

University of Louisville

## ThinkIR: The University of Louisville's Institutional Repository

---

Doctor of Nursing Practice Papers

School of Nursing

---

8-2022

### Reducing delirium in medical intensive care unit.

Hope Kathryn Eppley

University of Louisville, hope.eppley@yahoo.com

Follow this and additional works at: <https://ir.library.louisville.edu/dnp>



Part of the [Nursing Commons](#)

---

#### Recommended Citation

Eppley, Hope Kathryn, "Reducing delirium in medical intensive care unit." (2022). *Doctor of Nursing Practice Papers*. Paper 38.

Retrieved from <https://ir.library.louisville.edu/dnp/38>

This Doctoral Paper is brought to you for free and open access by the School of Nursing at ThinkIR: The University of Louisville's Institutional Repository. It has been accepted for inclusion in Doctor of Nursing Practice Papers by an authorized administrator of ThinkIR: The University of Louisville's Institutional Repository. This title appears here courtesy of the author, who has retained all other copyrights. For more information, please contact [thinkir@louisville.edu](mailto:thinkir@louisville.edu).

Reducing Delirium in Medical Intensive Care Unit

by

Hope K. Eppley

Paper submitted in partial fulfillment of the  
requirements for the degree of

Doctor of Nursing Practice

School of Nursing, University of Louisville

August 11, 2022

**Dr. Candace C. Harrington** Digitally signed by Dr. Candace C. Harrington  
Date: 2022.08.10 19:58:11 -04'00'  
Adobe Acrobat version: 2022.002.20191

---

Signature DNP Project Chair Date

**Nancy Kern** Digitally signed by Nancy Kern  
Date: 2022.08.10 11:33:45 -04'00'

---

Signature DNP Project Committee Member Date

---

Signature Program Assistant Dean Date

---

Signature Associate Dean for Academic Affairs Date

### Abstract

**Background:** Delirium in MICUs (medical intensive care units) is an acquired and detrimental condition patients often seen in MICU. This condition has a high prevalence and can result in increased risk of death, comorbidities and length of hospital stay. Prevention is critical to avoid an increased risk of mortality.

**Aim:** The purpose of quality improvement (QI) project was to implement a delirium bundle in a medical intensive care unit (MICU) to reduce delirium by 20% over an 8-week period.

**Method:** This QI project utilized the IHI rapid cycle quality improvement model, using two cycles of the Plan-Do-Study-Act (PDSA) model to implement the (ABCDEF) A2F delirium bundle. Non-mechanically ventilated patients had 100% chart audits. Two cycles were completed at 4-week intervals using rapid cycle quality improvement measures.

**Results:** The results of the QI project demonstrated that the use of the A2F bundle and the accurate use of a delirium screening tool decreased the rate of delirium in MICU patients by 40% in 8 weeks.

**Implications:** Nurses acquired an advanced training in ICU delirium prevention and identification. Healthcare costs will decrease as the number of patients who were diagnosed with ICU delirium decreased. Society will be positively affected as negative consequences of MICU delirium will be diminished.

Keywords: *Delirium assessment, delirium bundle, delirium-screening scale, critical care*

## Table of Contents

<b>Reducing Delirium MICU Delirium</b> .....	5
<b>Background</b> .....	5
<b>Problem</b> .....	7
<b>Definition of Terms</b> .....	8
<i>Delirium</i> .....	8
<i>A2F</i> .....	8
<i>DPB</i> .....	8
<i>CAM-ICU</i> .....	8
<i>Anticholinergic Burden</i> .....	8
<i>Prevention Measures</i> .....	9
<b>Significance</b> .....	9
<b>Measurement</b> .....	10
<i>Outcome Measurements</i> .....	11
<b>Environment</b> .....	11
<b>Principles</b> .....	12
<i>Plan for Notification</i> .....	12
<b>Culture</b> .....	12
<i>Facilitators for Project Implementation</i> .....	13
<i>Barriers to Project Implementation</i> .....	13
<b>Feasibility</b> .....	13
<b>Sustainability</b> .....	13
<b>Synthesis of the Literature</b> .....	13
<b>Gaps</b> .....	16
<b>Rationale for the Project</b> .....	17
<b>Pre-Implementation Phase (Needs Assessment)</b> .....	17
<b>Specific Aims</b> .....	18
<b>Method</b> .....	18
<b>Conceptual Model</b> .....	19
<b>First Cycle PDSA</b> .....	19
<i>Plan</i> .....	19
<i>Do</i> .....	20
<b>Data Collection</b> .....	<b>Error! Bookmark not defined.</b>
<i>Study</i> .....	21

**Results PSDA 1.....Error! Bookmark not defined.**  
*Act*..... 22  
**Second Cycle PDSA ..... 22**  
*Plan*..... 22  
*Do*..... 22  
**Data Collection ..... 23**  
*Study*..... 23  
**Results PDSA 2.....Error! Bookmark not defined.**  
*Act*..... 23  
**Ethics and Permissions ..... 24**  
**Implications ..... 24**  
**Dissemination Plan..... 25**  
**Discussion..... 26**  
 Summary.....**Error! Bookmark not defined.**  
 Interpretation ..... 26  
 Limitations.....**Error! Bookmark not defined.**  
**References ..... 29**  
**Appendix A ..... 34**  
**Appendix B.1 ..... 39**  
**Appendix B.2 ..... 40**  
**Appendix B.3 ..... 41**  
**Appendix C ..... 42**  
**Appendix D ..... 43**

## **Reducing Delirium MICU Delirium**

### **Background**

Delirium, defined by the American Psychiatric Association (2013), is an acute impairment in global cognitive function that develops within hours to days, and typically fluctuates throughout the course of the day. Three separate types of delirium are hyperactive, hypoactive, and mixed, with hyperactive being the most recognizable with symptoms such as agitation, restlessness, and confusion (Association of American Family Physicians, 2020).

Delirium increases hospital length of stay, as well as associated secondary complications, such as Post Traumatic Stress Disorder and reintubation for previously mechanically ventilated patients (Mulkey et al., 2019, [B, III]). In adults over the age of 65, delirium is considered a clinical emergency in 89% when admitted into acute care, such as an ICU who are 12 times more likely to develop dementia (Nithingham & Caplan, 2021). ICU delirium is especially difficult to diagnose when the patient has an underlying neurocognitive disorder, and often goes unrecognized.

The COVID-19 pandemic introduced further barriers when caring for patients in the ICU including resource shortages, isolation precautions, and COVID-19 related comorbidities (Kotfis et al., 2020). Patients infected with COVID-19 can have central nervous system involvement displaying symptoms such as dizziness, headache, impaired consciousness, ataxia, cerebrovascular disease, and seizures (Kotfis et al., 2020, [A, III]). COVID-19 related CNS involvement is a major contributing factor to the development of delirium (Kotfis et al., 2020). Possible contributing factors include peripheral organ system insufficiency, prolonged mechanical ventilation time, sedation, release of inflammatory central nervous system (CNS) mediators, and hypoxemia (Kotfis et al., 2020).

Delirium guidelines address patient comfort and safety including pain, sedation, delirium, and early mobility to decrease and better manage delirium (Devlin et al., 2018). The A2F bundle has been implemented in multiple research studies. The delirium prevention bundles interventions include use of sedation cessation, pain management, sensory stimulation, early mobilization, and sleep promotion (Smith et al., 2017). The DPB was only used in one published research study (Smith, et al., 2017).

Two delirium prevention bundles were identified through the literature search, the ABCDEF (A2F; Mikkelsen & Devlin, 2021) bundle and the delirium prevention bundle (DPB; Smith et al., 2017). The A2F bundle stands for: assess, prevent, and manage pain; spontaneous awakening trials (SATs) and spontaneous breathing trials (SBTs); choice of sedation/analgesia; delirium monitoring and management; early mobility and exercise; and family engagement and empowerment (Devlin et al., 2018).

Both the A2F bundle and DPB interventions were based on the Society of Critical Care Medicine's clinical practice guideline for ICU patients (Devlin et al., 2018). The implementation of the A2F delirium bundle showed a significant decrease in delirium among ICU patients, especially under the age of sixty-four years old (Bounds et al., 2016, [B, III]; Pun et al., 2019; Smith et al., 2017). The addition of the A2F bundle significantly increased patient odds of survival when all bundle components or partial bundle components were utilized (Barnes-Daly et al., 2017, [A, III]; Pun et al., 2019).

