDEF bundle,* and *interprofessional care*. The initial search generated 21 articles from Pubmed/Ovid/Medline, 5 from CINAHL, and 15 from Google Scholar. Twenty-nine articles relevant to the study were reviewed.

RESULTS: Literature reviewed identified attributes, antecedents, and consequences of delirium bundle care in the ICU.

CONCLUSION: The delirium bundle care was identified as the spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium assessment prevention and management; early mobility and exercise; and family communication and involvement or the ABCDEF bundle. In addition, the analgesia, agitation, and delirium (PAD) guidelines were identified as a delirium bundle in the ICU. Both bundles are multicomponent ICU management strategies targeted to improve ICU patient outcomes.

RELEVANCE TO CLINICAL PRACTICE: The conceptual model of delirium bundle care continues to progress with new evidence-base practices. Identifying the attributes, antecedents, and consequences of delirium bundle care in the ICU is a starting point to further explore implementing delirium bundle care in the ICU.

Introduction

Delirium is referred to as an acute fluctuating course of consciousness, cognition, and inattention in the *American Psychiatric Association DSM-V* (Association 2013). Classified as a general medical condition, delirium is defined as a disturbance of consciousness with a reduced ability to focus, sustain, or shift attention (Association 2013). Delirium is also referred to as a change in cognition that manifests as memory deficits or disorientation (Association 2013).

Despite prior studies, delirium in the ICU is under-recognized; thus, patients with delirium are likely to experience complications resulting in disability and possibly death (Maldonado 2008). Nelson et al. (2006) found that 56.2% of ICU patients who were mechanically ventilated and who experienced delirium died within six months of their hospitalization; of the remaining 43.8%, 73.8% were discharged to a nursing home or another acute-care hospital due to a new onset of cognitive impairment (Nelson et al. 2006). Higher frequency of delirium and longer stays in the ICU correspond to a lower likelihood of the patient's recovery and survival (Cavallazzi 2012).

Targeted approaches, such as bundled interventions, have been developed to provide a structured process guided by three or more evidence-based practice sets that have been confirmed to improve patient outcomes. The Institute for Healthcare Improvement defined *bundle care* as a set of evidence-based practices that improve patient outcomes when performed collectively (Resar et al. 2005). Bundles in the ICU exist for various issues including a central line bundle, ventilator bundle, and sepsis bundle, which all aimed to prevention infections. Bundle interventions have been identified to prevent and manage delirium in the ICU (Balas et al. 2013). New evidence has changed the targeted delirium bundle strategies over

time. The aim of this review is to apply Rodger's Evolutionary View of Concept Analysis to identify attributes, antecedents, consequences, surrogate concepts, and related terms of bundled delirium care in the ICU.

Theoretical framework

Rodgers' Evolutionary View of Concept Analysis is an inductive approach to identify attributes and characteristics common to phenomena (Rodgers 2000). The cyclic process of concept development using Rodgers' Evolutionary View consists of three phases: (a) significance, (b) use, and (c) application (Petri 2010b). As described by Rodgers (2000), the evolutionary method to collect data, analyze, and interpret the concept includes the following stages:

1. Identify the concept of interest and associated expression including surrogate terms
2. Identify and select an appropriate realm (setting and sample) for data collection
3. Collect data relevant to identify:
    a. The attributes of the concept
    b. The contextual basis of the concept
4. Analyze the data regarding the above characteristics of the concept
5. Identify an exemplar of the concept
6. Identify implications and hypotheses for further development of the concept (p. 85).

Rodgers' Evolutionary View of Concept Analysis is considered a valid systematic approach for analyzing and clarifying a healthcare concept (Tofthagen & Fagerstrom 2010). For example when Rodgers' Evolutionary View was used to identify the complexities of mealtime difficulties for geriatric patients with dementia (Aselage & Amella 2010). In the current analysis,

Rodgers' Evolutionary View was selected to conceptualize bundle care in the ICU due to the multiple overlapping and interrelated delirium interventions that evolve with greater use across ICU settings. Results from this review will characterize bundle care in the ICU and establish a direction for further development of the concepts used to explain the bundle (Tofthagen & Fagerstrom 2010).

Methods

Literature Search Strategy

In collaboration with a research librarian, a comprehensive literature search was conducted to identify publications that have evaluated bundled delirium care in the intensive care unit. Several article and literature searches were performed in the following databases to locate the most relevant articles published between 2005 and 2015: Pubmed/Ovid/Medline, and CINAHL. Also, Google Scholar was searched. The following terms were used alone and in combination to guide the literature search: *delirium, intensive care unit, ABCDEF bundle***,** and *interprofessional care*. The initial search produced the following article count: 21 for Pubmed/Ovid/Medline, 5 for CINAHL, and 15 from Google Scholar. Abstracts were assessed for duplicate titles and exclusion criteria.

Publications that met the following inclusion criteria were chosen : (a) provided a definition of delirium, (c) the setting was in an ICU, and (c) utilized a bundle approach. The exclusion criteria were (a) articles about a long-term nursing home, a palliative care setting or medical surgical floor in the acute care setting; (b) literature reviews; (c) editorial; (d) non-English publications; or (e) articles lacking description or definition of delirium and bundled care. Twenty-nine publications met the inclusion criteria.

Results

Identifying Bundle Care

Initially, bundle care was explored in the elderly population due to their high prevalence of ICU delirium. Research suggested using a multicomponent-targeted approach to prevent and manage delirium in the elderly population (Inouye et al. 1999). As the concept of delirium in the ICU developed, interventions for prevention and management of delirium in the ICU progressed. Mechanical ventilation was identified as an independent predicator of delirium and poor patient outcomes in the ICU (Ely et al. 2004). Further research was conducted to identify evidence-based practice to decrease the amount of time a patient is mechanically ventilated. Intervention such as daily spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT) were recommended to decrease the duration of mechanical ventilation for patients in the ICU (Girard et al. 2008). In addition, psychometric properties of the confusion assessment method for the intensive care unit (CAM-ICU) were established as an assessment tool to identify delirium in mechanically ventilated patients (Ely et al. 2001).

To prevent and manage delirium in the ICU, the following bundle care was initially recommended: awaken the patient daily (SAT), breathing or daily interruptions of mechanical ventilation (SBT), coordinate daily awakening and daily breathing, monitor delirium, and early mobility (ABCDEF) (Vasilevskis et al. 2010). In 2013, a panel of multidisciplinary experts reviewed, evaluated, and summarized the literature to develop an interdisciplinary approach to delirium care in the ICU (Barr et al. 2013). The pain and analgesia, agitation, and delirium (PAD) guidelines were established as evidence-based recommendations to guide the treatment and

involve all the elements of the ABCDEF bundle. When the PAD guidelines were developed, the ABCDEF bundle progressed and interventions were added. The revised ABCDEF bundle included the following steps: assess, prevent, and manage pain; both spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium assessment, prevention, and management; early mobility and exercise; and family and patient communications about ABCDEF bundle care (Frimpong et al. 2014). The ABCDEF bundle is a multicomponent ICU management strategy targeted to improve ICU patient outcomes. PAD guidelines are recommendations to support the elements of the ABCDEF bundle.

Contextual Basis of Bundled Care

The contextual basis of a concept consists of cultural or social groups that are related to the concept's development and use (Tofthagen & Fagerstrom 2010). In the current analysis, the ICU setting and delirium prevention and management interventions are the context for bundled care. Many ICUs are designed to facilitate patient comfort, patient safety, patient privacy, and staff working conditions based on evidence (Shaughnessy 2013). For example, to prevent and manage delirium in the ICU, pharmacologic and non-pharmacologic interprofessional management strategies have been developed using data derived from clinical trials (Guenther et al. 2010).

Attributes

The ABCEDF bundle and PAD guidelines have same contexts based on available evidence. The ABCDEF bundle covers the entire recovery process from awakening from sedation to the initial phases of mobility (Brummel et al. 2013). For example, the ABCDEF bundle has been used by clinicians on interprofessional teams to address modifiable risk factors

associated with delirium and to improve patient outcomes (Brummel et al. 2013). A set of evidence-based interventions to prevent and manage delirium, the PAD guidelines are flexible and adaptable to the culture and formulary of each ICU (Barr & Pandharipande 2013). PAD guidelines have also been identified as a bundle that is more abbreviated and specific than the ABCDEF bundle (Balas et al. 2013). Both the ABCDEF bundle and PAD guidelines are exemplars of bundle care that overlap and are used to prevent and manage delirium in the ICU. The existence of two bundles suggests that the concepts for ICU bundle care are evolving as more evidence accumulates from ICU delirium studies.

Assess, prevent, and manage pain. This attribute is the first aspect of the ABCDEF bundle and overlaps with PAD guidelines. The interprofessional team is faced with challenges to adequately control pain by not giving ICU patients too much or not enough pain medication. PAD guidelines recommend routine pain assessments with a reliable assessment tool such as the Behavioral Pain Scare or the Care Pain Observation tool for critical ill patients that cannot self-report pain (Barr & Pandharipande 2013). Additional PAD recommendations include incorporating the PAD assessment into daily rounds, addressing pain management as an ICU team, optimizing pain management first using sedation medications if necessary (Barr & Pandharipande 2013).

Spontaneous awakening and spontaneous breathing trials. A second aspect of the ABCDEF bundle refers to having daily trial of spontaneous awakening coordinated with daily trials for spontaneous breathing. These practices have been found to be an important and effective measure in the ABCDEF bundle to decrease the possibility of overall acute brain dysfunction of patients in the ICU, with 14% reduction in mortality rates (Collinsworth 2014,

Olsen 2012). Likewise, ICU patients who are exposed to this measure or strategy for care are usually extubated within an average of three days earlier than expected; thus, making them more likely to be transferred to a regular room from the ICU sooner than other patients who are managed without the ACBDE bundle (Olsen 2012).

Choice of sedative agent. A third attribute overlaps the ABCDEF bundle and PAD guidelines. The choice of sedative agent is an important attribute of the ABCDEF bundle, not just for delirium in the ICU, but also for the duration of mechanical ventilation and other outcomes (Collinsworth 2014, Olsen 2012). Research has shown that the correct sedative choice is associated with decrease in delirium. The PAD guidelines suggest using a sedation goal directed delivery to maintain a lighter level of sedation measured by the Richmond Agitation-Sedation Scale or Sedation Agitation Scale (Barr et al. 2013).

Delirium monitoring and management. The fourth attribute also overlaps the ABCDEF bundle and PAD guidelines is delirium monitoring and management. Due to the fluctuating presentation, delirium is difficult to assess. The interprofessional team should routinely assess patients for the presence of delirium using a delirium-screening tool designed for use in the ICU (Spronk 2009). PAD guidelines recommend using the CAM-ICU as an assessment tool (Barr et al. 2013). In addition, nonpharmacologic interventions such as cognitively stimulating activities, providing hearing aids and glasses, decreasing noise, decreasing stimulation, and a sleep protocol are recommended to prevent and manage delirium (Barr et al. 2013).

Early mobility and exercise. Another important aspect of the ABCDEF bundle is early mobility and exercise, which has proven beneficial to minimizing occurrences or experiences of delirium (Olsen 2012). In one salient study, early mobility was associated with numerous

beneficial effects on cognition in a majority of patients who were discharged from the ICU two days earlier than usual (Morris 2011). The effects of this intervention were long lasting; patients who were treated by the early mobility team while in the ICU were less likely to be readmitted to the hospital or die in the year following their index hospitalization (Morris 2011). Moreover, these patients exposed to early mobility interventions were discharged from the hospital seven days earlier than the usual patient (Morris 2011, Olsen 2012).

Family communication and involvement. The last attribute of the ABCEDF bundle is family engagement. The intention of this attribute is to engage the family by allowing them to participate in patient care decision-making. Family can contribute to caring for the patient by communicating the patient's preferences to interprofessional team, holding the interprofessional team accountable, and providing a familiar voice for the patient (Frimpong et al. 2014).

Antecedents of Bundle Care

Antecedents are characteristics that precede or have been associated in the past with the concept (Rodgers et al. 1993). Patient outcomes and interprofessional collaborative practice refer to important aspects of what happened previously in relationship to delirium bundle care in the ICU.

Patient outcomes. Patient outcomes have been used as a benchmark to measure the effectiveness of an intervention. Outcomes assessed for bundle delirium care are mechanical ventilator days, incidents of delirium, length of say in the ICU, and cognitive impairment. For over 15 years, mechanical ventilation has been a benchmark to evaluate the effectiveness of both spontaneous awakening and spontaneous breathing trials (Balas et al. 2014, Girard et al.

2008, Kress et al. 2000). In addition, the frequency of delirium is an outcome of bundled delirium care (Patel et al. 2014). The length of stay in the ICU has been used as a benchmark when assessing the effectiveness of bundle care in the ICU. A decreased length of stay was found when the ABCDEF bundle was implemented in the ICU (Kram et al. 2015, Mansouri et al. 2013). Last, delirium has been associated with cognitive impairment. Therefore, maintaining the patient's cognitive ability and preventing cognitive decline have become priority assessments when implementing the ABCDEF bundle (Mansouri et al. 2013, Nelson et al. 2006).

Interprofessional collaborative practice. *Interprofessionality* is defined as a process which professionals reflect, develop, and provide care for patients and family through continuous interaction and knowledge sharing (Interprofessional Educational Collaborative Expert Panel 2011). Interprofessional collaboration is essential when implementing bundle care in the ICU. The multicomponent interventions of the ABCDEF bundle and PAD guidelines require collaboration from the front-line ICU nurses, physicians, medical students, pharmacists, respiratory therapists, physical and occupational therapists (Balas et al. 2014). The PAD guidelines are flexible as they provide recommendations opposed to an one-size-fits-all approach allowing the PAD guidelines to fit to the ICU culture (Barr & Pandharipande 2013).

Consequences

Consequences of the bundled-care concept refers to the implication of implementing or promoting the concept (Rodgers 2000, Tofthagen & Fagerstrom 2010).

Facilitator and barriers of bundle care. Factors based on belief and perceptions of healthcare professionals contributed to the successful implementation of delirium recommendation were identified. Healthcare providers believe the ABCDEF bundle improves

patient outcomes (Yang 2014). Once the ABCDEF bundle was implemented, interprofessional teams reported the bundle was straightforward; interventions where obtainable, and they had a higher level of comfort using the delirium recommendations (Balas et al. 2013).

The beliefs and perceptions from healthcare providers identified barriers to implementing the ABCDEF bundle. Healthcare providers feel they have a strong influence on their patient outcomes. More specifically, healthcare providers reported a fear of harming patients by following the recommendations of the ABCDEF bundle (Balas et al. 2013). Nurses have perceived that following the sedation recommendation of the ABCDEF bundle was causing harm to patients that could cause an increased pain, agitation, and psychological instability (Pun et al. 2005). Members from the interprofessional team also reported that they did not have confidence in performing components of the ABCDEF bundle and did not receive feedback about their performance (Pun et al. 2005). Time, the provider workload, and communication were described as challenges of implementing the ABCDEF bundle (Al-Qadheeb et al. 2013, Balas et al. 2012). Lastly, documentation of delirium assessment was identified as a barrier. Nurses were concerned that electronic documentation would not be visible to all ICU team members, and the Electronic Medical Record could be abandoned shortly after implementation resulting in time wasted (Balas et al. 2013).