The Confusion Assessment Method for the Intensive Care Unit (CAM-ICU; Ely et al., 2002), a screening tool to assess delirium measured the development of delirium in ICU patients, including patients who are on mechanical ventilation and are limited in their capacity to communicate (Ely & T. Pun, 2002). The CAM-ICU contains four diagnostic feature areas: acute onset or fluctuating course, inattention, altered level of consciousness, and disorganized thinking

(Ely & T. Pun, 2002). A positive delirium diagnosis is identified when Feature 1 and Feature 2 and either Feature 3 or Feature 4 exist (Ely & T. Pun, 2002).

The A2F bundle had established validity or reliability research published and has shown a positive impact on reducing ICU delirium (Bounds et al., 2016; Pun et al., 2019; Smith et al., 2017). High interrater reliability ratings were found using Kappa statistics (0.84-0.95) for the CAM-ICU positive scores with values of 0.79 indicating adequate interrater reliability (Ely et al., 2001b; McHugh, 2012). Across studies, CAM-ICU sensitivity (95-100%) and specificity (89-93%) indicated that the CAM-ICU will correctly identify true positives and true negatives for delirium assessment. Only one out of three nurses or providers were able to accurately identify delirium in patients without the use of an evidence-based delirium screening tool (Barr et al., 2013, [B, III]).

### **Problem**

Delirium in intensive care settings significantly increased the patient's risk of death by 10% and increased healthcare costs averaging \$17,838 (95% confidence interval, \$11,132–\$23,497) (Kram, 2015; Vasilevskis et al., 2018). One MICU in a metropolitan hospital had a 50% incidence of delirium with opportunities to improve the use of delirium assessments with primary and secondary prevention measures to improve patient outcomes over the prior six-months. For intensive care unit patients, delirium occurred in approximately 33% of all patients and 80% of patients who were mechanically ventilated (Spiegelberg et al., 2020). Delirium in ICUs was identified in 45-84% of patients with COVID-19 infections (Kotfis et al., 2020). The high prevalence of delirium in the ICU presents an opportunity for practice change to improve patient outcomes. Evidence-based nursing intervention bundles consisting of key strategies to prevent delirium in patients who were mechanically ventilated and non-mechanically ventilated were analyzed.



## **Definition of Terms**

### ***Delirium***

The diagnostic criteria for delirium includes an acute onset in hours to days, disturbance in attention and arousal, with an additional disturbance on one or more areas of cognition – memory deficit, disorientation, language, visual spatial ability, or perception different from the patient’s baseline. (American Psychiatric Association, 2013).

**Hypoactive.** A state of delirium exhibiting symptoms of motor retardation, apathy, slowed speech, and a sedated appearance (van Velthuisen et al., 2018, [B, III]).

**Hyperactive.** A state of delirium exhibiting symptoms of agitation, restlessness, and occasionally aggressiveness (van Velthuisen et al., 2018, [B, III]).

**Mixed.** Combination of hypoactive and hyperactive symptoms (van Velthuisen et al., 2018, [B, III]).

### ***A2F***

The ABCDEF bundle is a multifaceted bundle of nursing interventions aimed at decreasing the likelihood of patients acquiring MICU delirium (Mikkelsen & Devlin, 2021, [A, I]).

### ***DPB***

Delirium prevention bundle. A multifaceted bundle consisting of nursing interventions aimed at decreasing MICU delirium in patients (Smith et al., 2017, [B, III]).

### ***CAM-ICU***

Confusion Assessment Method for the Intensive Care Unit. Screening tool used to assess for delirium in MICU patients (Ely & T. Pun, 2002, [A, III]).

### ***Anticholinergic Burden***

In patients with delirium, the neurotransmitter acetylcholine is impaired, implicating functions such as sleep, attention, and memory (Egberts et al., 2021 [A, I]). Anticholinergic medications cause a cholinergic deficiency, blocking the effects of acetylcholine (Egberts et al., 2021 [A, I]). This places the patient at a higher risk of developing delirium (Egberts et al., 2021 [A, I]).

### ***Prevention Measures***

**Primary Prevention Measures.** Prevention measures taken to maintain wellness and prevent disease or injury prospectively in those who are vulnerable (Kisling, 2021).

**Secondary Prevention Measures.** Prevention measures taken to detect disease states early on and reduce the impact of disease or injury that is current (Kisling, 2021).

**Tertiary Prevention Measures.** Prevention measures to lower the impact of chronic illness or ongoing injury that has lasting effects with the use pharmacologic agents, such as, typical and atypical antipsychotics and benzodiazepines (Kisling, 2021).

### **Significance**

Delirium in medical intensive care units (MICU) is an acquired and detrimental condition patients often seen in MICU. This condition has a high prevalence and can result in increased risk of death, comorbidities and length of hospital stay (Kram, 2015). Prevention is critical to avoid an increased risk of mortality. Delirium occurs in about 50-70% of hospitalized geriatric patients and can go underrecognized and untreated in around 84% of patients (Mulkey et al., 2019). Predisposing risk factors for delirium include age greater than sixty-five years old, trauma, metabolic imbalances, sepsis, history of dementia, and use of delirium producing medications (Devlin et al., 2018; Spiegelberg et al., 2020, [B, III]). High risk medications, such as opioids, benzodiazepines, and medications with high anti-cholinergic burden can cause

delirium, especially in older adults due to pharmacodynamics (Devlin et al., 2018; Spiegelberg et al., 2020).

### **Measurement**

The quality improvement project, conducted by the DNP student (hereafter program director) intended to eliminate waste by improving basic tasks already in place dayshift/nightshift of the A2F bundle. The checklist was kept near the nurses' station computers and patient rooms as reminders. The work environment was changed to create a specified time to automatically open patient blinds and turn on lights in the morning to help patients orient to time of day. Specific patient exceptions were noted. Patient-centered care precluded specific times of day to turn off TV's, close blinds, turn down lighting to help orient patients to time of day and prepare them for sleep. Nurses were instructed to give their patients periods of quiet time for uninterrupted sleep during the night, if feasible.

Workflow was improved by placing a space on the nursing handoff sheet that specifically addressed the patient's mental status, pertaining to delirium, and whether they were at risk for delirium. Patient assignments were attempted to be made so the nurse caring for two patients would have similar tasks to complete during the shift and improve workflow.

Time management was intended to be impacted by educating nurses on the importance of completing delirium assessments early in the shift to help set the stage of the rest of the shift depending on the results of the nurse's initial assessment. If ICU delirium could be identified in patients at the beginning of the shift, this was intended to help nurses plan their work around how to feasibly accomplish all necessary tasks for that shift. Nurses were also educated on bundling of bundle components while in the patient's room to cluster care.

Nurses were encouraged to use the delirium bundle chart checklist while in the room with the patient to not miss any components. A rapid recall sheet was created and placed in each patient room to help remind nurses of all steps involved in the CAM-ICU assessment tool.

### ***Outcome Measurements***

The key indicators used to evaluate the outcomes for this quality improvement project:

- CAM-ICU completion rate
- Appropriate notification of provider for positive CAM-ICU
- Documentation of primary prevention measures
- Documentation of secondary prevention measures
- Identification of high-risk medications (i.e., psychotropic [antipsychotic] or benzodiazepines)
- Diagnosis of delirium during current admission

These key indicators were documented based on chart audits. The A2F bundle elements and CAM-ICU scores determined whether the A2F bundle decreased the number of patients experiencing delirium symptoms.

### **Environment**

Purpose, principles, processes, people, and performance were important to help identify facilitators and barriers for positive practice change. (Barach & Johnson, 2006). The metropolitan health system where this project was implemented employs more than 10,000 highly skilled health professionals. The institution's stated mission was to

Deliver patient-centered care to each and every patient-each and every day. We intended to build upon a rich history of innovation and community service to improve the lives of those in their care with exceptional, compassionate, and high-quality medical care.

The Health System's vision is to give patients and families the highest medical care, have providers and health care professionals collaborate to provide the highest medical care, and to hire employees who strive for constant improvement.