Implications and Further Research and Development

Rodgers' Evolutionary View of Concept Analysis identified attributes, antecedents, and consequences based on the literature identified though this concept analysis. Prevention and management of delirium in the ICU has progressed over the past 16 years. In 1999, multicomponent interventions were found to prevent and reduce delirium (Inouye et al. 1999).

The multicomponent interventions of bundle delirium care have evolved due to new evidence-based practices from researched interventions. Delirium bundle care has been identified as assessing, preventing, and managing pain; both spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium assessment prevention and management; early mobility and exercise; and family communication and involvement or ABCDEF bundle and pain and analgesia; agitation; and delirium (PAD) guidelines (Barr et al. 2013, Frimpong et al. 2014). The ABCDEF bundle and PAD guidelines are an example of the evolving change of delirium bundle care in the ICU.

Establishing antecedents, attributes, and consequences of bundled care in the ICU is a starting point for further research per Rodgers' Evolutionary View (Rodgers et al. 1993). Evidenced-based practices, guidelines, and a shared investment in promoting patient outcomes have been identified in this literature review. However, delirium bundle care interventions are not routinely used in the ICU (Balas et al. 2014). Further research needs to emphasize the importance of interprofessional collaboration when implementing a delirium bundle care to promote and improve patient outcomes in the ICU.

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Manuscript 2

Social Ecological Approach to Identifying Factors that Influence the Implementation of the ABCDEF Bundle and PAD Guidelines to Manage Delirium in the Intensive Care Unit

Submit to *Critical Care Nurse*

Abstract

BACKGROUND: Delirium prevention and management in the Intensive Care Unit remains a significant patient care challenge for the interprofessional team. Targeted approaches, such as bundled interventions, have been developed to manage delirium, specifically, the ABCDEF bundle, which is comprised of six factors or stages. In 2013, the American College of Critical Care Medicine released the pain, agitation, and delirium (PAD) guidelines to improve ICU patient outcomes. However, questions regarding the best method for implementing delirium strategies in the ICU remain unanswered.

OBJECTIVES: To utilize the Social Ecological Model (SEM) when identifying factors that prevent or facilitate the implementation of delirium bundle care through the ABCDEF bundle and PAD guidelines.

METHOD: An integrative review was conducted to assess factors that prevent or facilitate the implementation of the ABCDEF bundle and PAD guidelines. Twenty publications met the inclusion criteria and were analyzed using NVivo10.

RESULTS: Factors that facilitate and hinder the implementation of the ABCDEF bundle and PAD guidelines were identified. Limited research has been done to identify the physical environment factors that support or challenge the interprofessional team's ability to implement the ABCDEF bundle and PAD guidelines.

CONCLUSION: Delirium recommendations are based on the best evidence available and support organizational, structural, and community characteristics of the ICU when implementing delirium recommendations. Barriers preventing the use of the ABCDEF bundle and PAD guidelines must be addressed using the interprofessional team to provide optimal care in the ICU. Facilitating factors will guide future use of the ABCDEF bundle and PAD guidelines.

Introduction

Delirium in the intensive care unit (ICU) is a serious complication associated with poor patient outcomes, notably increased hospitalization, long-term disability, and morbidity. Delirium that develops in the ICU may lead to, and accelerate cognitive impairments such as dementia in individuals who go on to receive long-term care.[1] Delirium is characterized as an acute fluctuating course of consciousness, cognition, and inattention in the *American Psychiatric Association DSM-V*.[2,3] Classified as a general medical condition, delirium is defined as a disturbance of consciousness with reduced ability to focus, sustain, or shift attention, as well as a change in cognition such as memory deficits or disorientation.[3] In the ICU, delirium can occur in 70% to 80% of mechanically ventilated patients.[4,5,6] The longer patients stay in the ICU while experiencing delirium, the less likely they are to survive their situation.[5] In one study, 56.2% of patients who were mechanically ventilated and experiencing delirium died after six months of hospitalization.[6] Out of the remaining 43.8%, 73.8% were discharged to a nursing home or another acute-care hospital due to a new onset of cognitive impairment.[6]

Management of Delirium in the Intensive Care Unit

To manage delirium in the ICU, pharmacologic and non-pharmacologic interprofessional management strategies have been developed using data derived from clinical trials. [2] The ABCDEF bundle adopted these strategies for everyday clinical practice.[7,8] Assessing, preventing, and managing pain; both spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium assessment prevention and management; early mobility and exercise; and family engagement and involvement or ABCDEF were used to construct the ABCDEF bundle. This bundle is recommended to prevent and manage delirium in

the ICU by the American Association of Critical Care Nurses and the Society of Critical Care Medicine.[9] Additional recommendations were added in 2013 to integrate the pain, agitation, and delirium (PAD) guidelines in order to prevent, assess, and treat delirium using an interdisciplinary team approach.[10] Despite recent research on the topic of delirium in the ICU, it remains a problem. Several factors have been identified**,** including adherence to delirium guidelines.[1,5]

The ABCDEF bundle elements and the recommendations of the PAD guidelines are associated with improved patient outcomes.[7.8,15] The ABCDEF bundle has been shown to reduce time on the ventilator; moreover, patients experience less delirium and spend more time out of bed compared to patients not treated with the bundle.[16] In a pre-implementation and post-implementation ABCDEF-bundle study, researchers found no significant differences in unplanned extubations, reintubation rates, and the time spent in physical restraints.[7] In addition, the ABCDEF bundle was found to be an important independent predictor of reduced delirium rates and increased the likelihood of mobilizing patients to move out of bed.[7] Alternately, the lack of adherence to delirium guidelines could have a negative effect on patient status and outcomes.[7,8,15]

The purpose of this review is to synthesize evidence of factors that prevent or facilitate the implementation of delirium bundle care through the ABCDEF bundle and PAD guidelines using the Social-Ecological Model (SEM). A systematic understanding of facilitators and barriers of an interprofessional approach for promoting delirium interventions at the individual, interpersonal, environmental, and community level of SEM will guide future use of the ABCDEF bundle and PAD guidelines in the care of critical patients in the ICU.

Framework

Social-Ecological Model

Theories of social ecology emerged between 1960 and1970 to understand the relationships between diverse personal and environmental factors.[17] The social-ecological perspective is inherently interdisciplinary in its approach for organization and evaluation of relationships.[17] This is specifically true among biological, behavioral, and environmental features that relate to health promotion.[17] Moreover, the SEM is rooted in core principles or themes concerning the interrelations among human behavior and the environment.[17] To identify an interprofessional approach for promoting health interventions in the current study, the following concepts of the SEM were explored: behavioral determinants (individual and interpersonal)**,** environmental factors, and community factors.

In this review, four concepts of the SEM were represented in a level or sphere. At the same time, these concepts were identified as individual, interpersonal, environmental, or communal. The center of the SEM represents individual characteristics that influence behavior such as knowledge, attitudes, beliefs, and personal traits.[18,19,20] Moving outward, the next level of the SEM includes the interpersonal characteristics associated with interpersonal processes that identify role definition.[18,19] The third level of the SEM addresses concepts of the physical environment.[17,18,19] The outermost level of the SEM signifies concepts associated with the community.[17,18,19]

The SEM has been used in previous studies to evaluate existing programs for preventing, managing, or treating unwanted implications of different medical and health issues.[19,20,21] Previous literature has proposed the use of SEM in examining barriers related specifically to enrollment in clinical trials. [20,22] Among the medical and health issues that were evaluated and improved using SEM as a guide are: (a) managing obesity,[19] (b) promoting prevention of eating disorders,[23] (c) improving participation of minority groups in clinical health trials and other health problems among minority groups,[20] (d) exploring factors related to HIV disclosure,[21] and (e) addressing smoking addiction.[20,23]

Researchers have shown how the identification and categorization of factors related to the different health issues according to levels of the SEM have been helpful in identifying effective means of addressing these issues based on the levels where they belong.[19,20] In this review, the SEM provides a theoretical framework to organize and identify facilitators and barriers of the ABCDEF bundle and PAD guidelines in the ICU. The SEM core concepts guide the interpretation of results. The interpretation is focused on the behavior, knowledge, and perceptions of professionals on the interprofessional ICU team. Also included in the interpretation is the physical environment of the ICU and policies developed by the hospital administrators and clinicians to manage critical patient care.

The findings from this integrative review will aid with understanding how to best implement the ABCDEF bundle and PAD guidelines in the ICU. Hence, through this study, the use of the SEM will advance and extend existing literature. This will be done by exploring the facilitators and barriers for implementing the ABCDEF Bundle and PAD Guidelines for managing delirium in the ICU. The identification of the different factors based on the levels in the SEM

may be useful in identifying means of implementing or modifying programs related to prevention or management of the delirium in the ICU.

The Review

Design

An integrative review was chosen to identify studies that have assessed factors that prevent or facilitate the implementation of the ABCDEF bundle and PAD guidelines. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) was used to establish a basis for organizing literature from this integrative review (Figure1).[24]

Methods

Using Pubmed/Ovid/Medline and CINAHL, articles published between 2005 and 2015 were searched. The following MeSH terms guided the search: *delirium* and *intensive care unit and ABCDEF bundle; delirium* and *intensive care unit and PAD; delirium* and *intensive care unit* and *bundle; interprofessional* and *delirium guidelines*. Publications that did not meet the following inclusion criteria were eliminated from the overall literature search: (a) focused on a setting described as an adult intensive care unit, (b) provided a definition of delirium, (c) was a clinical trial, and (d) utilized the ABCDEF bundle and/or PAD guidelines. The exclusion criteria were: (a) age group younger than eighteen, (b) long-term or nursing home settings, (c) palliative care setting, (d) medical surgical floor in the acute-care setting, (e) other psychiatric or cognitive diagnosis, (f) education recommendations lacking a research method, (g) literature

reviews, (h) case studies, (i) editorials, (j) non-English publications, (k) lacking description or definition of delirium, and (l) the ABCDEF bundle and/or PAD guidelines.

Search Outcome

The initial search yielded 118 articles produced the following article count: 63 from Pubmed/Ovid/Medline and 55 from CINAHL. Abstracts were assessed for duplicate titles and exclusion criteria. One hundred articles did not meet the inclusion criteria and were removed. Eighteen articles were re-assessed for relevance. Of the 18 articles assessed, 10 articles were excluded for not including factors that facilitate or prevent implementation of the ABCDEF bundle and PAD guidelines. Nine publications met the inclusion criteria, organized in NVivo10 and assessed with the CASP.

Data Abstraction

An electronic version of each publication was entered into NVivo10 for organization of literature by author, date of publication, and title of the publication. Articles were assessed for themes and assigned in a systematic manner, based on concepts from the SEM framework.

Appraisal and Synthesis

The Critical Appraisal Skills Programme (CASP) was used to appraise selected literature that met inclusion criteria. CASP provides a tool to appraise the trustworthiness, relevance, and results of published articles based on three principles: study validity, study results, and applicability of study results to clinical needs.[25,26] The CASP Cohort Study Checklist has 12 questions that facilitated the systematic review of literature. It is a program that promotes a systematic process, which allows for the identification of the strengths and weaknesses of a

research study.[26] Adherence to this process allows for the enhancement of the usefulness of a study and its findings.[26]

Results

Of the studies examined, six were cohort studies and two were surveys. The factors from the literature review are categorized and discussed according to the four different levels of the SEM: individual, interpersonal, physical environment, and community.

Individual Level

The center of the SEM represents behavior, knowledge, perceptions and beliefs as individual concepts.[19] Factors based on belief and perceptions from the individual level of the SEM that contributed to successful implementation of delirium recommendation were identified in the literature. Four studies assessed factors that prevent or facilitate the implementation of the ABCDEF bundle and PAD guidelines from the individual level of the SEM. Balas (2013) explored perceptions of delirium by identifying facilitators and barriers in five adult ICUs, one step-down unit, and one specialized unit in an academic hospital. Healthcare providers believe the ABCDEF bundle improves patient outcomes.[15] In addition, healthcare providers believed that they have a strong influence on their patient outcomes. More specifically, healthcare providers reported a fear of harming patients by following the recommendations of the ABCDEF bundle.[15] Inconsistent medical practice, reluctance to follow protocols, workload, electronic health record, and communication were identified as barriers to implementing the ABCDEF bundle and PAD guidelines.[15] The study participants from the

interprofessional team were identified as full- and part-time registered nurses, respiratory therapists, pharmacists, physical therapists, nurse practitioners, physician assistances, academic and/or surgical intensivists. However, the majority of the study participants were registered nurses who participated in the focused groups (67%), online education (62%) and surveys (59%).[15]

Pun (2005) found that nurses felt it was unethical to decrease sedation in the ICU.[27] Nurses perceived that following the sedation recommendation of the ABCDEF bundle was causing harm to patients by causing increased pain, agitation, and psychological instability.[27] They also reported that they did not have confidence in performing components of the ABCDEF bundle and did not receive feedback about their performance.[27]

Devlin (2011) surveyed 250 critical care pharmacists and found that delirium status is discussed on patient rounds 50% of the time. [14] However, delirium screen tools are not used by pharmacists, pharmacist reported a lack of time, and beliefs that screening for delirium is a role for nurses. [14] Lastly, time, the provider workload, and communication were described as challenges to implementing delirium care.[14,28] Documentation of delirium assessment was identified as a barrier. Nurses were concerned that electronic documentation would not be visible to all ICU team members and the Electronic Medical Record could be abandoned shortly after implementation resulting in time wasted.[15]

Two of the studies found that once the ABCDEF bundle was implemented, healthcare providers reported that the bundle was straightforward, the team was able to reach a treatment goal, and the team had a higher level of comfort using the delirium recommendations.[15,27] At the individual level of the SEM**,** facilitators and barriers of the ABCDEF

bundle and PAD guidelines in the ICU are reported in Table 1. Understanding and addressing factors at the center of the SEM can aid with addressing further complexities of implementing delirium management strategies in the ICU.

Interpersonal Level

Moving from the center of the SEM to the next sphere involves the concept of role definition. At this level, the SEM identifies the healthcare providers that form the interprofessional team-assigned disciplinary tasks within the ABCDEF bundle. The interprofessional team is typically comprised of the front-line ICU nurses, physicians, medical students, pharmacists, respiratory therapists, physical**,** and occupational therapists.[15] Additional members of the interprofessional team in the ICU were described as unit managers, advanced practice nurses, nurse or physician champions.[29]

Carrothers (2013) found enhanced communication tool through the use of multidisciplinary rounds and rounding check sheets facilitated implementing the ABCDEF bundle.[29] In addition, a nurse or physician champion has been shown to be effective as a resource to facilitate patient rounds, co-lead in educational topics**,** and support communication within the interprofessional team.[30]

The barriers that individuals identified from the interprofessional team were related to how the team functions and the resources available to implement delirium recommendations. Carrothers (2013) found that implementing the ABCDEF bundle was difficult because of limited or inconsistent interprofessional rounds and the lack of communication.[29] The knowledge deficit among the team also presented challenges.[30] Devlin (2008) found that traditional classroom instruction in the hospital had minimal effect on individual behavior and clinical

practice.[13] Balas (2014) reported that nurse managers and educators developed case studies and quizzes related to the ABCDEF bundle to modify group and individual education.[7] In addition, staff reported there was a lack of feedback and no meaningful follow-up to assess how knowledge was implemented.[15]

When implementing the delirium ABCDEF bundle and PAD guidelines in the ICU, it is important to embrace an approach that will include the entire interprofessional team. Additionally, delirium champions from the interprofessional team will offer resources for providers at the bedside, lead daily rounds, and provide effective communication that will also aid with implementing delirium recommendations and guidelines. The summary of the relevant literature at the interpersonal level is provided in Table 2.