**Principles**

The metropolitan health system was a fully integrated regional academic health system consisting of five hospitals, four medical centers, one rehabilitation center and one cancer care center. The four core principles of the health system were to demonstrate integrity and character, achieve outstanding results, inspire, and develop people, and lead innovation and positive change. These values were the guiding principles of the health system and how its employees were expected to conduct business. The health system has an inclusivity and equity culture to prevent discrimination based on race, ethnicity, sex, religious preferences, or disabilities and holds all employees to this standard.

***Plan for Notification***

Stakeholders (Chief Nursing Officer [CNO], unit manager, quality improvement [QI] Director) were notified through email about the intended QI project. The stakeholders were included in the quality improvement project implementation plan. Staff were notified through fliers posted throughout the unit and during shift change.

**Culture**

The intensive care unit where the practice change took place is a ten-bed unit, consisting of five nurses, one nursing assistant, and one-unit secretary when fully staffed per shift. Staffing during the implementation time was critically low due to a lack of nurses. The unit nurses have a wide range in years of experience including those who have worked on this unit for over thirty years, as well as new nurses. The turnover rate for nurses was low but has increased since the COVID-19 pandemic, losing around one staff nurse per month. Travel nurses rotated on the unit for six week increments during the time of the QI project, and there were one to two staffed per shift. Types of patients admitted to the specific MICU widely range in diseases and diagnoses such as sepsis, respiratory failure, overdose, GI bleeds, and traumas.

***Facilitators for Project Implementation***

Facilitators for project implementation include nursing staff, unit staff, unit Nursing Manager, QI Director, nursing educators, and the CNO. Patients and families had the ability to be facilitators if they were able to positively reinforce the evidence-based recommendations to prevent ICU delirium.

***Barriers to Project Implementation***

External barriers for project success included the use of various travel nurses and staff who were resistant to change. Internal barriers included nursing staffs' resistance to change, lack of available funding for project, lack of time for proper training of staff and patient and family resistance.

**Feasibility**

Costs associated with project implementation included the cost of training staff, and the cost of training materials, including paper fliers/handouts.

**Sustainability**

Changes in practice appeared to be accepted by staff as the delirium rate decreased after QI project implementation. Stakeholders will continue the QI project as it has been adapted into daily routine. Upper management will use the QI project on other ICUs as it has shown positive outcomes.

**Synthesis of the Literature**

Databases used to gather relevant literature on the chosen topic included PubMed and Google Scholar. The following search terms were used to identify the most relevant articles pertaining to the chosen topic on Google Scholar: ICU delirium AND quality improvement AND bundles AND "clinical practice" AND "nursing interventions". MeSH terms used in the search on PubMed included: (("ICU"[MeSH Terms] AND "delirium"[MeSH Terms] AND

“improvement”[MeSH Terms] AND “bundle”[MeSH Terms]. Once searched, stipulations of only full-text articles and English language were added.

The search performed on Google Scholar resulted in two hundred and sixty-four articles published from 2016 until present, all in English. This search was further broken down to the year 2020, resulting in 36 articles. A total of eight articles were chosen from the 36 based on relevance to the chosen topic: nursing prevention measures for ICU delirium. Five articles were removed from the total eight because only mechanically ventilated patients were included in the research study. Two more articles were removed because they were summaries of evidence.

The search performed on PubMed resulted in twenty-five articles published from 2016 to present. All twenty-five articles were in English and full text. Four articles were chosen out of the twenty-five based on relevance to the chosen topic: nursing prevention measures for ICU delirium. Exclusion of summaries of evidence and inclusion of patients who were not mechanically ventilated were other factors in the final chosen articles.

An updated literature search was performed prior to proposal submission. Searches were performed on PubMed and Google Scholar as previously completed with the inclusion of only articles published in 2021. Updates were completed as necessary, and two articles from 2021 were included.

In articles reviewed (Appendix A), the prevalence of delirium among ICU patients significantly decreased with the addition of an ICU delirium bundle (Bounds et al., 2016; Pun et al., 2019; Smith et al., 2017; Tonna et al., 2021 [II, B]). Barnes-Daly et al. (2017) and Pun et al. (2019) found that implementation of the A2F bundle showed a significant increase in patient odds of survival when using all bundle components. To use all A2F bundle components the patient must be mechanically ventilated. Patients not on mechanical ventilation, partial bundle components were used (Barnes-Daly et al., 2017). Partial bundle implementation does not

include SBTs, or SATs, or a choice of sedation/analgesia components due to patients not being on mechanical ventilation. Partial bundle implementation for non-mechanically ventilated patients also identified significant increased odds of survival (Barnes-Daly et al., 2017).

Coma prevalence significantly decreased with the implementation of the A2F bundle in mechanically ventilated patients (Lee et al., 2020, [B, III]; Pun et al., 2019). Non-pharmacologic interventions for pain were priority over pharmacologic measures that were known to be delirium inducive. Medications such as benzodiazepines, opioids, and sedatives should be avoided if possible, however, pain assessment is a high priority in both bundles and should be assessed and treated appropriately (Lee et al., 2020).

The odds of developing delirium while in physical restraints were 2.82 times higher than patients not physically restrained (Smith et al., 2017). The use of the A2F bundle showed a significant decrease in physical restraint use among patients (Pun et al., 2019). The DPB did not find a significant decrease in restraint use after bundle implementation (Smith et al., 2017).

Pain was more frequently reported as the use of the A2F bundle increased and the use of analgesic medications increased with bundle compliance (Bounds et al., 2016; Pun et al., 2019). Suggested reasons for this outcome include an increased number of pain assessments and increased patient mobilization (Pun et al., 2019).

Strengths found across all study designs included having been published within the past five years and having rigor of good to high quality across all bundles (Barnes-Daly et al., 2017; Bounds et al., 2016; Lee et al., 2020; Pun et al., 2019; Smith et al., 2017; Sosnowski et al., 2021 [I]). Large and diverse patient populations of more than six thousand were found in multiple studies (Barnes-Daly et al., 2017; Pun et al., 2019). Small study populations with low diversity were found in four of the research studies (Bounds et al., 2016; Lee et al., 2020; Smith et al.,



2017). Short study time frames were also a weakness found in multiple studies (Bounds et al., 2016; Lee et al., 2020).

One research study used a randomized controlled study design to study the effectiveness of the A2F bundle on patients who become delirious in the ICU and their functional outcomes and quality of life (Sosnowski et al., 2021). The results of this study have not yet been disseminated (Sosnowski et al., 2021). This is a weakness among the entire body of research on ICU delirium bundles as this is the only randomized control trial to date.

All studies reviewed were either a prospective cohort design or retrospective cohort design, apart from one randomized control trial that has not yet published results (Barnes-Daly et al., 2017; Bounds et al., 2016; Lee et al., 2020; Pun et al., 2019; Smith et al., 2017; Sosnowski et al., 2021). The many parts associated with an ICU delirium bundle make rigorous study protocols difficult to monitor and follow. This is a weakness among the entire body of research as many parts of the bundle were subjective and require different healthcare team members to complete.

Charting is another important facet for ICU delirium bundle effectiveness. All studies required gathering data from patient charts to identify outcomes associated with the implementation of bundle components (Barnes-Daly et al., 2017; Bounds et al., 2016; Lee et al., 2020; Pun et al., 2019; Smith et al., 2017). If charting was not completed correctly then reported outcomes could be skewed or incorrect.

### **Gaps**

The most prominent gap found across the entire body of ICU delirium bundle research is the lack of distinctive delirium bundles. The A2F bundle is the most widely studied bundle, with the DPB being found in only one research study (Barnes-Daly et al., 2017; Bounds et al., 2016; Lee et al., 2020; Pun et al., 2019; Smith et al., 2017). Although the A2F bundle has been the

most studied delirium prevention bundle, it is not widely accepted in everyday medical practice. This identifies a need for education and implementation within healthcare systems to prevent delirium in patients.

A gap found specifically within the A2F bundle is the complete lack of research on family engagement. Multiple studies did not include family as part of the ICU delirium prevention bundle (Bounds et al., 2016; Lee et al., 2020). Multiple other studies included family engagement as part of the multifaceted bundle, however, did not provide any data pertaining to that specific area (Barnes-Daly et al., 2017; Pun et al., 2019). Family engagement is critical to delirium reduction and a missing component that is complicated by COVID-19 visitation restrictions. The intent of all bundles is to prevent delirium, as primary prevention is the only effective management technique that improves morbidity and mortality, along with demonstrated screening tools, such as the CAM-ICU.