Physical Environmental Level

The third level or sphere of the SEM represents the physical environment in the intensive care unit. Many ICUs are designed based on evidence to facilitate patient comfort, patient safety, patient privacy, and staff working conditions.[31] Researchers have also identified variables as environmental risk factors for delirium development.[32] These variables were isolation, no visible daylight, no clock present or visible, no visitors, and physical restraints.[32] Further research needs to be conducted to identifying those barriers and facilitators of the effects of the physical environment when implementing the ABCDEF bundle and PAD guidelines in the physical ICU environment.

Community Level

The outermost level of the SEM represents the organizational, structural, and community characteristics of the ICU. The response of the organizational is interrelated and associated with the other spheres of the SEM. The physical environment of the ICU, the interprofessional team**,** and the individual knowledge and beliefs influence how delirium recommendations and guidelines are implemented into clinical practice. An example is a study conducted in 2006 and 2007 when a survey was sent to 41 US hospitals and seven international hospitals. Fifty-nine percent reported that they screened for delirium, and 88% reported using a sedation management scale.[33] Balas (2014) found that facilitators were identified as interprofessional collaboration and policy development to successfully implement an ABCDEF bundle policy in the ICU.[7] Another recommendation for developing a policy is to send a draft of the delirium policy to all ICU team members to address concerns and suggestions for improvement before the policy is put into practice.[15]

Healthcare providers reported that often the ABCDEF bundle was not conducted because it was not being ordered; hence, accessibility and use of the delirium protocol were reported to be difficult.[34] Barriers that hinder delirium implementation policy occur when a member of the interprofessional team believes there are too many policies**,** making it difficult to follow a new policy**.** Moreover, all patients should not be included in a policy implementing the ABCDEF bundle and PAD guidelines due to the nature of each patient's respective illness or injury.[15] Table 3 presents the summary of factors related to the ABCDEF bundle and PAD guidelines based on existing literature.

Discussion and Implication

Prevention and management of delirium continue to be two significant aspects of patient care that challenge the interprofessional team. The ABCDEF bundle and PAD guidelines are an essential part of assessing and managing delirium in the ICU. This integrative review is the first to summarize published clinical trials identifying concepts within the SEM. The analysis confirmed that the individual and interpersonal levels of the SEM have been explored in prior studies.

Addressing barriers such as knowledge support, time management, and performance feedback will help facilitate delirium guideline implementation. Frequent patient rounds and a clinical champion have also been found to support successful implementation of delirium recommendations. A limited amount of research has been conducted to identifying the barriers and facilitators of implementing the ABCDEF bundle and PAD guidelines. Further research is needed to evaluate physical environment factors that help or hinder the interprofessional team when they implement delirium recommendations. Lack of standardization in delirium policy has resulted in inconsistent results in how policy has either prevented or been used to govern delirium care.

Future Research

There is a need to further explore how the ICU environment facilitates or prevents the implementation of the ABCDEF bundle and PAD guidelines in the ICU. Factors such as work areas, location for interprofessional rounds, patient room area, support and service area for early mobility would assist implementing the ABCDEF bundle and PAD guidelines in the ICU. Moving further away from the center of SEM, there is insufficient evidence in the outer layers

of the model to draw conclusions. Optimal patient care depends on continuing research into finding ways to overcome these barriers to implementation.

Limitations

The following limitations exist for this integrative review. The terms used in the literature search may have missed other studies that met the inclusion criteria. The studies reviewed were nonrandomized cohort studies and surveys that may provide results based on other factors or influences. The review was performed only 1 reviewer posing a risk for investigator bias. Also, the literature review was restricted to English language publications.

A Conclusion

Despite current research on delirium, delirium in the ICU is under-recognized; thus, patients with delirium are poorly managed and are likely to experience complications resulting in disability and possibly death. To manage delirium in the ICU, pharmacologic and non-pharmacologic interprofessional management strategies are recommended; they are known as the ABCDEF bundle and PAD guidelines. Implementation of these guidelines has been met with resistance. However, a better understanding of facilitators and barriers can guide future interprofessional ICU use of the ABCDEF bundle and PAD guidelines in order to prevent and manage delirium in critical care patients.

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Figure 1. The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) Framework

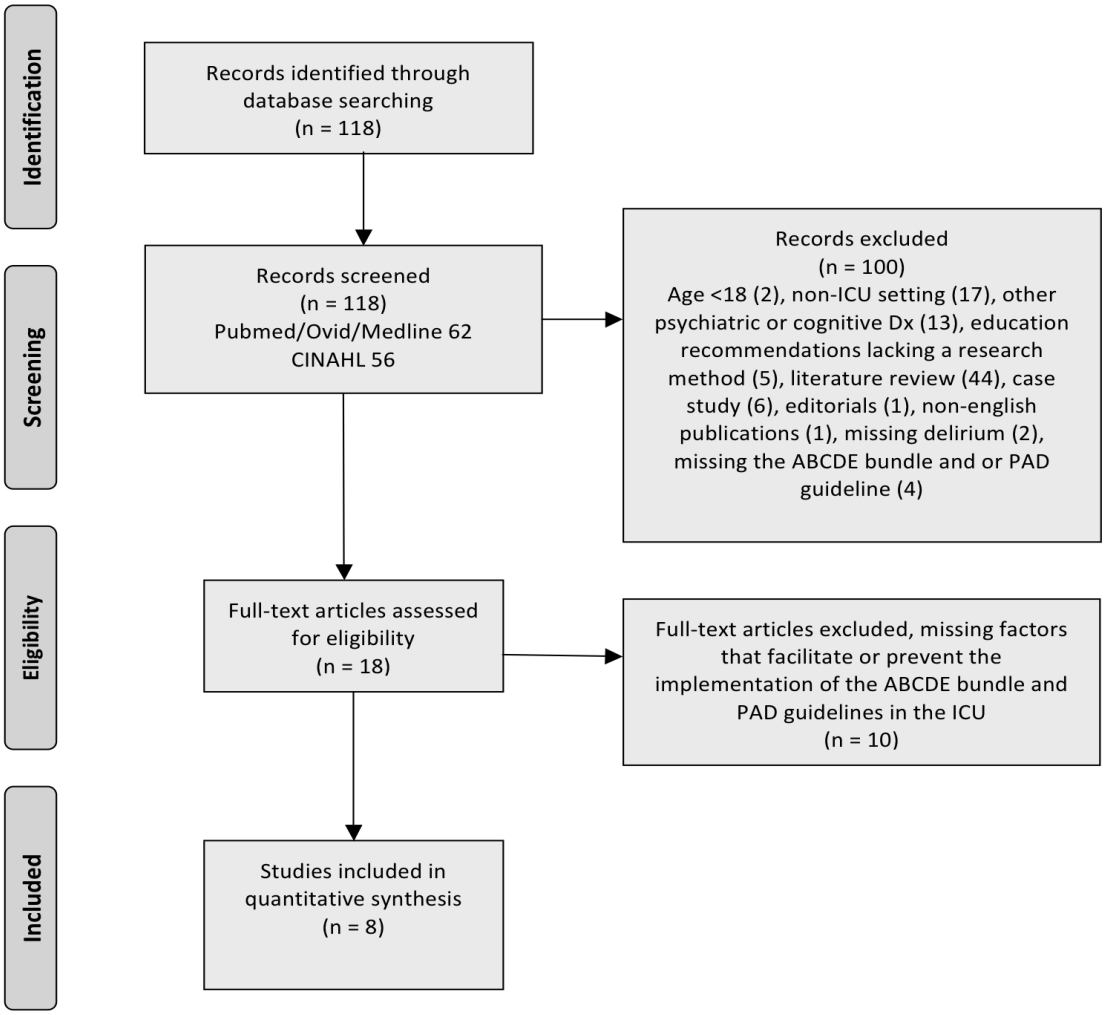

Table 1

Facilitators and Barriers at the Individual Level

Author, Year, CASP Score	Population, Setting	Study Design	Factors Associated with Facilitators	Factors Associated with Barriers
Balas et al., 2013 CASP 11/12	220 RN, 70 RT, 5 pharmacists, 2 physical therapists, 4 nurse practitioners, 17 intensivists, 9 critical fellows in 5 ICUs, 1 step-down, and 1 special unit	Prospective, mixed method, before-after intervention survey, focus groups	Respondent believed the ABCDEF bundle improves patient outcomes, CAM-ICU is straightforward, bundle is based on strong evidence	Perceived hard, unethical not to sedate ICU patients, believed to cause emotional and psychological distress. Timing of SAT/SBT. Concern about workload, lack of time, knowledge deficits
Pun et al., 2005 CASP 12/12	64 nurses, 170 observations, 711 patients in medical ICUs at 2 institutions	Prospective observation cohort study	Post implementation, nurses reported a high degree of comfort and satisfaction with RASS and CAM-ICU instruments, team was able to reach sedation goal	Time, confidence in performing the CAM-ICU other ICU team members (physicians and residents), lack of resources to answer questions, lack of feedback on performance, knowledge supported by leadership
Devlin et al., 2011 CASP 11/12	250 critical care pharmacists	Survey	50% reported delirium status discussed on patient rounds	Delirium screen tool not used by pharmacists, lack of time, belief that screening is a role for nurses, anti-psychotics are frequently recommended
Al-Qadheeb et al., 2013 CASP 12/12	30 nurses, 56 physicians in 2 medical ICUs	Survey	Nurses used goal judgment when paging physician at night related to pain, agitation and delirium	Quality of communication is low, urgency of physicians differed when responding to pain, agitation and delirium

Table 2

Facilitators and Barriers at the Interpersonal Level

Author, Year, CASP Score	Population, Setting	Study Design	Factors Associated with Facilitators	Factors Associated with Barriers
Balas et al., 2014 CASP 12/12	146 patient pre-bundle and 150 patients post-bundle implementation	Prospective, cohort, before-after intervention	N/A	Lack of resources
Balas et al., 2013 CASP 12/12	220 RN, 70 RT, 5 pharmacists, 2 physical therapists, 4 nurse practitioners, 17 intensivists, 9 critical fellows in 5 ICUs, 1 stepdown and 1 special unit	Prospective, mixed method, before-after intervention survey, focus groups	Team members independently provided additional ABCDEF bundle education after adopting it as standard of care, quality of evidence	Knowledge deficits related to delirium
Carrothers et al., 2013 CASP 12/12	62 RN, 6 physicians, 9 respiratory/physical therapists, 3 QI staff, and 2 physician assistants in the ICU	Pilot study, interviews, observations and survey	Project manager or ICU clinical champion, participation in daily multidisciplinary rounds, dedicated RT/PT/OT to ICU, rounding checklist	Lack of resources, early progressive mobility, coordination of disciplines, lack of respect among disciplines, knowledge, accountability, documentation
Devlin et al., 2008	50 nurses, 100 patients	Cohort study	Intergrading clinical reasoning based pedagogical approach that matches day to day experiences of ICU nurses	Delirium self-reporting tool not the best measure for knowledge and education
Shaughnessy, 2013 CASP 12/12	6-week assessment audit on 108 patients in cardiothoracic critical care unit	Cohort study	N/A	Lack of knowledge, inaccuracy of CAM-ICU scoring, lack of specific place to document CAM-ICU

Table 3

Facilitators and Barriers at the Community Level

Author, Year, CASP Score	Population, Setting	Study Design	Factors Associated with Facilitators	Factors Associated with Barriers
Carrothers et al., 2013 CASP 12/12	62 RN, 6 physicians, 9 respiratory/physical therapists, 3 QI staff, and 2 physician assistants in the ICU	Pilot study, interviews, observations and survey	Culture of quality improvement and patient safety, ICU and hospital leadership support, super users	Excessive staff turnover
Tanios et al., 2009 CASP 11/12	69 physicians, 15 nurses, 16 pharmacists	Cohort study, survey	Guidelines and protocol based on the best available evidence	Lack of physician order, prefer more control than protocol, difficult to use protocol

Manuscript 3

A Mixed Methods Study of Using the ABCDEF Bundle: Interprofessional Perceptions, Roles, and Practices in Caring for Patients with Delirium in Intensive Care Unit

Submit to *American Journal of Critical Care*

Abstract

BACKGROUND: Delirium in the intensive care unit (ICU) is a complication associated with an increased length of stay in the hospital, a declining functional status, and an increased cost of care. The interprofessional team is faced with challenges to prevent and manage delirium in the ICU. Targeted approaches, such as bundle interventions, have been established to guide delirium prevention and management in the ICU.

OBJECTIVES: To determine how the interprofessional team delineates and designates roles of delirium bundle care while caring for patients in the surgical ICU.

METHODS: A convergent parallel mixed-method design was used to collect qualitative observations and interviews concurrently with a quantitative survey.

RESULTS: Factors that facilitate using the ABCDEF bundle were identified as regular and frequent communication during interprofessional rounds and the knowledge of the nurses who work on the unit. The barriers identified were a lack of awareness of roles and responsibilities, resources, and safety concerns. Five methods to promote implementing the ABCDEF bundle identified from the study result are interprofessional education, increased frequency of interprofessional rounds, leadership involvement, family involvement and a delirium committee.

CONCLUSION: Facilitators and barriers for implementation of the ABCDEF bundle were identified through observations and interviews. Additional data were collected from the SAQ that categorized clinical perceptions, roles, and practices of the surgical ICU interprofessional team. Integration of the data obtained from observations, interviews, and surveys were used in a CFIR concept matrix to identify components to implement delirium bundle care.

Introduction and Background

Delirium in the intensive care unit (ICU) is a widespread problem, making patients more likely to experience complications that may result in disability and even death.[1] Defined as behavioral changes associated with an acute fluctuating course of consciousness,[2] delirium is highly prevalent in mechanically ventilated patients with approximately 80% affected.[3] Importantly, up to half of mechanically ventilated patients with delirium may die within six months of hospitalization, and of the remaining patients, approximately 75% will be discharged to long-term care environments.[4] The prevalence of delirium can occur in 70% of surgical and trauma ICU patients.[5] By contrast, delirium is present in 10%-25% of admissions to the acute-care setting.[6] Despite current research on its pathophysiology and origin, delirium remains poorly understood and under-recognized in the ICU.