### **Rationale for the Project**

Delirium was identified by the nursing staff in a metropolitan hospital MICU as significantly higher than national average (33%; (Spiegelberg et al., 2020). Prior to this quality improvement initiative, unit staff were not charting CAM-ICU scores according to hospital standards, which was once per nursing shift and if the patient had a change in mental status.

The purpose of quality improvement project was to implement a delirium bundle in a medical intensive care unit (MICU) to reduce delirium by 20% over an 8-week period. Charting one CAM-ICU assessment along with primary and secondary delirium prevention interventions were priority. These priorities were congruent with The Health System's mission and values to provide the highest quality of care to patients.

### **Pre-Implementation Phase (Needs Assessment)**

Baseline data was collected on 20 patients ( $N = 20$ ) that were not on mechanical ventilation prior to the initiation of the QI project using chart audits. Problem areas included the use of the CAM-ICU at 30% ( $n = 6$ ) compliance rate, the use of secondary prevention measures at 25% ( $n = 5$ ) compliance rate, and use of high-risk medications (opiates, benzodiazepines, and high cholinergic burden medications) prescribed in 80% ( $n = 16$ ) of the patients audited. These demonstrate a need for change in delirium prevention and care. Although primary prevention measures had an 85% ( $n = 17$ ) compliance rate, the population had a 50% ( $n = 10$ ) development of ICU delirium while in the MICU. The baseline population was 60% male ( $n = 12$ ), 60% Caucasian ( $n = 12$ ) and 35% Black ( $n = 7$ ), and 5% Latino ethnicity ( $n = 1$ ). Percentage of patients aged 65 and older was 60% ( $n = 12$ ).

### **Specific Aims**

The specific aim of this quality improvement QI project was exceeded in the MICU setting. At week four, delirium was reduced by 10%. A second PDSA cycle resulted in a 40% reduction in delirium diagnoses at eight weeks post implementation of the A2F delirium bundle.

### **Method**

Healthcare is constantly evolving to utilize the most up to date evidence-based practices and improve processes. Quality improvement processes, such as the Model for Improvement process, tests change within the work environment to determine if the change provides an improvement on a small scale prior to expansion through the system (Institute for Healthcare Improvement, 2021). The Institute for Healthcare Improvement (IHI) Model for Improvement was chosen to accelerate success for the quality improvement project (IHI, 2022) (Appendix B.1). Data collected from patient chart audits included all primary and secondary measures implemented, bundle components implemented, CAM-ICU scores, whether a physician was notified of positive CAM-ICU scores, if medications were given for the treatment of MICU

delirium, if the patient was placed in restraints, and if family was involved in patient care.

Personal health information and identifiers were excluded from the chart audit.

### **Conceptual Model**

The Model for Improvement consisted of two parts with the first being a list of three questions that must be answered (IHI, 2022). For this project we 1) were aiming to reduce the incidence of delirium in a MICU and used two cycles for rapid quality improvement to analyze whether the practice change was positive, feasible, sustainable, and resulted in better patient outcomes.

The model phases guide the project the specific aim, which was decreasing ICU delirium in the MICU by 10% at 4 weeks and 20% at 8 weeks post QI practice change. The second phase of the Model for Improvement is the Plan-Do-Study-Act Model (PDSA). The PDSA is a four-step rapid cycle approach that initiates a change in practice to see whether the change leads to improvement (IHI, 2022). The QI project consisted of two rapid cycles over an 8 week period (Appendix B.2, Appendix B.3).

The cyclical nature of the PDSA Model allowed for adaptation within the environment if the intended improvement is not achieved (IHI, 2022). The IHI Model for Improvement was used to evaluate the QI project on preventing delirium through the implementation of an ICU delirium bundle.

#### **First Cycle PDSA (Appendix B.2)**

##### ***Cycle One Plan***

The “Plan” phase of the project consisted of gathering stakeholders for project approval and creating and implementing educational materials for healthcare staff, patients, and families on delirium and delirium prevention strategies. Educational materials for nursing staff reinforced delirium identification, screening scales, ICU delirium bundle interventions and where to chart

interventions. Educational pamphlets for patients and family members included information on delirium symptoms and ways to help prevent patients from becoming delirious.

### ***Cycle One Do***

The “Do” phase of the quality improvement process consisted of nursing compliance in implementing the ICU delirium bundle components, charting bundle components, completing delirium screening scales correctly, informing provider regarding a new positive CAM-ICU score and educating patients and families and collecting data.

Two weeks prior to the QI project implementation, nursing education was initiated on the unit. The initial proposed education for nurses devised for the Plan portion of the Conceptual Framework to focus on computer modules to present the information. The revised educational intervention was paper packets of information, and step-by-step guidelines, which were handed out during shift change to reach each nurse quicker than through email. Extra packets were posted around the unit and in the employee breakroom for convenience. The A2F Bundle components were placed next to each computer at the nurse’s station and patient rooms to reinforce the bundle components while working with patients and charting. All unit staff completed reading the materials and were encouraged to ask questions.

**Data Collection.** Data collected from patient chart audits included all key indicators; primary and secondary measures implemented, bundle components implemented, CAM-ICU scores, whether a physician was notified of positive CAM-ICU scores, if medications were given for the treatment of MICU delirium, if the patient was placed in restraints, and if family was involved in patient care. Personal health information and identifiers were excluded from the chart audit. Demographic data including patient birth year, biological sex and ethnicity were recorded. The Excel spreadsheet was organized to show all patient demographics and chart audit outcomes to

calculate each chart's compliance and percentage of positive change between cycles one and two.

Using the Excel spreadsheet created, delirium bundle components were entered as "0" if not present, and "1" if present within the patient's chart. This included columns for primary and secondary prevention measures. If a CAM-MICU score was charted this value was entered as "1" and a missing CAM-MICU score was entered as "0". If the positive CAM-ICU score was not correctly charted or reported to a physician, the score was entered as "0", and if it was reported correctly charted as "1".

### ***Cycle One Study***

The "Study" phase included a random audit of twenty patient charts to analyze results of bundle implementation strategies from the four-week cycle. Rates of compliance were calculated, percent of positive change was calculated for primary and secondary nursing interventions charted, if CAM-ICU was charted correctly, and whether a provider was notified of a new positive CAM-ICU score. Finally, the diagnosis of ICU delirium was tracked.

Four weeks post implementation, chart audit one was completed on a total of 20 patients ( $N = 20$ ) not on mechanical ventilation. The patient population was 65% Caucasian ( $n = 13$ ) and 35% Black ( $n = 7$ ), with seven males and 13 females, and 15% age 65 or older ( $n = 3$ ) ( $\mu = 49.7$ ;  $SD = 15.9$ ). In PDSA 1 the CAM-ICU completion had a change improvement from baseline ( $n = 6$ ) to audit one ( $n = 12$ ). Primary prevention measures improved positive percentage of change 6% from baseline and secondary measures had 40% positive percentage of change with an increase in compliance of 5% between baseline and audit one. High risk medications had a 10% increase in use after PDSA one. We noted a 10% reduction in delirium. The specific aim for PDSA cycle one was a 10% decrease in delirium, which was met. The team chose to continue with a second cycle to see if further improvement could be achieved.

***Cycle One Act***

The “Act” phase consisted of reflection on the first PDSA cycle results. The QI project key indicators were reinforced to current staff and presented to new agency staff who did not receive the initial educational training. Appropriate charting and provider notification were to be included in the reeducation. The Study phase of the first PDSA cycle indicated a need for re-education because none ( $n = 0$ ) of the total ( $N = 20$ ) patients with a positive CAM-ICU had provider notification charted when nine ( $n = 9$ ) patients fit the criteria for a new onset delirium with positive CAM-ICU scores. Therefore, the cycle two plan consisted of re-educating, continuing to work with the nursing staff to get buy-in for the initiative and identifying patients during shift report who met the criteria for delirium but thought to be exhibiting “sundowning” from dementia. During shift report nurses were reeducated on how to appropriately chart a CAM-ICU, to notify a provider of a new positive score, and how to chart the provider was notified.