Delirium is associated with a 20% greater chance of a patient remaining in the ICU, greater long-term cognitive impairment after discharge from the ICU and hospital, and increased costs of care.[7,8] In 2004, the total cost for a delirious patient in the intensive care unit was $22,345 as compared to $13,332 for a patient who did not develop delirium.[9] The total hospital cost for a patient who experienced delirium was 1.5 times higher per admission; estimated total cost is $41,836 compared to $27,106 for a patient without delirium.[9] The specific pathophysiology and origin of delirium are unknown; however, ICU patient risk factors include predisposing risk factors associated with physiological deficits due to injury or illness, prolonged use of sedatives and pain medications, immobility, and environmental factors such as the lack of daylight.[10]

Additional risk factors include the individual's preexisting and acquired risk factors of delirium, such as medical illnesses, organ failure, chronic stress, age greater than 65 years, hypertension, dementia, transfer from nursing home, alcohol and drug abuse, smoking, visual impairment, hearing loss, history of stroke, epilepsy, chronic heart failure, history of depression, and increased injury severity score.[11,12] Acquired risk factors of developing delirium in a surgical ICU setting vary from other ICU setting; specifically a higher Glasgow Coma Scale score at the time of admission, age less than 50 years, blood transfusions, and a higher Multiple Organ Failure Score.[13]

A healthcare *bundle* was defined in 2001 by the Institute for Healthcare Improvement as a set of evidence-based practices that, when performed collectively, improve patient outcomes.[14] The objective of the ABCDEF bundle—Assess, prevent, and manage pain, Both spontaneous awakening trials and spontaneous breathing trials, Choice of analgesia, Delirium assessment, prevention and management, Early mobility and exercise, and Family engagement and empowerment—is to combine multiple evidence-based practice strategies into daily care.[15] Using an implementation research framework in conjunction with a best-practice bundle, researchers can evaluate needs, and interventions to improve care can be strengthened through customizing the *protocol* implementation.

The ABCDEF bundle is derived from numerous clinical trials.[3,16,17] Adopted by the American Association of Critical Care Nurses and the Society of Critical Care Medicine,[18] the ABCDEF bundle is recommended for implementation by an interprofessional team, which typically consists of nurses, physicians, pharmacists, respiratory therapists, and physical therapists. Interdisciplinary implementation is an essential feature in the bundle's success on

patient outcomes.[19] The Consolidated Framework for Implementation Research (CFIR) was used to guide a study that explored factors that facilitated bundle implementation by an interprofessional team.[20] Results from this study found that characteristics of the ABCDEF bundle both helped and hindered interprofessional implementation.[20]

Over an 18-month timeframe, factors that facilitated implementing the ABCDEF bundle were frequent interdisciplinary rounds, decreased use of continuously infused sedatives, increased coordination options, and more frequent and earlier patient mobilization.[20] Barriers to implementing the ABCDEF bundle were described as inconsistent patient care practice, reluctance to follow both new and prior protocols, communication barriers, and workload and documentation related concerns.[20] A pilot study[21] explored factors that facilitate or hindered the implementation of the ABCDEF bundle over a 12-month period. The results indicated the following facilitating factors: stable ICU leadership, consistent interprofessional team members, an organizational-wide patient safety culture, implementation planning, access to training material, and the use of prompts or a documentation checklist.[21] Excessive turnover, poor staff morale, lack of respect among disciplines, and knowledge deficits were identified as factors that hindered implementing the ABCDEF bundle. In a follow-up prospective study, researchers assessed whether the ABCDEF components, as a bundle, were safe and effective for ICU patients.[22] The ABCDEF bundle was found to be an independent predictor; the bundle was associated with a decrease in the amount of time patients were on a ventilator, a reduction in delirium rates, and an increase in the frequency of patient mobilization.[22]

The ABCDEF bundle requires separate and collaborative performance from all clinicians on the ICU interprofessional team. Prior studies have shown that the structural and cultural

elements of the ICU need to be considered when exploring how an interprofessional team implements the ABCDEF bundle. Further research is needed to determine best approaches for implementing the ABCDEF bundle from the perspectives of the interprofessional team that are specific to the ICU structure and culture. The purpose of this study is to determine how the interprofessional team, typically comprised of nurses, physicians, pharmacists, respiratory and physical therapists, delineates and designates roles within the ABCDEF bundle while caring for patients in the surgical ICU.

Theoretical Framework

The CFIR focuses on the promoters and barriers of implementing a program, organizing constructs across theories into five domains.[23] In a retrospective study of five Veterans Affairs (VA) facilities, CFIR was utilized to explore the implementation of a weight management program; the researchers identified five major topic areas with measurable constructs to differentiate between high and low implementation effectiveness.[24] CFIR is the result of a meta-analysis of 19 theories or approaches to implementation research in clinical settings, resulting in constructs that can be used for evaluation of a program. CFIR has been used as a method to explore planning and evaluation of interventions in over 300 studies. Balas (2013) applied the CFIR domains to explore factors that facilitated the ABCDEF bundle implementation by the interprofessional team in the ICU.

To meet the aims of this study, three CFIR domains were selected; inner setting, outer setting and planning. The CFIR domain inner setting was selected to explore the culture of the ICU. The construct culture is defined by CFIR as norms, values, and basic assumptions of a given organization.[23] The CFIR outer setting was selected to explore the construct patient needs and

resources to identify barriers and facilitators.[23] The last construct selected was planning from the process CFIR domain. The planning construct from the process CFIR domain was selected to identify a method or approach in advance for implementing an intervention.[23] Figure 1 summarizes the specific aims as they relate to the CFIR constructs selected for this study.

Methods

The overall goal of this study was to identify facilitators and barriers of using the ABCDEF bundle and CFIR constructs in a surgical ICU setting and to explore levels of safety attitudes that were used to develop a concept matrix to effective implementation of the ABCDEF delirium bundle by surgical ICU teams. Ethnography was used as described by Schensul, Schensul, and LeCompte (1999) to explore the social and cultural patterns in a single setting. This study focused on the individual professionals who operated within an interprofessional team in a surgical ICU: nurses, physicians, pharmacists, respiratory therapists, and physical therapists. Ethnographic data were collected on the perceptions, beliefs, management, and consequences of the use of the ABCDEF bundle in the prevention, detection, and management of delirium in the surgical ICU.

The study used a convergent parallel mixed-methods design[26] to collect qualitative data from observations and interviews and quantitative data from surveys. The CFIR framework guided comparison of the data to construct a concept matrix to guide effective implementation of the ABCDEF delirium bundle. The study site Sponsored Programs & Research Office reviewed and approved the study protocol. Once approval was obtained from the study site, approval was obtained from the Institutional Review Board (IRB) for the protection of Human Subjects at the Medical University of South Carolina (MUSC).

The specific aims for this study were to: (1) evaluate selected constructs from the CFIR framework related to the implementation of the ABCDEF bundle in a metropolitan hospital surgical ICU, using clinical ethnographic approaches, including observation and interviews; (2) identify facilitators and barriers of ABCDEF bundle implementation; (3) explore the clinical perceptions, roles, and practices of the surgical ICU interprofessional team in implementing the ABCDEF bundle using The Safety Attitudes Questionnaire; and (4) integrate data obtained from observations, interviews, and surveys to develop a CFIR concept matrix for developing an intervention.

Procedures

Data collection. Data collection began in September 2015 and concluded in October 2015. All observations and interviews were conduction during this allocated block of time to deeply immerse in this ethnographic experience. Interprofessional team members were recruited from a surgical ICU of a 477-bed community-based level-1 trauma center. Participants were informed of the study at department meetings and the beginning of day and night shifts during department huddles. Study flyers were posted in a unit break room and in the workstations of surgical ICU residents. The study criteria included being a member of the interprofessional team currently working in the intensive care unit with an assigned role in the ABCDEF bundle, such as a nurse, physician, pharmacist, respiratory therapist, or physical therapist. Exclusion criteria were having less than one-year experience in the ICU, currently involved in new employee orientation, or currently an intermittent or float pool employee.

Observations and interviews. To attain the objectives of aim 1 and aim 2, ethnographic observations and interviews were used to explore how the interprofessional team delineates

and designates roles of the ABCDEF bundle while caring for patients. Ethnography is a qualitative approach to investigate social and cultural patterns in a single setting.[25] Observations of each interprofessional team member occurred in one-hour increments at random times over a period of three weeks. Before each observation, a member from the interprofessional team was approached and provided a participant information sheet describing the purpose of the study. Study participants were given an option to be observed and interviewed or to decline participating in the study. Observations were focused on the ICU settings, noise level, interpersonal communication, specific clinical activities involving the ABCDEF bundle, notation of clinical milestones occurring in the setting, and event sequences. Observations were made in the hallway where the individual from the interprofessional team could be observed and heard without disrupting patient care. Field notes were audio recorded involving detailed language to define behaviors and to describe the environment.[25] An observation template was used to guide observational data collection, as seen in Figure 2. Interviews were conducted after the observations on clinical perceptions, roles, and practices of the surgical ICU interprofessional team regarding bundle implementation. Study participants were audio recorded during a 15-minute interview answering questions about the ABCDEF bundle. Interview questions were guided by the selected CFIR domains; inner and outer setting (Figure 2). Data collected from the observations and interviews were transcribed by a professional transcription service.

Sampling. Purposive sampling was used to select participants to explore and describe the conditions and meanings surrounding bundle implementation.[27] This technique was used to collect data from knowledgeable experts to explore the inner and outer setting of CFIR domains

in the surgical ICU setting. A designated surgical ICU nurse and the nurse manager in the surgical ICU assisted with recruitment efforts by identifying and referring eligible participants. Using clinical ethnographic approaches, interviews occurred over a total of 33 observation hours. Interprofessional team members were informed that the research procedures involved observation of clinicians in an ICU setting and an interview and survey involving non-sensitive subject data. Participants were provided a participant information sheet and advised of the purpose, procedures, risks, and benefits, as well as the voluntary nature of participation. Study participants during observation were asked to meet the PI after their shifts in a quiet location on the first floor of the hospital for a 15-minute interview. At the conclusion of the interview, the participants received a link to a survey derived from the Safety Attitudes Questionnaire.

Description of SAQ survey. For aim 3, the Safety Attitudes Questionnaire (SAQ) was used to identify clinical perceptions, roles, and practices of the surgical ICU interprofessional team. A $5 gift card with a link to the survey was handed out to participants at the conclusion of the interview. The SAQ was derived from an original survey to evaluate breakdowns in interpersonal aspects of crew performance from the flight industry.[28] The SAQ has been adapted for use in intensive-care units and is a psychometrically sound instrument for assessing six safety related climate domains by systematically eliciting input from healthcare providers.[28] The SAQ survey constructs measured include the following items: (1) teamwork climate, items 1-6; (2) safety climate, items 7-13; (3) job satisfaction, items 15-19; (4) stress recognition, items 20-23; (5) perceptions of management, items 24-29; and (6) working conditions, items 30-32. Items 14 and 33-36 are not used in scoring the SAQ survey. Items 2, 11, and 36 are reverse scored. With these exceptions, 36 questions are scores for each item on the 5-point Likert scale

and were assigned the following values: 1=*disagree strongly*, 2=*disagree slightly*, 3=*neutral*, 4=*agree slightly*, 5=*agree strongly.* To obtain a SAQ construct score, the mean of the construct items was obtained and then reduced by 1 and multiplied by 25.

Data Analyses

Qualitative data. An integrated approach was used to identify patterns, categories, and themes to inform the domains and constructs of the CFIR model. The intergraded approach utilizes both an inductive and deductive approach to identify conceptual codes and subcodes to develop a taxonomy.[29] Data collected from the observations and interviews were transcribed and imported as word processing files into Dedoose software to classify observations and participant responses into themes. During the coding process, text from the imported word processing files were read sentence by sentence; excerpts were grouped into themes and categorized into CFIR constructs. A senior qualitative mentor reviewed conceptual codes and subcodes. Additional revisions refined and organized conceptual codes and subcodes into CFIR themes. Results were categorized and then summarized in a tree diagram representing each CFIR construct; those were compared and merged with the survey results into Figure 5.

Quantitative data. To investigate levels of safety attitudes from the SAQ survey, the total scores for each SAQ construct were calculated. Descriptive statistics such as *mean*, *standard deviation*, *median* and *range* were used to assess qualitative data regarding the inner and outer CFIR domains. Clinician responses to the SAQ were divided into two groups based on respective years of ICU experience: (1) less than 10 years of experience versus (2) more than 10 years of experiences. Mean SAQ construct scores were reported for the entire sample and by years of experience. Mean ranks of SAQ construct scores were compared by years of

experience using the Mann-Whitney U test at a .05 significance level. All quantitative data were collected and stored in Research Electronic Data Capture (REDCap) and then transferred into Statistical Program for the Social Sciences (SPSS) version-23 software for analysis.

Results

Participant Characteristics

Study participants (total *n* = 33) were predominantly nurses (*n* = 11), physicians (*n* = 7), five ICU administrators, four respiratory therapists, four physical therapists, and two pharmacists. Years of experience ranged from three years to 21 or more years of clinical experience in the ICU. The majority (81%) of the participants were female (Table 1).

Contextual Analysis

Study aim 1 results are demonstrated in the CFIR domain inner setting, construct culture (Table 2). Study aim 2 results are outlined in the CFIR domain outer setting, patient needs, and resources identifying facilitators and barriers of the ABCDEF bundle. Table 3 (facilitators) and Table 4 (barriers) illustrate the main themes from the analysis outer setting, patient needs, and resources. Study aim 3 results from the SAQ categorize clinical perceptions, roles, and practices of the surgical ICU interprofessional team. Study aim 4 is explained through triangulating data results from the observations, interviews, and statistical results to identify convergent or divergent situations based on each CFIR construct.

Study Aim 1

Parallel process vs. integrated approach. Observations of the surgical ICU for use of the ABCDEF bundle revealed a busy dynamic critical care environment. The ICU is a locked unit

requiring an individual from inside the ICU to allow access to caregivers and visitors. Throughout the observations, one or more members from the interprofessional team entered the unit, used a computer in the nurse's station, or entered a patient room. The volume of noise varied depending on the time of day and other activities on the unit. For example, the noise level increased during nurse handoff, during procedures, and during patient admissions or transfers. Quieter times were observed during the day between 2–4 pm and at night between 12–3 am. Delirium care was conducted in a parallel process. Within their respective designated roles, nurses, physicians, pharmacists, respiratory therapists, and physical therapists were observed caring for patients. An integrated approach to patient care was observed when interactions between two or more of the interprofessional team members discussed a clinical question, or when it was necessary to conduct a procedure or transfer a patient. Data collected through observation and interviews were classified into the elements of the ABCDEF bundle: (1) spontaneous awakening and breathing trials, (2) choice of sedation, (3) delirium detection, and (4) early mobility. Additional themes identified from the observations and interviews were quiet time and interprofessional team.

Both spontaneous awakening and breathing trials. The spontaneous awakening and breathing trials were observed early in the morning. The intervention began with a respiratory therapist initiating breathing trials on patients who were mechanically ventilated. Most of the observed time, the respiratory therapist talked to the nurse caring for the mechanically ventilated patient before entering the patient's room. The respiratory therapist and nurse briefly reviewed the patient's medications and any concerns regarding a breathing trial. At the conclusion of the discussion, both the respiratory therapist and nurse returned to their own

professional specific task. A nurse participant explained the spontaneous awakening and breathing trial this way:

> A breathing trial is usually done by respiratory therapy and the nurses, in the morning, early on, at least here at this hospital, is when it's done, and what it is, is they'll put a patient early on pressure support at around 4am. So, they're giving a breathing trial, making this individual breathe on their own and remain hemodynamically stable, or do they still need that ventilated support? And sometimes they try to bundle that with decreasing sedation at the same time. So, we're going to wake up this person, we're going to decrease sedation, we're going to see how they tolerate it, and if we can lower those parameters to help them get off the ventilators sooner or to lessen the length of stay in the ICU is, kind of, the front end of this intervention.

Choice of sedation. The use of pain and sedation medication is common in the surgical ICU environment. During the observation stage of the study, the Richmond Agitation and Sedation Scale (RASS) was used to assess and document patient sedation level.[30] The Verbal Numerical Rating Scale or the Face Legs Arms Cry Consolability (FLACC) scale was the assessment tool for pain. The confusion assessment method for ICU patients (CAM-ICU) is a delirium assessment tool used to detect and identify four features of delirium: acute onset or fluctuating course, inattention, altered level of consciousness, and disorganized thinking.[3] The CAM-ICU assessment tool result is positive, negative, or unable to assess.[3] A laminated visual cue was posted outside of each patient room. The visual cue provides an area for nurses to write their assessment of the patient's pain level, pain scale used, pain medications, RASS score, and the CAM-ICU score. The laminated visual cues included a variation of dates and room numbers making it difficult to determine if the interprofessional team used the visual cues

(Figure 5). Often, the level of pain, sedation score, and choice of medication were discussed by the interprofessional team during patient rounds that took place once per week. When the nurse was available, the pain, agitation, and delirium (PAD) assessment and scores were reported to the interprofessional team. During rounds, the patient's medications were reviewed and revised by the interprofessional team. Two pharmacists explained specifics regarding pain medications and choice of sedation process:

> Pain medications we use in the surgical ICU are Fentanyl out of the box and morphine, or dilaudid PCAs depending on patient. But then they are using that fair amount of pain catheters now too with bupivacaine, and I really I like that we're mixing it up—that we're providing a more local control so that it doesn't contribute to sedation and delirium as much. Everyone gets transition to oxycodone. There are some people that's too much for, a lot of people that's not enough, and I think that the sort of cook-book approach when you give everybody Tylenol, and everybody oxycodone, it's better than not having a plan. (Pharmacist 1)

> If a patient is adequately controlled pain-wise, but then their RASS score is still elevated or CAM-ICU score still positive, then we can start talking about sedation agents. We do try and limit benzodiazepines as much as we can. If we can get away with Propofol based on blood pressure, we try and do that, and we have started to use more Precedex, although Precedex still is costly, so we try and pick our battles with whom we think actually would respond well. If we have benzodiazepines, it's preferred that we use intermittent dosing of benzodiazepines rather than drips. (Pharmacist 2)

Delirium detection. The surgical ICU nurses used the Pain, Agitation, and Delirium (PAD) guidelines to prevent and treat pain, agitation, and delirium.[18] The nurses also used the Confusion Assessment Method for the ICU (CAM-ICU) checklist to assess for delirium.[3] The previous year, nurses had started to report PAD scores during rounds. In general, observations

in the current study revealed that the PAD score was reported on Friday mornings when the complete interprofessional team was available for patient rounds. However, reported PAD scores varied for individual patients depending on attending physician, nurse availability, and patient care required from specific members of the interprofessional team. An ICU administrator commented on the processes used to evaluate and treat delirium:

> I think everyone was on board with the fact that we knew delirium was a problem, and we need to access it appropriately. Getting to the level that it is now where the residents just say no and turn and ask the residents or turn and ask the nurses for their PAD assessment that took some, a lot of effort in reminding and it wasn't in their normal flow, and I think a lot of times that was the hardest. It was easy to get residents to want to do that because they are here day to day; they see it. The attendings just weren't used to it, and so they would forget about it. So, it just took a lot of frequent reminding like "oh this would be a good patient that we should hear the nurses PAD assessment."

Early mobility. A safe intervention for mechanical ventilated patients, early exercise and mobility has been shown to decrease the duration of delirium in the ICU.[17] Observations in the current study revealed that one physical therapist and one physical therapist assistant were assigned to the surgical ICU, where they evaluated and treated patients in sessions that ranged from 15 minutes to 45 minutes depending on the patient. The following excerpts are from observational field notes:

> A physical therapist and physical therapy assistant walked into a patient's room to provide care. They started by introducing themselves, oriented the patient to the day and time, described what they were going to be doing and explained what the patient should expect. The bedside nurse went to get a portable

> oxygen tank and a portable cardiac monitor. The primary nurse stayed in the patient's room providing assistance to help ambulate the patient. The total time physical therapy with the patient was 20 minutes.
>
> During an interview, a physical therapist stated he works with patients in the surgical ICU from 8 am until 4 pm. Patients are not seen during their 30-minute lunch break and between 2–3:30 pm due to the quiet time initiative. A physical therapist interviewed stated, "on a good day I can see eight patients." During another interview, a physical therapist was asked if patients are normally on a ventilator during physical therapy. The physical therapist stated "yeah, I'll get both. Most of the time, they are probably towards the end of their ventilator course. I'm so busy that I probably wouldn't be able to see them if they were on the ventilator. Like those patients get down prioritized, and I have to see the patients that can stand up and walk and move. I prioritize those patients compared to just doing range of motion."

Quiet time. An additional theme identified during observations and interviews, quiet time is an intervention aimed to reduce noise and stimulation and to promote sleep in the ICU.[31] Quiet time was observed between 2–3:30 pm and 11pm–5:00 am. During quiet time, the lights are turned off throughout the unit, including the lights in the patient rooms. The lights at the entrance of the surgical ICU and above the workstations in each pod are illuminated. When the lights were turned off, the noise level in the surgical ICU decreased. The frequency of the interprofessional team entering or exiting patient rooms also declined; clinicians entered patient rooms only to address alarms or to give medications. When a nurse and attending were asked if they used the ABCDEF bundle and whether they felt the bundle helped prevent or manage delirium, they responded as follows:

> I think I do a lot of the ABCDEF bundle. I feel like this bundle encompasses a lot. I don't necessarily think it includes a quiet time. They are serious about the quiet time. We don't talk or we do, but we can't be loud. It's good for the patients. I get in room and do my interventions while maybe it's their time to get turned.

> Then this way, I'm out of the room for two hours other than to tip urine, which I can do very quietly. The lights and TVs are off. I am trying to get the patient to sleep as well as they can. You know, I think sleep is such a huge aspect of that delirium that we try to do everything we can to make them as comfortable as possible to get some rest. (Nurse)

> So, now we do the PAD score on everyone every day in the ICU, and we assess if they are CAM positive or CAM negative. And then for prevention, we do all the relatively simple nursing stuff like trying to adhere the day and night cycles, making sure they have their hearing aids and their reading glasses, and family members around the patients know what works best for them. And then, we started nap time or quiet time, which I'm not a huge fan of, but the intention is to decrease fatigue and minimize the chance of becoming delirious. (Attending)

Interprofessional team. The surgical ICU is a unit in a community-based level-1 trauma center. The culture was described as a rank based unit with residents and attendings. The attendings were observed leading patient rounds once a week with the interprofessional team. Approximately 20 individuals such as nurses, residents, attendings, a respiratory therapist, a pharmacist, and trauma care coordinators assembled as the interprofessional team. A fellow described interprofessional rounds as "a time to educate residents with real time cases to improve care being provided." Observations from the interprofessional rounds indicated that a unit physician assistant, unit pharmacist, nurse manager, and nurse educator were the contact individuals from the interprofessional team for the team's patient referrals. Other patient rounds were observed during various time of the day, which were profession-specific. Nurses were observed rounding on patients twice per day as a form of hand-off for the next shift. At a separate time, respiratory therapists were also observed rounding on patients as a form of hand-off for the next shift.

Study Aim 2

Facilitators. Observations and interviews revealed factors and sub-factors that facilitate ABCDEF bundle components (Table 3). Nurses were observed as the primary member from the interprofessional team by assessing and providing care based on the ABCDEF bundle. In addition, charge nurses and resource nurses were observed providing additional interventions for patients. During interviews, ICU administrators were described as providing a cultural that is engaging and supportive of teamwork with other members from the interprofessional team. Patient rounds were also observed as a factor that facilitates the ABCDEF bundle. Factors that facilitated implementation of the ABCDEF bundle revealed three emerging themes: (1) nurses, (2) interprofessional rounds, and (3) leadership.

Nurses. Nurses were observed as the primary healthcare providers who spent the most time with the surgical ICU patients. One nurse stated during an interview that she established the patient's baseline and assessed for changes several times throughout her shift. When changes in the patient's status occurred, the nurse was observed communicating these changes to the charge nurse as well as the resident when available during interprofessional rounds. During an interview with the ICU Quality Coordinator, nurses were identified as a "resource for other members of the interprofessional team because they are the constant on the surgical ICU floor and because they understand the cultural norms by knowing what medications are needed for a patient's condition." The unit charge nurse was an additional resource for the nurses because of her continual availability for mentoring. Several conversations between the bedside nurses and charge nurse were observed.

Leadership. Interviews revealed ICU administrators contribute to the overall success of implementing the ABCDEF bundle in the ICU. When a nurse was asked what the facilitators of the ABCDEF bundle were, the following response was given: "The culture is more engaging than it ever has been. I think the leadership has done a great job of keeping pharmacy, physicians, all of the therapies on the same page with nursing."

Interprofessional rounds. The surgical ICU has four connected pods. Each pod is different in shape, but has a central nurses' station in the middle. The hallway in each pod is large enough to fit all of the members from the interprofessional team during patient rounds. Interprofessional rounds took place on Friday mornings. A nurse described the weekly interprofessional rounds as "a method to communicate with other members of the interprofessional team." The time spent on each patient varied due to the patient's level of acuity. The interprofessional team spent more time on the patients with a higher acuity compared to those who were considered stable. Members from the interprofessional team met outside of the patient's room that had ICU status. Patients that had transfer orders to the progressive care or acute care unit were excluded. The design of the surgical ICU provides adequate workspace and resources for the interprofessional team. Interprofessional rounds were described as a time for the interprofessional team to work together to identify the underlying problem with a patient and a time to educate.

Barriers. Observations and interviews identified factors that hinder implementing the ABCDEF bundle in the ICU. A parallel process was evident as observations revealed each discipline functioned within their respective professional role to prevent and manage delirium. In addition, a lack of understand of roles and responsibilities were also identified as a barrier.

Overall, three major themes emerged regarding barriers to using the ABCDEF bundle: *roles* and *responsibilities*; *safety* and *patient status*, and *resources*.

Roles and responsibilities. Members from the interprofessional team were observed and interviewed individually. During observations, it was noted that each discipline functioned within their respective professional role. Occasionally, brief conversations were observed between nurses and physicians regarding a question about the care provided for a patient. During an interview, a physical therapist stated, "I don't even know how to find out who the appropriate resident is up here, like it is nearly impossible." Data extracted from observations and interviews describe the variables associated with separate professional roles and responsibilities:

> "I think barriers might be just getting a physical order from a physician on what to do." (Nurse)

> I think change in general is perceived well, and I think the unit does a great job of implementing because they know it's best for the patient. I think it's hard sometimes when you've been practicing for 20 years doing your neurological exam and then adding this bundle. I think it's easier maybe when you start seeing evidence that supports us doing it. Just for an example: we started trialing or doing these daily goal sheets. Right. But none of the doctors use it. So now we did this for a month. None of the doctors did it, but they still want nursing staff to do it, but the nursing staff now is like "why am I going to do this if no one is using it?" Doesn't make sense. (Nurse)

> The biggest barrier in any initiative, I think, here is just getting everybody to know about it and getting everybody on board. So, it's really hard to reach every single resident that might be coming in and out, much less every single nurse who's here (maybe just on the weekends; maybe just Monday, Tuesday, Wednesday night) to know everything. If you can get 70% of the people to know at any one time, that's big deal. (ICU Administrator)

> "A barrier is time constraints, another one is that I think a lot of surgery residents and attendings don't really consider the ABCDEF bundle to be in the domain of surgery, so lot of the residents are working towards being a thoracic surgeon, so why should they care about all the details of how to manage delirium?" (Attending)

Safety and patient status. On the subject of safety and patient status, one nurse educator stated the following: "I think in trauma patients, there's a lot of barriers you know, one of the barriers is that so many of our patients have drugs and alcohol on board so many of our patients have a ton of pain that it's really hard to treat their pain without totally failing them." Another nurse stated:

> I think awakening of patients sometimes it's not necessarily that we as a culture don't want to awaken patients, but sometimes it's a safety thing. Sometimes you need to sedate the patient because they may self-extubate, and sometimes there are just not enough eyes, sometimes if you [are] busy with other patients who keep this other patient safe. So, I think safety can affect the awakening part and I think we are all on board, breathing trials happen every day if they can, and the only thing that stops it if the patient isn't stable.

Resources. During the interviews, study participants expressed a limitation of resources as a barrier. The electronic health record, support from leadership, and financial constraints were identified as the missing resources needed to support use of the ABCDEF bundle:

> "The electronic health record is not supported in any way, doesn't queue new residents to look at the patients in the right way" (Nurse).

> "I think we have a lack of understanding in the position leadership of why it is important to an ICU, if they were more concerned about ICU initiatives and they really cared about the ICU staff as much as they care

about the surgery we would probably be in a different place because it's not hard to figure out, but just not their focus" (Nurse).

"Financial components we are really focused on productivity. We are really focused on not using a lot of extra time outside of taking care of patients, so our non-productive time is a big deal. We already use a ton of non-productive time in critical care because of the amount of time it takes to develop a critical care nurse" (ICU Administrator).

"Nurses don't have the time to do everything that they like to do period for any initiative. They don't have the physical resources like I mentioned, they don't have the room and the equipment to work towards mobility like we want" (ICU Quality Coordinator).

Sometimes we have very, very big families that are in here visiting, and sometimes they're more concerned with visiting right now and not really caring that it's quiet time, and we're trying let them the patient get some rest so that they can heal. Even though you explain that and everything, you look in the room they're stimulating the patient trying to wake them up, and so sometimes that can be a little bit of a barrier.(Nurse)

Study Aim 3

Safety attitudes questionnaire. Sixteen interprofessional team members responded to the survey after completing the interview. To obtain a SAQ construct score, the mean of the construct items was obtained and then reduced by 1 and multiplied by 25 to calculate percentages. Within the SAQ domains, the four highest responses were found in teamwork climate (89%, SD 9.50), safety climate (86%, SD 10.17), and job satisfaction (93%, SD 9.78) domains. The lowest SAQ domain responses were labeled as neutral and were identified in safety climate, stress recognition (73%, SD 21.83), and perceptions of management (77%, SD

10.56). Table 5 outlines the statistical results from the SAQ survey, and Table 6 details the statements from the highest and lowest SAQ mean scores.