**Second Cycle PDSA (Appendix B.3)*****Cycle Two Plan***

The “Plan” phase of the second cycle included re-educating healthcare staff, patients, and families on delirium and delirium prevention strategies. Educational materials for nursing staff reinforced delirium identification, screening scales, ICU delirium bundle indicators and where to chart these indicators accurately. Educational pamphlets for patients and family members included information on delirium symptoms and ways to help prevent patients from becoming delirious.

***Cycle Two Do***

The “Do” phase of the second cycle consisted of nursing compliance in implementing the ICU delirium bundle components, charting bundle components, completing delirium screening

scales correctly, informing a provider regarding a new positive CAM-ICU score and educating patients and families.

**Data Collection.** Data collected from patient chart audits included all first cycle key indicators. Personal health information and identifiers were excluded from the chart audit. Using the Excel spreadsheet created, delirium bundle components were entered the same as the first PDSA cycle.

### ***Cycle Two Study***

The “Study” phase included a random audit of twenty patient charts to analyze results of bundle implementation strategies from the second four-week cycle. Rates of compliance were calculated, percent of positive change was calculated for primary and secondary nursing interventions charted, if CAM-ICU was charted correctly, and whether a physician was notified of a new positive CAM-ICU score. Finally, the diagnosis of ICU delirium was tracked. The difference between the two cycles was reeducation to staff due to a 100% lack in correct CAM-ICU scoring for patients who should have been scored positive with a provider notification.

### ***Cycle Two Act***

The “Act” phase consisted of reflection on the second PDSA cycle results. Compliance was audited, and results were calculated. At the end of the 8-week period results were handed to the stakeholders and given the opportunity to provide feedback. Once all components of the second PDSA cycle were completed, the new (3<sup>rd</sup> and subsequent) cycles will be taken over by stakeholders if they choose to continue the project. Although this QI project is not generalizable to all ICU units, the project demonstrates the process for correct translation of research for quality patient care, the next cycle can be applied to a larger ICU with inclusion of the A2F bundle in its entirety.



### **Ethics and Permissions**

A letter of support was obtained from the Hospital CNO (Appendix C). A statement for hospital IRB for exemption from human research was obtained for the QI project (Appendix D).

### **Implications**

#### **Implications for Society**

Mortality rates for delirium vary between 22-76% in the ICU (AAFP, 2021). The QI project directly affected society as morbidity and mortality rates of MICU delirium were decreased a 40% reduction in MICU delirium diagnoses, which was twice the desired change. Positive societal impact includes a decrease in burden of care placed on family members and long-term care facilities.

#### **Implications for Health Care Finance**

The QI project results reduced hospital costs by approximately \$17,000 per case based on the literature. Healthcare costs were decrease as the number of patients who were diagnosed with MICU delirium decrease because of increased primary and secondary prevention measures implemented by the Program Director.

#### **Implications for Advanced Practice Nursing**

The project leader has advanced knowledge and leadership skill congruent with their new role as a nurse practitioner with the ability to prevent, identify, and treat MICU delirium. In turn, these staff nurses acquired advanced training in MICU delirium prevention and identification to improve their patients' outcomes and their provision of care quality that may lead to decreased morbidity, mortality and length of hospital stay for patients if permanently adopted into their practices.

### **Dissemination Plan**

The QI project was presented in a poster format at the UofL Health and UofL School of Nursing Advanced Practice Conference on August 5, 2022. The organization involved was be presented with the quality improvement project findings, and the project will continue to be revised within the organization. There is a need for further research on patients developing ICU delirium, specifically for patients with neurodegenerative diseases for providers and clinicians to differentiate the two due to lack of a standardized tool.

### **Limitations**

The inclusion of only patients who were not mechanical ventilated was a limitation. This limited the QI project from using the entire A2F bundle. In PDSA cycle 3, this will be included for further practice change. Patients who required high risk medication known to contribute to delirium was an unavoidable limitation. The used of high risk medications in patients on mechanical ventilation is standard practice, specifically sedation and analgesia. These patients are placed at a higher risk of developing ICU delirium due to necessary medications that are instigating agents. Information on decreasing ICU delirium in this population is vital as these patients are critically ill and avoidance of ICU delirium could drastically change their outcome.

Changes in unit staff during the QI project could have played a role in the outcome. Agency RNs were hired during the third week of the project and were not involved in the initial education period prior to implementation. The agency nurses did receive the *Act* intervention at the end of the first rapid PDSA cycle, which could have helped decrease the number of patients with MICU delirium at the end of the second PDSA cycle. Chart audits were not tracked according to which nurse completed each chart. Therefore, it cannot be concluded whether unit staff who received pre- and mid-cycle education were actively implementing the A2F bundle and CAM-ICU, or if the inclusion of agency RNs affected this outcome.

### **Discussion**

This QI project has supported that ICU delirium is a preventable complication while in the hospital with the addition of proper primary and secondary nursing interventions. The specific aim was met with a 10% decrease in ICU delirium in patients at 4 weeks and 40% reduction at 8 weeks.

### **Interpretation**

Professional development, proper use of primary and secondary nursing interventions, and the proper use of an evidence-based screening tool (CAM-MICU) have shown to decrease the incidence of ICU delirium development in patients. The findings in this QI project correlate with previous findings in similar quality improvement projects, demonstrating the addition of the A2F bundle decreases ICU delirium rates in patients (Bounds et al., 2016; Pun et al., 2019; Smith et al., 2017; Tonna et al., 2021). Findings indicate this QI project are transferrable to similar units.

The association between the increased use of secondary interventions correlates with a decrease in the number of patients diagnosed with ICU delirium. The high percentage of baseline chart audits with completed primary prevention measures did not correlate with the baseline number of ICU delirium diagnoses. This finding indicates that primary prevention measures did not affect the outcome of whether patients developed ICU delirium and secondary measures did. It is difficult to say if nurses were charting primary care prevention measures prior to implementation, but were not completing them, could be one answer to this outcome.

A decrease in the number of high-risk medications prescribed was noted with a decrease in ICU delirium diagnoses at the end of the 8-week period. Although, it is interesting that the number of high-risk medications prescribed after PDSA cycle one had increased from baseline, there was still a 10% positive percentage of change in the patients being diagnosed with ICU delirium. After the reeducation by the project leader at the end of PDSA cycle 1, there was a

13% decrease in the number of high-risk medications prescribed and a very significant 40% reduction diagnosed with ICU delirium. High risk medications like benzodiazepines, antipsychotics, and highly anticholinergic medications are known to contribute to delirium; however, correlations between this indicator and the final outcome deserve further attention but were beyond the scope of this QI project.

The implementation of new nursing practices in detection of delirium and utilizing the CAM-MICU screening tool have shown that practice change can occur within a short period of time. Nurses who have been practicing for decades was a concern as they practice the art of nursing, and not necessarily evidence-based practice. Direct leadership shown by the project leader through conversations with staff, emphasized that the chart audits of the CAM-ICU screening tool from PDSA cycle 1, was being incorrectly charted.

! Staff were notified that none of the patients with positive CAM-ICU scores were reported to a provider. Shown through chart audits, some nurses assimilated to the new approach as shown in chart audits from PDSA cycle 2. PDSA cycle 2 saw the largest decrease in ICU delirium diagnoses in only four weeks, possibly related to conversations between the Program Director and unit staff about correctly charting the CAM-ICU.

Identifying delirium in patients with known or unknown neurodegenerative disease is an important task for future QI projects. Patients with known neurodegenerative disease were treated with secondary prevention measures as these patients are harder to recognize delirium developing. There is a need for a standardized screening tool, along with the CAM-ICU for providers to determine the difference between patients with delirium, dementia, or both. Further education for staff nurses on differentiating delirium and dementia, and when primary versus secondary prevention measures are appropriate could decrease the percentage of ICU delirium diagnoses and improve patient outcomes. This would result in a decrease of necessary tertiary

measures, limiting the possible cascade of events following the initiation of high-risk medications.