The SAQ domain scores were compared between the groups of clinicians with less than 10 years of experience and those with more than 10 years of experience. Although no statistically significant differences were observed between the groups, mean scores in clinicians with less experience tended to be higher than in the more experienced for the domains group teamwork (9.1 vs. 7.7), job satisfaction (9.1 vs. 7.8), and working conditions (9.1 vs. 7.8). Perceptions of management (8.1 vs. 9.1) were reported higher in the more experienced group (Table 7).

Mixed Methods Analysis

The Convergent Parallel Mixed Method design was used to analyze the qualitative and quantitative data separately and to merge findings from the observations, interviews, and survey into pre-determined CFIR constructs. Data collected from the observations and interviews, as well as statistical results, were used to identify convergent or divergent situations based on each CFIR construct. The two data sets had factors that established the same concept, validating triangulation.[32] Results from study aim 4 identified five methods that need to be considered in advance for implementing the ABCDEF bundle in the surgical ICU: interprofessional education, increased frequency of interprofessional rounds, leadership involvement, family involvement, and a delirium committee. Recommendations are based on the results identified from triangulation and are guided by previous clinical trials. The Institute of Medicine established four competency domains to provide team-based care, values/ethics

for interprofessional practice, roles/responsibilities, interprofessional education, and teamwork.[33]

Implementing interprofessional education will enhance coordinated efforts of the ABCDEF bundle and transition a parallel process to an integrated approach. Increasing the frequency of interprofessional rounds from once a week to daily will enhance the team approach by sharing clinical expertise and coordinating towards a common goal for the patient.[15] In addition, leadership involvement has been identified as factor of successfully implementing the ABCDEF bundle, as leadership is involved in all phases of the implementation process.[20] Next, family involvement was added to the delirium bundle to engage family members to participate as a member of the team and increase family member's knowledge regarding delirium care in the ICU.[34] Last, a delirium committee with champions increases implementation of the ABCDEF bundle while providing support for the interprofessional team.[21] Figure 5 presents the qualitative, quantitative, and triangulated matrix results.

Discussion

The purpose of this study was to identify the best approaches for implementing the ABCDEF bundle from the perspectives of the interprofessional team. This study utilized CFIR to explore the ICU surgical culture and related facilitators and barriers for implementing the ABCDEF bundle; results were integrated to develop a CFIR concept matrix for developing further implementation strategies. Study aim 1 results demonstrated in the CFIR domain inner setting, construct culture. The cultural in the surgical ICU provides a climate the supports teamwork, safety, and job satisfaction. The interprofessional team that delivers care in the surgical ICU had a rank-based process established for providing patient care. Members from the

interprofessional team provide fragments of the ABCDEF bundle that were profession task specific in a parallel process. The interprofessional team assembles once per week and will discuss pain, agitation, and delirium during interprofessional rounds. Results from aim 1 vary from previous studies. Balas (2013) described the CFIR domain inner setting, stating the cultural in the ICU demonstrates an inconsistency in practice from the interprofessional team and a lack of acceptance of new and existing policies.[20] The difference in results suggests structural and cultural elements of ICUs needs to be considered when exploring how the interprofessional team implements interventions.

Study aim 2 results from the CFIR domain and construct, patient needs, and resources identify factors that facilitate and hinder implementation of the ABCDEF bundle. Factors that facilitate using the ABCDEF bundle were identified as regular and frequent communication during weekly interprofessional rounds and the knowledge of the nurses that work on the unit. The culture in the ICU openly accepts nurses' input. In addition, the culture supports an environment where the interprofessional team can openly ask questions. A unit initiative that the interprofessional team provides daily is quiet time—an intervention to promote sleep and prevention ICU acquired delirium. The barriers identified in this study included a lack of awareness of roles and responsibilities, resources, and safety concerns. Disciplines from the interprofessional team provide professional task-specific delirium interventions in a parallel process, not as an interprofessional team. A lack of resources including time to implement new care practices, the electronic health record system, and physical resources to ambulate patients were identified as barriers to implementing the ABCDEF bundle.

Results from this study found interprofessional patient rounds were being conducted once a week, which provided a platform for team discussion. However, safety climate was the lowest SAQ survey score. Specifically, study participants reported through the survey that it is difficult to discuss errors. Therefore, the lack of a safe climate that permits errors to be communication with the interprofessional team was identified as an additional barrier. Results from aim 2 correlate with facilitators and barriers that have been identified in other studies. Factors that have been identified in other studies to facilitate implementing the ABCDE bundle include structural characteristics of the ICU, patient safety, implementation planning, frequent interdisciplinary rounds, coordination options, and more frequent and earlier patient mobilization.[20,21] Barriers include lack of respect among disciplines, knowledge deficits, lack of time, and not enough staff available to implement the ABCDEF bundle.[20,21]

Study results from aim 3 identified clinical perceptions, roles, and practices of the surgical ICU interprofessional team using a survey derived from SAQ. After being observed and interviewed, 16 interprofessional team members responded to the SAQ survey. The following four domains from the SAQ had a mean score greater than 80%; teamwork climate, safety climate, job satisfaction, and working conditions. The domains with a mean score less that 80% were stress reorganization and perceptions of management. No statistically significant differences were observed between the two groups explored: (1) less than 10 years of experience and (2) more than 10 years of experience. However, mean scores in the group with less experience tended to be higher than in the more experienced group.

The Convergent Parallel Mixed Method design was used to identify study aim 4 results by triangulating results from the qualitative and quantitative data. Results from this study

identified the following recommendations to advance implementing the ABCDEF bundle in the surgical ICU; interprofessional education, increase frequency of interprofessional rounds, leadership involvement, family involvement, and a delirium committee. Recommendations are based on the results identified from triangulation and on previous clinical trials. Literature recommends formulizing the process of interprofessional rounds, leadership engagement, online ABCDEF bundle education for the interprofessional team, delirium champions and family involvement.[20,34] These findings emphasize the importance of planning an approach to implementing the ABCDEF bundle.

Limitations

The findings from this study identified approaches for implementing the ABCDEF bundle from the perspectives of the surgical ICU interprofessional team. However, several limitations were identified. This study was conducted in a single surgical ICU resulting in less generalizability. Another study limitation was the complexity of the study site. Observations of the interprofessional team in the ICU were dependent on patient care requirements and did not always include delirium interventions. Although the PI attempted to blend with the culture and setting, during the third week of the study, the PI noted the participants' behaviors changed during observations. Members from the interprofessional team would start to talk more frequently about patient PAD scores. Study participants were unable to access the survey link on the computer at the study site due to a firewall setting. Participants reported that they had to use the mobile devices to access the survey, limiting the number of responses. Only 48% of the participants responded to the survey. Results from the survey were not statistically significant, yet themes emerged that warrant further attention, in particular to the differences

based on years of experience, perceptions of management, and roles and responsibilities needs to be explored in a larger study.

Conclusion

The ABCDEF bundle is recommended for implementation by an interprofessional team and is beyond individual profession-specific tasks. Many of the findings from this study were consistent with previous research. Through mixed methods of clinical ethnography and survey results, perspectives from the interprofessional team revealed how the interprofessional team in a surgical ICU utilizes the ABCDEF bundle. This study emphasizes the importance of understanding cultural factors that influence interprofessional role that deliver the ABCDEF delirium bundle in the ICU. Cultural specific facilitators and barriers of using the ABCDEF bundle were conceptualized in CFIR domains. Results were used to develop a concept matrix to promote effective implementation of the ABCDEF delirium bundle as utilized by the interprofessional team. Interprofessional collaboration remains a gap when implementing the ABCDEF bundle.

This study revealed the interprofessional team was conducting factors from the ABCDEF bundle in a profession-specific manner resulting in a parallel process. In addition, nurses were the foundation and had primary responsibility for implementing the ABCDEF bundle. The methods identified in the CFIR matrix will need to be explored and tested as an intervention designed to promote effective implementation of the ABCDEF in the surgical ICU. Achieving this goal will enhance interprofessional collaboration and will improve preventing and managing delirium in the surgical ICU.

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Table 1.

Demographics

	Nurses	Physicians and Residents	ICU Admin	Respiratory Therapists	Physical Therapists	Pharmacists	Total N Observations	Female	Male
Observations of ICU inter-professional team	11	7	5	4	4	2	33	81%	19%

Survey responses

Gender	Years in Critical Care	Years of ICU Experience
Male	5-10 years	Less than 10 years
Male	5-10 years	Less than 10 years
Female	21 years or more	11 or more years
Female	11 to 20 years	11 or more years
Female	21 years or more	11 or more years
Female	5-10 years	Less than 10 years
Female	11 to 20 years	11 or more years
Female	3-4 years	Less than 10 years
Female	1 to 2 years	Less than 10 years
Female	5-10 years	Less than 10 years
Male	3-4 years	Less than 10 years
Female	21 years or more	11 or more years
Female	11 to 20 years	11 or more years
Female	5-10 years	Less than 10 years
Female	11 to 20 years	11 or more years
Female	5-10 years	Less than 10 years
16	16	16

Table 2.

Inner Setting, Culture

	Construct	Factor	Sub-factor	Variables Associated with Culture
Inner setting	Culture	ABCEDF Intervention	Spontaneous awake and breathing Choice of sedation Delirium detection Early mobility Family engagement *Quiet time	-Breathing trial done by respiratory therapist and registered nurse -Takes place at 0400 -Guided by pain, agitation, delirium report from registered nurse -Pharmacist recommended based on patient needs -Pain, agitation, delirium reported by registered nurse -Use CAM-ICU assessment tool -Evaluation and treatment conducted by physical therapy -Timeframe 0800-1600 -On average 8 patients are seen per day -Patients closer to transfer are prioritized to be seen first -Open visiting hours -Unit initiative to decrease excess stimulation and promote sleep hygiene -Takes place between: 2:00 pm-3:30 pm and 11:00 pm to 05:00 am -Lights are turned off in the unit -Interventions including bed side procedures are put on hold unless they are urgent -Patient rounds are placed on hold -Family are allowed at the bedside as long as they are quiet -Alarms are minimized to promote a quiet environment
		Inter-professional team	Rank Process	-Attendings and residents -Attending lead rounds
			Communication	-Patient rounds -Rounds are used to educate residents -Visual cues are posted on patient room doors
			Resources	-Physician assistant -Pharmacist -Nurse manager and educator
			Nurses	-Know the cultural norms

	-Approachable -Know the patient

Table 3.

Outer Setting Patient Needs and Resources, Facilitators

Domain	Construct	Factor	Sub-factor	Variables Associated with Facilitators
Outer Setting	Patient Needs and Resources	Nurses	Bedside nurse	Spends most time with the patient
				Makes recommendations based on culture norms
				Conducts and reports the PAD score
			Charge nurses	Advocate for the patient and nurses
			Resource nurse	When available, they are a resource to help with patient care interventions
		Patient rounds	Environment	Open space that fits all members of the interprofessional team
				Available workspace
				Good visibility
			Teamwork	Good working relationship with the interprofessional team
				Identifies the underlying problem with a patient
				Used as a time to educate
			Choice of sedation	Pharmacist is a champion
				Team reviews patient's pain and medication

Table 4.

Outer setting Patient Needs and Resources: Barriers

Domain	Construct	Factor	Sub-factor	Variables Associated with Barriers
Outer Setting	Patient Needs and Resources	Roles and responsibilities	Separate professional basis	-Not everyone is on board/buy in -Frequent turnover -Not a part of the workflow -Not considered a domain of surgery -No order set to follow -Disciplines are task specific -Rotating residents
			Knowledge	-Lacking EBP about the intervention -Unknown source for IP education -Differences between discipline education
			Communication	-Unknown who is caring for the patient -Different attending each week -Schedule conflicts -Time constraints -Visual queues not used
			Patient rounds	-RN reports PAD -Missing physical therapy -Family doesn't participate
			Leadership	-Ranked based culture -Champion is the unit pharmacist
		Safety and Patient status		-Moving intubated patients -Medications for pain and sedation -Unsafe to wake patients -Acuity -Trauma -Admitted with drugs or alcohol -Psychiatric history
		Resources		-Not enough time -Not enough staff -Staff fatigue -Larger workload
		ABCEDF Intervention	Early mobility	-Mobility occurs later in admission -Requires 2-3 people -Frequency of patient care delays sessions -Limited schedule to move patients
			Family engagement	-Family dynamics -Over stimulating to the patient -Large families

Table 5.

SAQ Results (Overall means, minimum, maximum and standard deviations)

	SAQ Results			
	Minimum	Maximum	Mean	Std. Deviation
Teamwork Climate	66	100	89	9
Safety Climate	67	100	86	10
Job Satisfaction	65	100	93	9
Stress Recognition	25	100	73	21
Working Conditions	33	100	80	18
Perceptions Management	57	100	77	10

Table 6.

SAQ Domains Based on Highest and Lowest Mean Results

Highest and Lowest Means Based on SAQ Constructs					
SAQ domain	Statement	Minimum	Maximum	Mean	Std. Deviation
Job Satisfaction	I am proud to work in this clinical area.	5	5	5.0	.00
Safety Climate	I know the proper channels to direct questions regarding patient safety in this clinical area.	4	5	4.8	.43
Teamwork Climate	Nurses' input is well received in this clinical area.	4	5	4.8	.40
Teamwork Climate	It is easy for personnel here to ask questions when there is something they do not understand.	4	5	4.8	.40
Perceptions of Management	I get adequate timely information about events that might affect my work from management.	1	5	3.6	1.0
Stress Recognition	Fatigue impairs my performance during emergency situation.	1	5	3.5	1.3
Safety Climate	In this clinical area, it is difficult to discuss errors.	1	5	3.5	1.3

Table 7.

Mean Ranks and Mann-Whitney-U from the Safety Attitudes Questionnaire

SAQ Survey Responses based on Years of Experience				
	Years of experience	Mean Rank	Mann-Whitney-U	p-value
Teamwork Climate	Less than 10 years	9.11		
	11 or more years	7.71		
			26.00	.555
Safety Climate	Less than 10 years	8.56		
	11 or more years	8.43		
			31.00	.957
Job Satisfaction	Less than 10 years	9.06		
	11 or more years	7.79		
			26.50	.570
Stress Recognition	Less than 10 years	8.28		
	11 or more years	8.79		
			29.50	.830
Working Conditions	Less than 10 years	9.06		
	11 or more years	7.79		
			26.50	.585
Perceptions Management	Less than 10 years	8.06		
	11 or more years	9.07		
			27.50	.669

Figure 1 Specific Aims and Consolidated Framework for Implementation Research

Aims	Domain	Construct	Definition
Aim 1) Evaluate selected constructs from the Consolidated Framework for Implementation Research related to implementing the ABCDEF bundle in a metropolitan hospital surgical ICU using clinical ethnographic approaches, including observation and interviews	Inner Setting	Culture	Norms, values, and basic assumptions of a given organization.
Aim 2) Identify facilitators and barriers of implementation through observations and interviews. Aim 3) Explore the clinical perceptions, roles, and practices of the surgical ICU interprofessional team regarding bundle implementation using the Safety Attitudes Questionnaire	Outer Setting	Patient Needs and Resources	The barriers and facilitators to meet patient needs.
Aim 4) Integrate data obtained from observations, interviews, and surveys to develop a CFIR concept matrix for developing an intervention.	Process	Planning	Carrying out or accomplishing the implementation according to plan.