### **Conclusion**

Delirium is an acute neuropsychiatric syndrome that is preventable and potentially reversible, that increases patient morbidity rate, mortality rate, and hospital length of stay. Delirium is an unnecessary complication to that, for many is preventable with primary and secondary prevention measures. To prevent ICU delirium, nursing staff and providers are vital, and must be educated on how to prevent and detect. Using evidence-based tools and interventions, nurses can change patient outcomes for the positive. Primary and secondary prevention measures (A2F bundle) and the use of the CAM-ICU screening tool have proven to decrease ICU delirium rates. Patients and their families will not suffer from the short- and long-term sequela of delirium and the more extensive recovery if ICU delirium can be avoided, or the patient is able to recover. If the A2F bundle and CAM-ICU screening tool could be implemented in more ICUs around the country, the number of patients developing ICU delirium and associated problems would drastically decrease. The project leader demonstrated in this quality improvement initiative that practice change is possible, feasible, and sustainable with team and administrative buy-in.

### References

- American Academy of Family Physicians (AAFP). (2021). *Quality improvement basics*. <https://www.aafp.org/family-physician/practice-and-career/managing-your-practice/quality-improvement-basics.html>
- American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, DC: Author.
- Barach, P., & Johnson, J. K. (2006). Understanding the complexity of redesigning care around the clinical microsystem. *Quality & safety in health care, 15 Suppl 1*(Suppl 1), i10–i16. <https://doi.org/10.1136/qshc.2005.015859>
- Barnes-Daly, M. A., Phillips, G., & Ely, E. W. (2017). Improving hospital survival and reducing brain dysfunction at seven California community hospitals: Implementing pad guidelines via the ABCDEF bundle in 6,064 patients. *Critical Care Medicine, 45*(2), 171–178. <https://doi.org/10.1097/CCM.0000000000002149>
- Barr, J., Fraser, G. L., Puntillo, K., Ely, E. W., Gélinas, C., Dasta, J. F., Davidson, J. E., Devlin, J. W., Kress, J. P., Joffe, A. M., Coursin, D. B., Herr, D. L., Tung, A., Robinson, B. R., Fontaine, D. K., Ramsay, M. A., Riker, R. R., Sessler, C. N., Pun, B., Skrobik, Y., American College of Critical Care Medicine (2013). Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Critical care medicine, 41*(1), 263–306. <https://doi.org/10.1097/CCM.0b013e3182783b72>
- Bounds, M., Kram, S., Speroni, K. G., Brice, K., Luschinski, M. A., Harte, S., & Daniel, M. G. (2016). Effect of abcde bundle implementation on prevalence of delirium in intensive care unit patients. *American Journal of Critical Care: An Official Publication, American*

*Association of Critical Care Nurses*, 25(6), 535–544.

<https://doi.org/10.1097/DCC.0000000000000129>

Devlin, J. W., Skrobik, Y., Gélinas, C., Needham, D. M., Slooter, A., Pandharipande, P.

P., Watson, P. L., Weinhouse, G. L., Nunnally, M. E., Rochweg, B., Balas, M. C., van den Boogaard, M., Bosma, K. J., Brummel, N. E., Chanques, G., Denehy, L., Drouot, X., Fraser, G. L., Harris, J. E., Joffe, A. M., ... Alhazzani, W. (2018). Executive summary: Clinical practice guidelines for the prevention and management of pain, agitation/sedation, delirium, immobility, and sleep disruption in adult patients in the ICU. *Critical Care Medicine*, 46(9), 1532–1548.

<https://doi.org/10.1097/CCM.00000000000003259>

Egberts, A., Moreno-Gonzalez, R., Alan, H., Ziere, G., & Mattace-Raso, F. (2021).

Anticholinergic drug burden and delirium: A systematic review. *JAMA*, 22(1), 65–73.e4.

<https://doi.org/10.1016/j.jamda.2020.04.019>

Ely, E. W., Inouye, S. K., Bernard, G. R., Gordon, S., Francis, J., May, L., Truman, B., Speroff,

T., Gautam, S., Margolin, R., Hart, R. P., & Dittus, R. (2001a). Delirium in mechanically ventilated patients: validity and reliability of the confusion assessment method for the intensive care unit (CAM-ICU). *JAMA*, 286(21), 2703–2710.

<https://doi.org/10.1001/jama.286.21.2703>

Ely, E. W., Margolin, R., Francis, J., May, L., Truman, B., Dittus, R., Speroff, T., Gautam,

S., Bernard, G. R., & Inouye, S. K. (2001b). Evaluation of delirium in critically ill patients: Validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). *Critical Care Medicine*, 29(7), 1370–1379.

<https://doi.org/10.1097/00003246-200107000-00012>

- Ely, E. W., & T. Pun, B. (2002). *Confusion Assessment Method for the ICU: Training Manual*, 1-13.  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.669.3256&rep=rep1&type=pdf>
- Inouye, S. K., Van Dyck, C. H., Alessi, C. A., Balkin, S., Siegal, A. P., & Horwitz, R. I. (1990). Clarifying confusion: The confusion assessment method. A new method for detection of delirium. *Annals of internal medicine*, 113(12), 941–948. <https://doi.org/10.7326/0003-4819-113-12-941>
- Institute for Healthcare Improvement (IHI). (2022). *Science of improvement: How to improve*:<http://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx>
- Kisling, L. A. (2021). *Prevention strategies*. National Center for Biotechnology Information. <https://www.ncbi.nlm.nih.gov/books/NBK537222/>
- Kotfis, K., Williams Roberson, S., Wilson, J. E., Dabrowski, W., Pun, B. T., & Ely, E. W. (2020). COVID-19: ICU delirium management during SARS-CoV-2 pandemic. *Critical Care (London, England)*, 24(1), 176. <https://doi.org/10.1186/s13054-020-02882-x>
- Kram, S. (2015) Implementation of ABCDE bundle to improve patient outcomes in the intensive care unit in a rural community hospital. *Dimensions of Critical Care Nursing*, 34(5), 250- 258. <https://doi.org/10.1097/DCC.0000000000000129>
- Lee, Y., Kim, K., Lim, C., & Kim, J. S. (2020). Effects of the abcde bundle on the prevention of post-intensive care syndrome: a retrospective study. *Journal of Advanced Nursing*, 76(2), 588–599. <https://doi.org/10.1111/jan.14267>
- McHugh M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, 22(3), 276–282. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3900052/>



- Mikkelsen, M. E., & Devlin, J. W. (2021). The a2f bundle: quantity and quality matter\*. *Critical Care Medicine*, 49(2), 380–382. <https://doi.org/10.1097/CCM.0000000000004794>
- Mulkey, M. A., Olson, D. W. M., & Hardin, S. R. (2019). Top four evidence-based nursing interventions for delirium. *Medsurg Nursing: Official Journal of the Academy of Medical- Surgical Nurses*, 28(6), 357–362.
- Nitchingham, A., & Caplan, G. A. (2021). Current challenges in the recognition and management of delirium superimposed on dementia. *Neuropsychiatric Disease and Treatment*, 17, 1341–1352. <https://doi.org/10.2147/NDT.S247957>
- Pun, B. T., Balas, M. C., Barnes-Daly, M. A., Thompson, J. L., Aldrich, J. M., Barr, J., Byrum, D., Carson, S. S., Devlin, J. W., Engel, H. J., Esbrook, C. L., Hargett, K. D., Harmon, L., Hielsberg, C., Jackson, J. C., Kelly, T. L., Kumar, V., Millner, L., Morse, A., Perme, C. S., ... Ely, E. W. (2019). Caring for critically ill patients with the ABCDEF bundle: Results of the ICU liberation collaborative in over 15,000 adults. *Critical Care Medicine*, 47(1), 3–14. <https://doi.org/10.1097/CCM.0000000000003482>
- Society of Critical Care Medicine. (2021). *ICU Liberation Bundle (A-F)*. <https://www.sccm.org/ICULiberation/ABCDEF-Bundles>
- Smith, C. D. S., & Grami, P. (2017). Feasibility and effectiveness of a delirium prevention bundle in critically ill patients. *American Journal of Critical Care*, 26(1), 19–27. <https://doi.org/10.4037/ajcc2017374>
- Sosnowski, K., Mitchell, M., Cooke, M., White, H., Morrison, L., & Lin, F. (2021). Effectiveness of the ABCDEF bundle on delirium, functional outcomes and quality of life in intensive care patients: a study protocol for a randomized controlled trial with embedded process evaluation. *BMJ Open*, 11(7), e044814. <https://doi.org/10.1136/bmjopen-2020-044814>