Figure 2. Observation Data Collection Template and CFIR Interview Questions

Observation template

Observation number: Date of Site Visit: Time:

Interprofessional team member (circle one): nurse, physician, pharmacist, respiratory therapist, and physical therapist

Awakening and Breathing Coordination

Observations	Stated done	Stated charted in the electronic health record	Observed
Spontaneous Awakening Trial Screen done in the last 24 hours			
Spontaneous Awakening Trial done? If not, why not			
Spontaneous Breathing Trial done? If not, why?			
SAT&SBT Coordinated/Paired			

Table adopted from http://www.icudelirium.org

Delirium Nonpharmacologic Interventions

Observations	Stated done	Stated charted in the electronic health record	Observed
Pain assessment/management			
Orientation			
Appropriate sensory stimulation: quiet room; adequate light			
Sleep			
Incorporating Families into Care			

Table adopted from http://www.icudelirium.org

Figure 2. *Continued*

Early Exercise and Mobility

Observations	Stated done	Stated charted in the electronic health record	Observed
Active Range Of Motion			
Sitting up on side of bed			
Standing			
Walking			

Table adopted from http://www.icudelirium.org

Describe the individual from the interprofessional team, their role in the surgical ICU, how they utilizes the ABCDEF bundle:

Who from the interprofessional team interacts with the patient? What are their interactions with the other members of the interdisciplinary team? How long did it last?

Did they participate in interdisciplinary team rounds? If so, what was their role, how did they contribute to the conversation, what did they communicate about the ABCDEF bundle? Who was listening?

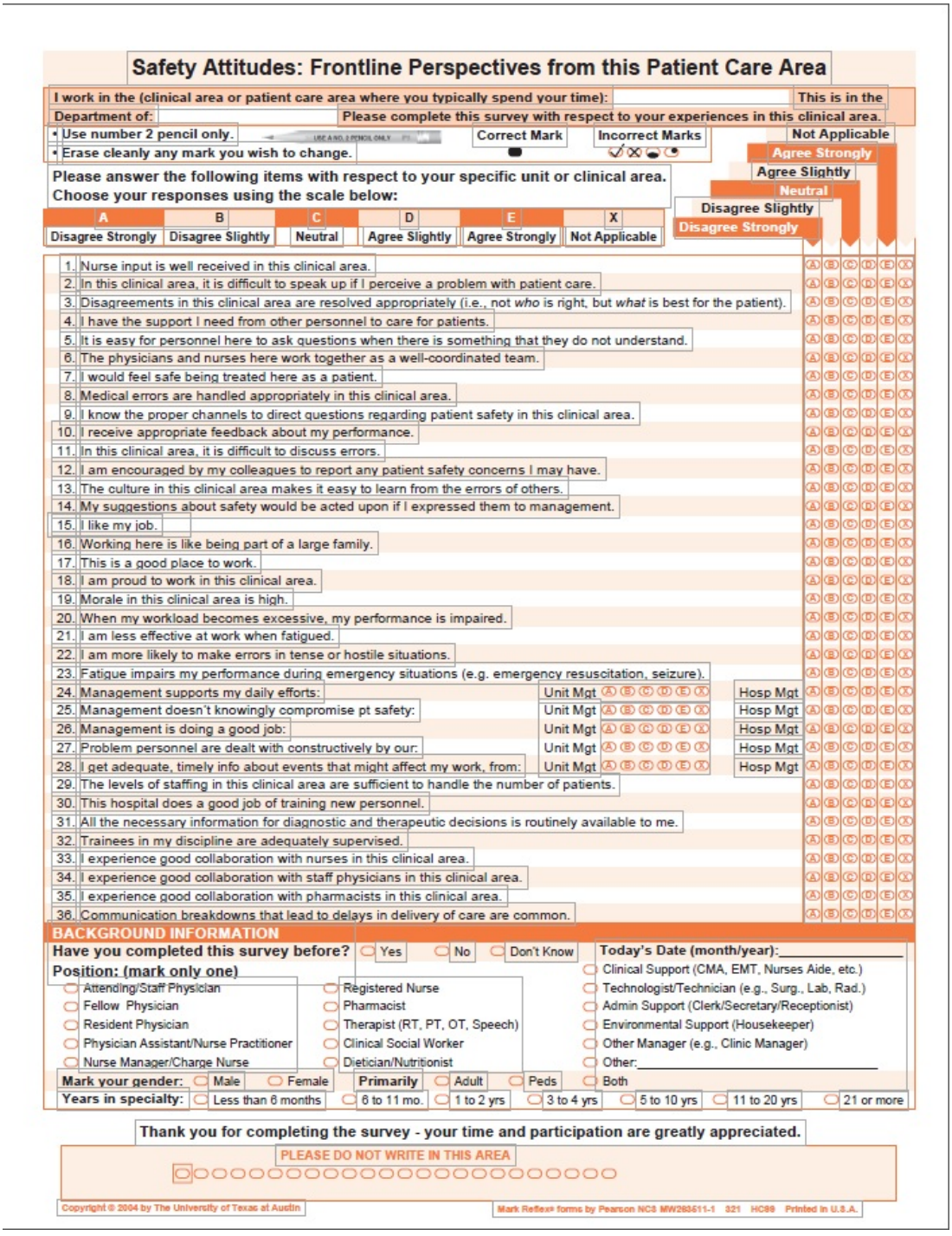
What is the physical environment for the Interdisciplinary team? What objectives, resources, technologies are in the setting?

CFIR Interview Questions

1. Inner Setting/Culture
    a. How would you describe the culture of your organization? Of your own setting or unit?
    b. Do you feel like the culture of your own unit is different from the overall organization? In what ways?
    c. How do you think your organization's culture (general beliefs, values, assumptions that people embrace) will affect the implementation of the ABCDEF bundle?

2. Outer Setting/Patient needs and resources
    a. To what extent is staff aware of the needs and preferences of the individuals being served by your organization?
    b. How well do you think the ABCDEF bundle will meet the needs of the patients in the surgical ICU?
    c. What barriers you have experienced with implementing the ABCDEF bundle?
    d. What facilitators have you experienced with implementing the ABCDEF bundle?
    e. Can you describe a specific story about your experience with the ABCDEF bundle?

Figure 3. SAQ Survey



Safety Attitudes: Frontline Perspectives from this Patient Care Area

I work in the (clinical area or patient care area where you typically spend your time): This is in the
Department of: Please complete this survey with respect to your experiences in this clinical area.

- Use number 2 pencil only. Correct Mark Incorrect Marks
- Erase cleanly any mark you wish to change.

Please answer the following items with respect to your specific unit or clinical area.
Choose your responses using the scale below:

A	B	C	D	E	X
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly	Not Applicable

Not Applicable / Agree Strongly / Agree Slightly / Neutral / Disagree Slightly / Disagree Strongly

1.	Nurse input is well received in this clinical area.		
2.	In this clinical area, it is difficult to speak up if I perceive a problem with patient care.		
3.	Disagreements in this clinical area are resolved appropriately (i.e., not *who* is right, but *what* is best for the patient).		
4.	I have the support I need from other personnel to care for patients.		
5.	It is easy for personnel here to ask questions when there is something that they do not understand.		
6.	The physicians and nurses here work together as a well-coordinated team.		
7.	I would feel safe being treated here as a patient.		
8.	Medical errors are handled appropriately in this clinical area.		
9.	I know the proper channels to direct questions regarding patient safety in this clinical area.		
10.	I receive appropriate feedback about my performance.		
11.	In this clinical area, it is difficult to discuss errors.		
12.	I am encouraged by my colleagues to report any patient safety concerns I may have.		
13.	The culture in this clinical area makes it easy to learn from the errors of others.		
14.	My suggestions about safety would be acted upon if I expressed them to management.		
15.	I like my job.		
16.	Working here is like being part of a large family.		
17.	This is a good place to work.		
18.	I am proud to work in this clinical area.		
19.	Morale in this clinical area is high.		
20.	When my workload becomes excessive, my performance is impaired.		
21.	I am less effective at work when fatigued.		
22.	I am more likely to make errors in tense or hostile situations.		
23.	Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure).		
24.	Management supports my daily efforts:	Unit Mgt	Hosp Mgt
25.	Management doesn't knowingly compromise pt safety:	Unit Mgt	Hosp Mgt
26.	Management is doing a good job:	Unit Mgt	Hosp Mgt
27.	Problem personnel are dealt with constructively by our:	Unit Mgt	Hosp Mgt
28.	I get adequate, timely info about events that might affect my work, from:	Unit Mgt	Hosp Mgt
29.	The levels of staffing in this clinical area are sufficient to handle the number of patients.		
30.	This hospital does a good job of training new personnel.		
31.	All the necessary information for diagnostic and therapeutic decisions is routinely available to me.		
32.	Trainees in my discipline are adequately supervised.		
33.	I experience good collaboration with nurses in this clinical area.		
34.	I experience good collaboration with staff physicians in this clinical area.		
35.	I experience good collaboration with pharmacists in this clinical area.		
36.	Communication breakdowns that lead to delays in delivery of care are common.		

BACKGROUND INFORMATION

Have you completed this survey before? Yes No Don't Know

Today's Date (month/year): _____

Position: (mark only one)

- Attending/Staff Physician
- Fellow Physician
- Resident Physician
- Physician Assistant/Nurse Practitioner
- Nurse Manager/Charge Nurse
- Registered Nurse
- Pharmacist
- Therapist (RT, PT, OT, Speech)
- Clinical Social Worker
- Dietician/Nutritionist
- Clinical Support (CMA, EMT, Nurses Aide, etc.)
- Technologist/Technician (e.g., Surg., Lab, Rad.)
- Admin Support (Clerk/Secretary/Receptionist)
- Environmental Support (Housekeeper)
- Other Manager (e.g., Clinic Manager)
- Other: _____

Mark your gender: Male Female **Primarily** Adult Peds Both

Years in specialty: Less than 6 months | 6 to 11 mo. | 1 to 2 yrs | 3 to 4 yrs | 5 to 10 yrs | 11 to 20 yrs | 21 or more

Thank you for completing the survey - your time and participation are greatly appreciated.

PLEASE DO NOT WRITE IN THIS AREA

Mark Reflex® forms by Pearson NCS MW283611-1 321 HC99 Printed in U.S.A.

Figure 4. Pain, Agitation, and Delirium Visual Cue

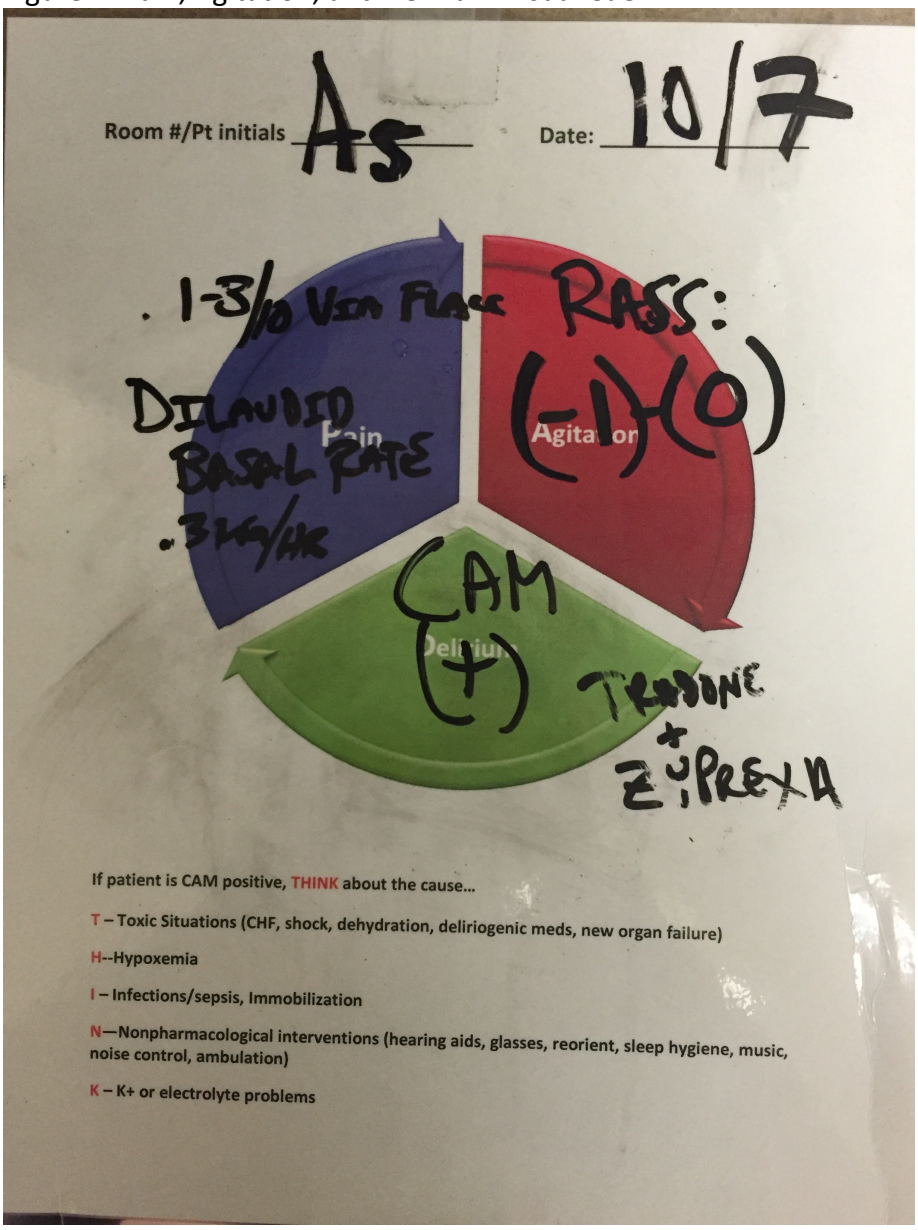


Figure 5. Consolidated Framework for Implementation Research Concept Matrix

	CFIR Domain Inner Setting: Culture	CFIR Domain Outer setting Patient Needs and Resources: Facilitators	CFIR Domain Outer Setting Patient Needs and Resources: Barriers	CFIR Domain Process: Planning
Triangulation	-ABCD-Delirium interventions are conducted -Quiet time is an additional delirium intervention -Distinct channels for patient care -Pride in the workplace	-Nurses have input -Open communication during Interprofessional rounds	-Operate in separate professional roles and responsibilities -Lacking interprofrssional development -Needs adequate and timely information about implementing initiatives -Communication, error reporting	-Integrating delirium prevention and management strategies annual training for the interprofessional team -Increase the frequency of Interprofessional Rounds -Leadership involvement -Family communication and involvement -Delirium committee
Qualitative Factors	-Spontaneous Awake and Breathing Trials -Choice of Sedation -Delirium Detection -Quiet time -Interprofessional team	-Nurses -Interprofessional Rounds	-Roles and Responsibilities -Safety and Patient status -Resources	
Quantitative Factors	-Teamwork Climate -Safety Climate -Job Satisfaction -Working Conditions	-Teamwork Climate -Job Satisfaction	-Perceptions of Management -Stress Recognition -Safety Climate	

Summary and Conclusion

This dissertation consists of three manuscripts; a concept analysis, a literature review and a mixed-method study. The first manuscript details Rodgers' Evolutionary Concept Analysis to identify attributes, antecedents, consequences, surrogate concepts, and related terms of bundled delirium care in the ICU. Identifying delirium bundle care established a conceptual definition. The second manuscript utilized the Social Ecological Model (SEM) to identify factors that prevent or facilitate delirium bundle care. Results from this literature review established a process to explore and identify the facilitators and barriers for implementing delirium bundle interventions following concepts of the SEM: behavioral determinants (individual and interpersonal), environmental factors, and community factors. Results from the second manuscript organized and evaluation of relationships of the biological, behavioral, and environmental features that relate to delirium bundle care in the ICU. The third manuscript details a Convergent Parallel Mixed Method design guided by Consolidated Framework for Implementation Research (CFIR) to explore clinical perceptions, roles, and practices of the surgical ICU interprofessional team regarding delirium bundle implementation. Results from this study identified recommendations to promote delirium bundle care in the ICU based on the ICU's culture and patient needs and resources. The information from the three manuscripts has important implications to delirium bundle care and interprofessional collaboration.

The attributes, antecedents and consequences of bundle care (manuscript 1) were identified using Rodgers' Evolutionary View of Concept Analysis. Though this method, the delirium bundle care was identified as assess, prevent, and manage pain; both spontaneous awakening trials and spontaneous breathing trials; choice of sedation and analgesia; delirium

assessment prevention and management; early mobility and exercise; and family communication and involvement or ABCDEF bundle and pain and analgesia, agitation, and delirium (PAD) guidelines (Barr et al., 2013). The ABCDEF bundle and PAD guidelines are examples of pharmacological and nonpharmacological interventions that have progressed to establish delirium bundle care in the ICU. Evidence-based practices, guidelines and a shared investment in promoting patient outcomes have been identified in this literature review. However delirium bundle care interventions are not routinely used in the ICU (Balas et al., 2014).

The Social Ecological Model (SEM) provided a framework to a systematic review to explore and identify the facilitators and barriers for implementing the ABCDEF Bundle and PAD Guidelines for managing delirium in the ICU (manuscript 2). To identify an interprofessional approach for promoting delirium bundle interventions in the current study, the following concepts of the SEM were explored: behavioral determinants (individual and interpersonal), environmental factors, and community factors. Results from this literature review found the center of the SEM that represents individual characteristics that influence behavior and the next level of the SEM, interpersonal characteristics, and the outermost level of the SEM representing the structural characteristics of the ICU were addressed in the literature. Results identified barriers such as knowledge, support, time management, and performance feedback. Facilitators were identified as daily patient rounds and a clinical champion.

The last manuscript represents the results from a mixed-method study to identify the best approaches for implementing the ABCDEF bundle from the perspectives of the interprofessional team and specific to the ICU structure and culture. This study utilized

Consolidated Framework for Implementation Research to explore the surgical culture, identify facilitators and barriers of implementing the ABCDEF bundle, and integrate the results to develop a CFIR concept matrix for developing further bundle implementation strategies. This mixed-method study showed that structural and cultural elements of an ICU need to be considered when exploring how the interprofessional team implements the ABCDEF bundle. Results from this study specified the cultural in a surgical ICU that provides a climate that supports teamwork, safety, and job satisfaction. The interprofessional team that delivers care in the surgical ICU has a rank-based process established for providing patient care. Members from the interprofessional team provide fragments of the ABCDEF bundle that were profession task specific. In addition, the interprofessional team assembled one time per week and discussed pain, agitation and delirium during interprofessional rounds. Results from the CFIR domain patient needs and resources identify factors that facilitators and hinder implementation of the ABCDEF bundle specific to the surgical ICU setting. Last, data collected from the observations and interviews, as well as statistical results, were used to identify convergent or divergent situations based on the CFIR domains inner setting, culture and outer setting patient needs and resources. Triangulating results from the qualitative and quantitative results, the researcher identified five methods to advance implementing the ABCDEF bundle in the surgical ICU. Recommendations based on the study results involve interprofessional education, increased frequency of interprofessional rounds, leadership involvement, family involvement, and a delirium committee. This study revealed interprofessional collaboration remains a gap when implementing the ABCDEF bundle.

The theoretical model and framework used in this dissertation were essential to guide and distinguish the results in the three manuscripts. Previous literature demonstrated Rodgers' Evolutionary View of Concept Analysis to advance nursing science (Tofthagen & Fagerstrom, 2010). Concept analyses from Petri (2010) and Aselage and Amella (2010) aided with the concept analysis discussed in manuscript 1. As demonstrated in manuscript 1, Rodgers' Evolutionary View of Concept Analysis has been an essential approach to nursing science and the current effort to clarify and classify the concept of delirium bundle care. The Consolidated Framework for Implementation Research was identified as a type of implementation research that focuses on the promoters and barriers of implementing a program as well as organizing constructs across theories into five domains by the Agency for Healthcare Research and Quality (L. J. Damschroder & J. C. Lowery, 2013). CFIR is the result of a meta-analysis of 19 theories or approaches to implementation research in clinical settings, resulting in constructs that can be used for evaluation of a program. CFIR has been used as a method to explore planning and evaluation of interventions in over 300 studies. Literature from Balas (2013) applied the CFIR domains the ABCDEF bundle and PAD guidelines in the ICU (Balas et al., 2013). This research study was used as a resource when developing and analyzing results in manuscript 3. The Social Ecological Model is beneficial method to contribute to the science of nursing by exploring the dynamic interrelations between individual and the environment. SEM provided a framework for manuscript 2 that identified factors that facilitate or hinder delirium bundle care in the ICU. Attention needs to be given to the implications of the SEM used in manuscript 2 as it relates to the acute care setting, more specifically the ICU setting.

There are limitations to this dissertation study. The first two manuscripts depend on literature reviews to construct a concept analysis and establish the interrelations between individual and the environment as it related to delirium bundle care in the ICU. Although previous literature established a foundation for understanding the research problem regarding ICU bundle care, the Social Ecological Model has been underutilized as a theoretical framework in the ICU environment. Also, manuscript 3 used ethnographic observations and interviews to explore how an interprofessional team delineated and designated their respective roles while using the ABCDEF bundle to care for patients. Moreover, observations of the interprofessional team in the ICU were dependent on patient care requirements that did not always include delirium interventions. This could explain why some of the interprofessional team members did not participate in interviews or complete quantitative surveys. Additionally, results from the interview were self-reported data that could contain potential sources of bias. Last, the number of participants who responded to the survey in manuscript 3 did not support statistically significant results; yet themes emerged that warrant further investigation. Despite these limitations, this compendium of studies contributes to the literature on delirium bundle care in the ICU.

The contributions of this dissertation are significant because interprofessional collaboration remains a gap when implementing the ABCDEF bundle. This dissertation bridges the gap by providing guidance towards implementing the ABCDEF bundle by identifying that bundle care is provided in a parallel process and is predominantly the responsibility of nurses. The ABCDEF bundle requires collaboration from an interprofessional team and is beyond individual profession-specific tasks. Contributions from this dissertation bridges the gap of

delirium care in the ICU by conceptualizing delirium bundle care, categorizing facilitators and barriers of interprofessional delirium care following concepts of the SEM, identifying facilitators and barriers for implementation of the ABCDEF bundle and establishing a CFIR concept matrix to further direct implementing delirium bundle care by an interprofessional team. Factors identified in this dissertation should be considered to bridge the gap of interprofessional collaboration and successful implementation the ABCDEF bundle into everyday care to provide optional patient outcomes.

Further research needs to emphasize the importance of interprofessional collaboration when implementing delirium bundle care in the ICU. In addition, further research should explore the methods identified in the CFIR matrix from manuscript 3; interprofessional education, increase frequency of interprofessional rounds, leadership involvement, family involvement and a delirium committee. Although these recommendations are based on previous clinical trials, feasibility of the interventions needs to be explored in the setting and culture of the surgical ICU.

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APPENDIX A
The IRB approval letter for the study reported in manuscript 3

Institutional Review Board for Human Research (IRB)
Office of Research Integrity (ORI)
Medical University of South Carolina

Harborview Office Tower
19 Hagood Ave., Suite 601, MSC857
Charleston, SC 29425-8570
Federal Wide Assurance # 1888

APPROVAL:
This is to certify that the research proposal **Pro00045364** entitled:
A Mixed Method Study of Interprofessional Perceptions, Roles, and Practices of Delirium in Intensive Care Units: The ABCDEF Bundle

Submitted by: **Jama Goers**
Department: **Medical University of South Carolina**

For consideration has been reviewed by **IRB-I - Medical University of South Carolina** and approved with respect to the study of human subjects as adequately protecting the rights and welfare of the individuals involved, employing adequately methods of securing informed consent from these individuals and not involving undue risk in the light of potential benefits to be derived therefrom. Additionally, the Institutional Review Board for Human Research (IRB) recommends approval of the investigator's request for Waiver of Signed Consent in accordance with 45 CFR 46.117(c)(1),(2) because the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality and/or because the research presents no more than minimal risk and involves no procedures for which written consent is normally required outside of the research context. No IRB member who has a conflicting interest was involved in the review or approval of this study, except to provide information as requested by the IRB.

Original Approval Date: **9/3/2015**
Approval Expiration: **9/2/2016**

Type: **Expedited**

Chairman, **IRB-I - Medical University of South Carolina**
Mark Hamner*

Statement of Principal Investigator:

As previously signed and certified, I understand that approval of this research involving human subjects is contingent upon my agreement:

1. To report to the Institutional Review Board for Human Research (IRB) any adverse events or research related injuries which might occur in relation to the human research. I have read and will comply with IRB reporting requirements for adverse events.
2. To submit in writing for prior IRB approval any alterations to the plan of human research.
3. To submit timely continuing review reports of this research as requested by the IRB.

4. To maintain copies of all pertinent information related to the research activities in this project, including copies of informed consent agreements obtained from all participants.
5. To notify the IRB immediately upon the termination of this project, and/or the departure of the principal investigator from this Institution and the project.

∗ ***Electronic Signature****: This document has been electronically signed by the IRB Chairman through the HSSC eIRB Submission System authorizing IRB approval for this study as described in this letter.*

APPENDIX B.
Approval letter from the study site

DENVER HEALTH
Level One Care for ALL

Sponsored Programs & Research Office

655 Broadway, 9th floor MC 1925
Denver, CO 80203-3477
Office:(303) 602-7048 Fax:(303) 602-7078
E-Mail: sparo@dhha.org

September 2, 2015

To Katherine D. Bright,
IRB, Office of Research Integrity
Medical University of South Carolina
19 Hagood Ave
Charleston, SC 29407

RE: IRB submission for Jama Goers, *A Mixed Method Study of Interprofessional Perceptions, Roles, and Practices of Delirium in Intensive Care Unit: The ABCDEF Bundle*

I am writing to verify that Jama Goers has been approved to conduct her dissertation research study at Denver Health and Hospital Authority in the Surgical Intensive Care Unit. The research proposal has been reviewed and approved by Denver Health's Sponsored Programs and Research Office (SPARO). Please feel free to contact me if you have any questions or concerns.

Sincerely,

Amanda Breeden, MA, CRA
Interim Director, Sponsored Programs and Research Office
Phone: 303-602-7046
Email: Amanda.Breeden@dhha.org

APPENDIX C.
Recruitment flyer for the study reported in manuscript 3

MUSC
COLLEGE of NURSING

VOLUNTEERS WANTED
FOR A RESEARCH STUDY

A Mixed Method Study of Interprofessional Perceptions, Roles, and Practices of Delirium in Intensive Care Unit: The ABCDEF Bundle

We are conducting a research study to determine how the interprofessional team (comprised of nurses, physicians, pharmacists, respiratory and physical therapists) delineates and designates roles of The **A**wakening and **B**reathing trials assessment of the **C**hoice of sedation, delirium **D**etection, **E**arly Mobility and Exercise and **F**amily engagement (ABCDEF) bundle while caring for patients in the surgical ICU.

To be eligible for this study you must:

- Be 18 years of age or older.
- A member of the interprofessional team currently working in the intensive care unit with an assigned role in the ABCDEF bundle, such as a nurse, physician, pharmacist, respiratory therapist, or physical therapist.

Participation in this study includes:

- You will be observed for 1 hour providing care to a patient in the surgical ICU.
- You will be asked to complete a 15-minute interview answering questions about the ABCDEF bundle that will be audio recorded.
- After the interview you will be asked to complete a short survey. The survey will take 5 minutes for you to complete.

Participating in this study should not put you at risk of harm and you are not obligated to participate. While there is no direct benefit to participate, the knowledge gained is hoped to help develop an intervention designed to promote effective implementation of the ABCDEF delirium bundle as utilized by the interprofessional ICU team.

Contact Information:
To find out more about this study, contact Jama Goers at
goers@musc.edu or 720-570-6071

APPENDIX D.
Data collection schedule for study reported in manuscript 3

A Mixed Method Study of Interprofessional Perceptions, Roles, and Practices of Delirium in Intensive Care Unit: The ABCDEF Bundle

Data Collection Schedule

Researcher: Jama Goers BSN, RN
goers@musc.edu 720-570-6071
Medical University of South Carolina

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Week 1 **9/14/2015-9/18/2015**	***Post flyers and Inform participants at staff meetings and department huddles***						
Week 2 **9/20/2015-9/26/2015** obs 0700-1900	Day 1: 3 observations 1600-1900	Day 2: 2 observations 1400-1600	Data not collected	Day 3: 3 observations 0900-1200	Data not collected	Data not collected	Data not collected
follow up after shift Interview	1930	1930	N/A	1930	N/A	N/A	N/A
Week 3 **10/4/2015-10/10/2015** obs 0700-1900obs AND 1900-0700	Data not collected	Data not collected	Data not collected	Data not collected	Data not collected	Day 4: 6 observations 0900-1500	Day 5: 4 observations 0300-0700
follow up after shift Interview	N/A	N/A	N/A	N/A	N/A	1930	730
Week 4 **10/11/2015-10/17/2015** obs 0700-1900obs AND 1900-0700	Day 6: (2.5) observations21:00-23:30	Day 7: 4 observations 0800-1200	Data not collected	Data not collected	Day 8: 3 observations 1200-1630	Day 9: 5 observations 0900-1400	Data not collected
follow up after shift Interview	730	1930	N/A	N/A	1930	0730 (following day)	N/A
Week 5 **10/18/2015-10/24/2015** obs 0700-1900obs AND 1900-0700	Data not collected	Day 10: 4 observations 0000-0500	Data not collected	Data not collected	Data not collected	Day 11: 3 observations 0800-1100	Data not collected
follow up after shift Interview	N/A	730	N/A	N/A	N/A	0730 (following day)	N/A