- Spiegelberg, J., Song, H., Pun, B., Webb, P., & Boehm, L. M. (2020). Early identification of delirium in intensive care unit patients: Improving the quality of care. *Critical Care Nurse*, 40(2), 33–43. <https://doi-org.echo.louisville.edu/10.4037/ccn2020706>
- Tonna, J. E., Dalton, A., Presson, A. P., Zhang, C., Colantuoni, E., Lander, K., Howard, S., Beynon, J., & Kamdar, B. B. (2021). The effect of a quality improvement intervention on sleep and delirium in critically ill patients in a surgical ICU. *Chest*, 160(3), 899–908. <https://doi.org/10.1016/j.chest.2021.03.030>
- van Velthuisen, E. L., Zwakhalen, S., Mulder, W. J., Verhey, F., & Kempen, G. (2018). Detection and management of hyperactive and hypoactive delirium in older patients during hospitalization: a retrospective cohort study evaluating daily practice. *International Journal of Geriatric Psychiatry*, 33(11), 1521–1529. <https://doi.org/10.1002/gps.4690>
- Vasilevskis, E.E., Chandrasekhar, R., Holtze, C.H., Graves, J., Speroff, T., Girard, T. D., Patel, B., Hughes, C.G., Cao, A., Pandharipande, P. P., & Ely, E. W. (2018). The cost of ICU delirium and coma in the intensive care unit patient. *Medical Care*, 56(10), 890–897. <https://doi.org/10.1097/MLR.0000000000000975>

Appendix A  
Literature Review

Table 1 Literature Matrix

Citation	Rationale for inclusion (Background, concept, practice change example, literature review)	Evaluation Method: Johns Hopkins	Study Design	Rigor	Summary of Findings	Analysis
Barnes-Daly, M. A., Phillips, G., & Ely, E. W. (2017). Improving hospital survival and reducing brain dysfunction at seven California community hospitals: implementing pad guidelines via the abcdef bundle in 6,064 patients. <i>Critical Care Medicine, 45(2),</i> 171–178. <a href="https://doi.org/10.1097/CCM.00000000000002149">https://doi.org/10.1097/CCM.00000000000002149</a>	Practice change using the ABCDEF bundle to improve patient outcomes.	III	Prospective cohort quality improvement initiative conducted in seven community hospitals within California’s Sutter Health System. A total of 6,064 patients were enrolled in the study from medical and surgical ICUs.	A – High quality	A 10% incremental increase in total bundle compliance, odds of hospital survival increase to 7%. 12% increase in survival with each 10% incremental increase in total bundle compliance. With each 10% incremental increase in partial bundle compliance increase odds of survival by 15%.	STRENGTHS: - Large study population - Within past 5 years - Statistically significant findings - 1-year time frame of study WEAKNESSES: - Not a randomized control trial - Lack of rigorous study protocols LIMITATIONS: - Possible human error in charting GAPS: - Family engagement

Citation	Rationale for inclusion (Background, concept, practice change example, literature review)	Evaluation Method: Johns Hopkins	Study Design	Rigor	Summary of Findings	Analysis
<p>Bounds, M., Kram, S., Speroni, K. G., Brice, K., Luschinski, M. A., Harte, S., &amp; Daniel, M. G. (2016). Effect of abcde bundle implementation on prevalence of delirium in intensive care unit patients. <i>American Journal of Critical Care : An Official Publication, American Association of Critical-Care Nurses</i>, 25(6), 535–544.</p>	<p>Practice change using the ABCDE bundle to quantify the prevalence and duration of delirium in ICU patients.</p>	<p>III</p>	<p>Retrospective study conducted in two rural hospitals, part of the University of Maryland Shore Regional Health Center. Two med-surg ICU units were used. One 8-bed unit and one 10-bed unit.</p>	<p>B – Good quality</p>	<p>Prevalence of delirium decreased significantly after ABCDEF bundle. Mean number of delirium days decreased significantly. After implementation, significant decreases in both delirium prevalence and duration while on mechanical ventilation. Increase in delirium free stays in patients on mechanical ventilation. No significant findings relating to LOS and total days on ventilator. Use of sedation/analgesics did not change. Mean number of analgesia days increased after bundle implementation. Number of patients placed in chair position increased significantly after implementation.</p>	<p>STRENGTHS: - Statistically significant results demonstrating reduced prevalence and duration of delirium WEAKNESSES: - 159 total patients used in study before implementation and 79 patients after implementation - Not a randomized study design LIMITATIONS: - Did not focus on the “F: family engagement” part of bundle due to revision of bundle happening after study - Retrospective study with HER - Rural hospital setting - Potential variability among nurses regarding delirium screening tool ICDS GAPS: - Revised ABCDEF bundle research</p>

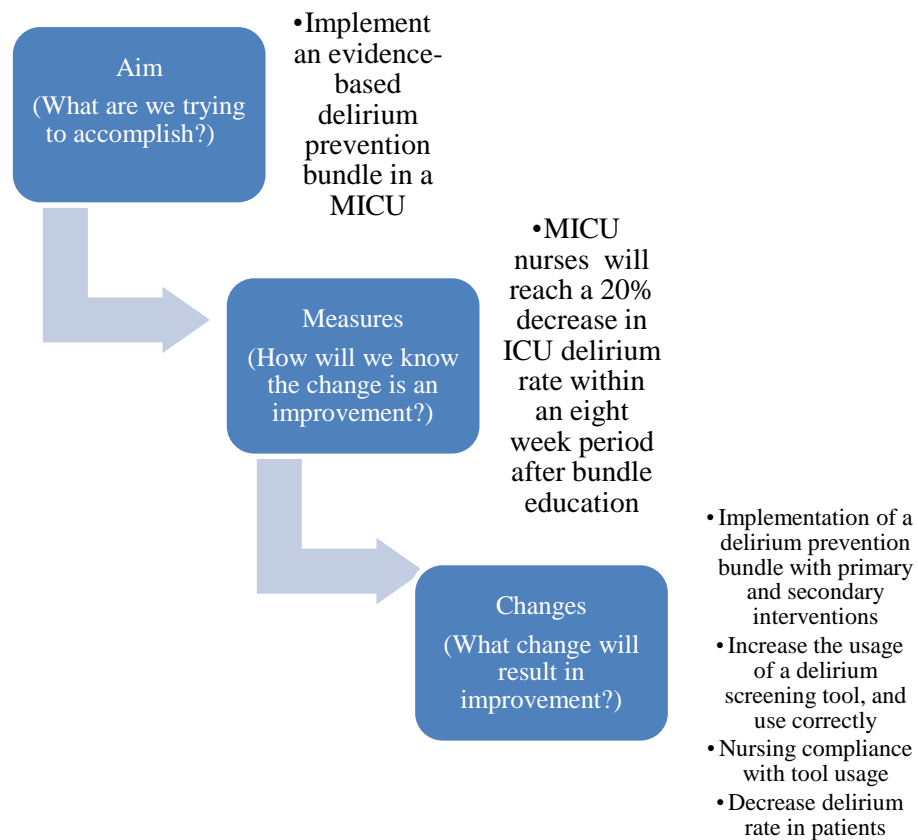
Citation	Rationale for inclusion (Background, concept, practice change example, literature review)	Evaluation Method: Johns Hopkins	Study Design	Rigor	Summary of Findings
<p>Lee, Y., Kim, K., Lim, C., &amp; Kim, J. S. (2020). Effects of the abcde bundle on the prevention of post-intensive care syndrome: a retrospective study. <i>Journal of Advanced Nursing</i>, 76(2), 588–599. <a href="https://doi.org/10.1111/jan.14267">https://doi.org/10.1111/jan.14267</a></p>	<p>Practice change using the ABCDE bundle on post-intensive care syndrome patients</p>	<p>III</p>	<p>Retrospective study using an early ABCDE bundle on 91 patients, and a modified ABCDE bundle on 94 patients on a 16-bed medical ICU.</p>	<p>B – Good Quality</p>	<p>Sedation levels of alertness and calmness significantly increased using the ABC part of the bundle. Coma prevalence sig. decreased. Patients receiving early mobility interventions sig. increased.</p>

Citation	Rationale for inclusion (Background, concept, practice change example, literature review)	Evaluation Method: Johns Hopkins	Study Design	Rigor	Summary of Findings
<p>Pun, B. T., Balas, M. C., Barnes-Daly, M. A., Thompson, J. L., Aldrich, J. M., Barr, J., ... Ely, E. W. (2019). Caring for critically ill patients with the abcdef bundle: results of the icu liberation collaborative in over 15,000 adults. <i>Critical Care Medicine</i>, 47(1), 3–14.  <a href="https://doi.org/10.1097/CCM.000000000000034">https://doi.org/10.1097/CCM.000000000000034</a></p>	<p>Practice change using the ABCDEF bundle and patient centered outcomes.</p>	<p>III</p>	<p>Prospective Multicenter cohort study conducted in 68 academic, community, and federal ICUs collected over a 20-month period.</p>	<p>A- High quality</p>	<p>Complete ABCDEF bundle performance was associated with a lower likelihood of hospital death within 7 days, next-day mechanical ventilation, coma, physical restraint use, ICU readmission, and discharge to a facility other than the patient’s home. Pain was more frequently reported as bundle performance proportion increased.</p>

Citation	Rationale for inclusion (Background, concept, practice change example, literature review)	Evaluation Method: Johns Hopkins	Study Design	Rigor	Summary of Findings
Smith, C. D. S., & Grami, P. (2017). Feasibility and effectiveness of a delirium prevention bundle in critically ill patients. <i>American Journal of Critical Care</i> , 26(1), 19–27. <a href="https://doi.org/10.4037/ajcc2017374">https://doi.org/10.4037/ajcc2017374</a>	Practice change using the Delirium Prevention Bundle.	III	Controlled interventional cohort study in 2 medical-surgical ICUs in large medical centers in Houston, TX. Patients admitted to the 18 bed ICU were the control group and given standard ICU care. The 10 bed ICU unit was used as the intervention group where the DPB was implemented.	B- Good quality	Findings include – Odds of developing delirium are 3 times higher in patients receiving mechanical ventilation, patients in restraints are 2.82 times more likely to develop delirium, and ICU LOS greater than 3 days are 3 times more likely to develop delirium. Reduction in odds of delirium include use of DPB and age <64 years.

Appendix B.1

Model for Improvement Conceptual Framework – IHI Model

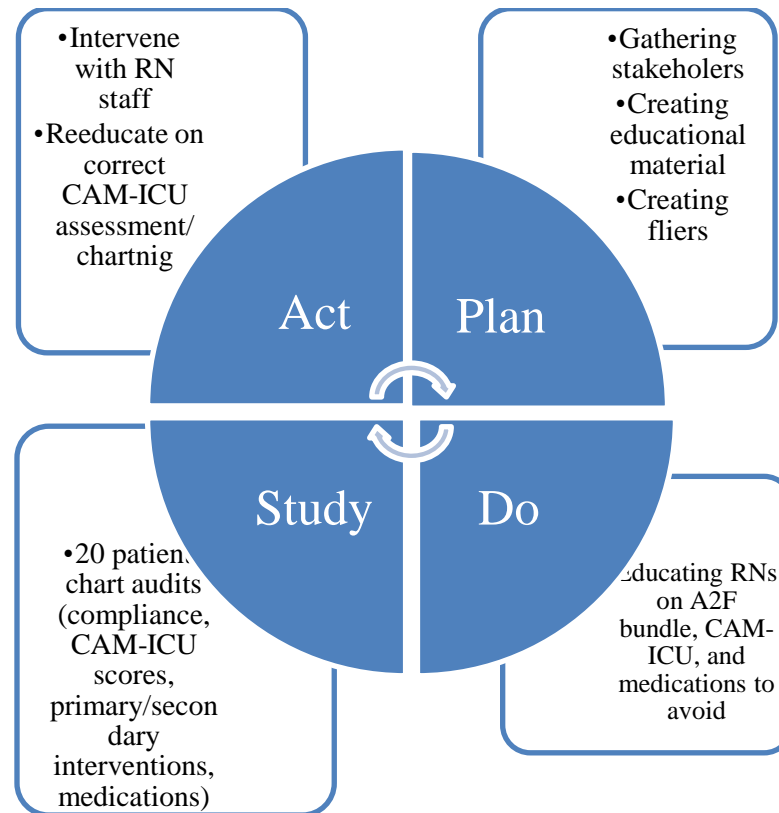


*Science of Improvement: How to improve: IHI.* Institute for Healthcare Improvement. (2022). <https://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx>



Appendix B.2

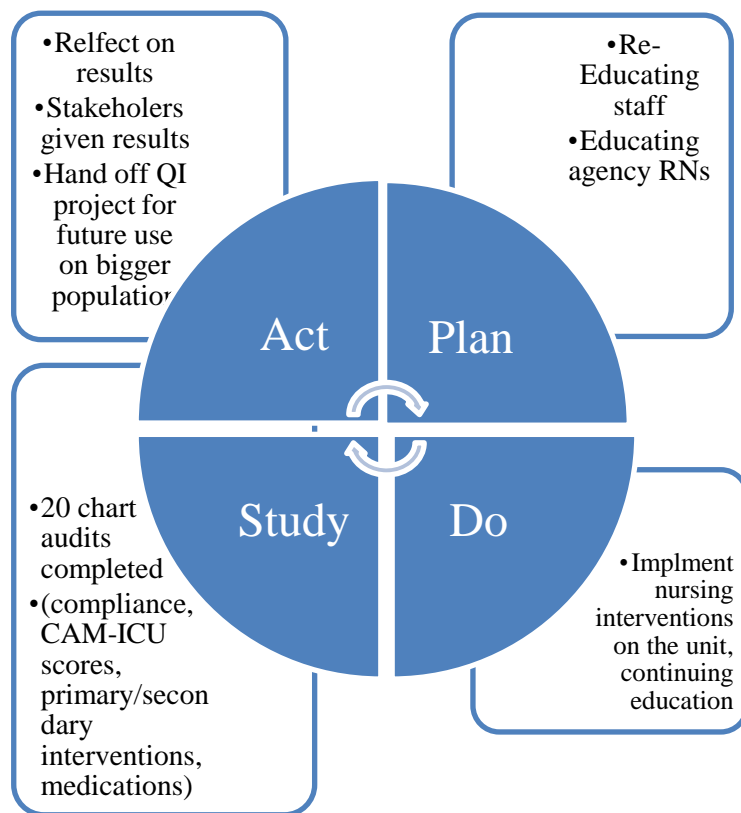
PDSA Cycle 1



Institute of Health (2022). *Science of Improvement: How to improve*: Institute for Healthcare Improvement.  
<https://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx>

Appendix B.3

PDSA Cycle 2



Institute of Health (2022). *Science of Improvement: How to improve*: Institute for Healthcare Improvement. <https://www.ihl.org/resources/Pages/HowtoImprove/ScienceofImprovementHowtoImprove.aspx>

Appendix C

Hospital IRB Approval Letter

[REDACTED]

November 16, 2021

To Whom It May Concern:

I am writing this letter in support of the IRB submission by Hope Eppley, RN. The goal of project is to decrease the use of tertiary prevention measures and decrease ICU delirium rates specifically in the Medical ICU at [REDACTED]

I fully support this research study occurring at our site. Please do not hesitate to contact me if there are any questions regarding this project.

Sincerely,

[REDACTED]

Appendix D

IRB Approval Letter

[REDACTED]  
Human Subjects Protection Program Office  
[REDACTED]

DATE:	January 18, 2022
TO:	[REDACTED]
FROM:	[REDACTED]
IRB NUMBER:	[REDACTED]
STUDY TITLE:	Quality Improvement DNP Project Proposal for the Prevention of ICU Delirium
REFERENCE #:	[REDACTED]
DATE OF REVIEW:	01/17/2022
CONTACT FOR QUESTIONS:	[REDACTED]

The IRB Chair/Vice-Chair (or An IRB member) has reviewed your submission. The project described does not meet the "Common Rule" definition of human subjects' research. The IRB has classified this project as Non-Human Subjects Research (NHSR). The project can proceed.

This submission has been determined to be quality improvement, and not human subjects research, based on the goal(s) stated in the protocol.

Institutional policies and guidelines on participant privacy must be followed. If you are using protected health information, the HIPAA Privacy rules still apply.

Any changes to this project or the focus of the investigation must be submitted to the IRB to ensure that the IRB determination above still applies.

Amendments for personnel changes or study closures are not required.

Thank you,  
[REDACTED]