Targeted Education to Improve Delirium Screening Among Neuroscience Patients

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On my honor, I have neither given nor received any unauthorized aid on this project.

Table of Contents

Abstract

Delirium is a significant clinical concern that results in longer hospital and intensive care unit lengths of stay; increased morbidity, mortality, and healthcare costs; and is associated with long-term cognitive deficits and neuropsychological disorders. Considering healthcare system burdens and poor patient outcomes related to delirium, there has been emphasis on early recognition of patients experiencing delirium. The literature supports the importance of screening for delirium at the bedside and identifies tools used to meet this end. However, most studies exclude use of the tools in neuroscience settings because of the complexity assessing delirium in neuro-compromised patients.

The Confusion Assessment Method for the intensive care unit (CAM-ICU) is a validated screening tool for delirium in neuroscience patients, yet there is still a gap in the literature regarding application of the CAM-ICU for neuroscience patients. The purpose of this project was to increase neuroscience nurses' ability to accurately document delirium assessments using the CAM-ICU by minimizing the use of "unable to assess" and increase detection of delirious patients in a neuroscience intensive care unit. A pre- and post-test design was used to evaluate changes in mean baseline documentation accuracy rates. Audits of electronic health records (EHRs) were conducted pre- and post-educational intervention to determine unit level documentation accuracy rates. A formal 30-minute educational presentation was offered to eligible registered nurses (RNs) in the neuroscience intensive care unit, with subsequent coaching sessions for those who attended the presentation. There were 124 documentation audits retained in the pre- and in the post-education intervention phase of the study. The mean pre-audit documentation accuracy rate increased from .44 to .83 ($p < .001$). The results provide further evidence that formal education for RNs on use of the CAM-ICU instrument improves

documentation accuracy and delirium identification in this highly at-risk patient population. Future research should focus on the impact formal education has on each of the outcome possibilities of the CAM-ICU and the collaborative development of treatment protocols.

Keywords: CAM-ICU, RASS, delirium, delirium screening, neuroscience, baseline mental status, quality improvement

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Targeted Education to Improve Delirium Screening Among Neuroscience Patients

Early recognition of inpatient delirium is important because it can be life threatening and treatment may be associated with improved patient outcomes. Delirium is characterized by alterations in cognition, specifically inattention and disorganized thinking, as defined by the American Psychiatric Association, DSM-5 criteria (European Delirium Association, 2014). Delirium is frequently manifested in behavior changes and fluctuations during a patient's hospital course. Patients' behavior may alternate irregularly between three recognized states of delirium, which are hyperactive, hypoactive, and a mixed morphology of both hyper- and hypoactive.

Background

After a review of the literature on delirium, it is evident that prevalence rates vary widely and risk factors are patient dependent such as age, primary diagnosis, and co-morbidities. External risk factors that may affect prevalence rates are many and may include medication regimens, alterations in sleep-wake cycle, and setting. Differing levels of care where patients are treated also see a variance in prevalence, such as acute care v. critical care. It is worth noting that there are many sub-groups at each level of care, for example surgical, medical, and neurological. Additionally, there have been studies in which critical care patients have been sub-divided into mechanically ventilated v. non-ventilated, in an attempt to tease out risk factors for detection and prognostication of delirium. In view of the multiple influences on delirium, prevalence rates are frequently reported specific to a patient population. This elucidates why many prevalence studies exist; researchers and practitioners are seeking clarity on risk specific to their patient population of interest.

It is important to know the extent to which patients are at risk for delirium since it is associated with longer lengths of stay in the hospital (Thomason et al., 2005), increases in mortality rates (Pisani et al., 2009), healthcare costs (Leslie et al., 2008), long-term cognitive deficits and neuropsychological disorders (Pandharipande et al., 2013), and generally poorer outcomes than those who do not have delirium. Pisani et al., (2009) performed a prospective cohort study which demonstrated the association between intensive care unit (ICU) delirium and higher mortality within one-year post-discharge, showing a positive correlation between the number of days of ICU delirium and mortality. In a prospective cohort study by Thomason et al., (2005), patients who experienced delirium had longer stays both in the ICU and in the hospital overall.

It is intuitive that longer hospital stays are linked to higher costs, which has led to much discussion in the health care arena and has been a driver of the need for value-based care. Leslie, et al., (2008) analyzed many expenses related to caring for patients with a delirium diagnosis and estimated the annual economic costs to be between $38 billion and $152 billion. Though a wide estimate, the key finding is that a large sum of health care dollars is spent on delirium. These factors highlight the importance of prompt screening for delirium using reliable assessment tools. After prompt identification of delirium and associated risk factors, preventive measures and treatment protocols can be implemented.

Realizing the need for early detection of delirium, Inouye et al., (1990), introduced the Confusion Assessment Method (CAM) as a screening tool to be used by clinicians who were non-psychiatrists. Scoring delirium using the CAM is reliant on the clinicians' assessments of four features of patients' status: 1) acute or fluctuating changes in mental status, 2) inattention, 3) disorganized thinking, and 4) altered level of consciousness. Since that time, the CAM

instrument has been adapted for use with critically ill patients, a population that presents unique challenges for assessing mental status. Ely, Inouye et al., (2001), recognized the need for an instrument more suitable for delirium detection in critically ill patients, specifically mechanically ventilated, and further developed the CAM-intensive care unit (ICU) instrument. The CAM-ICU instrument has undergone many revisions to account for difficulty in assessing intubated and/or sedated patients' cognition and attention.

The CAM-ICU instrument (see Appendix A) is the most commonly used tool for delirium assessment in intensive care units and has withstood many rigorous studies for validity, reliability, and feasibility across variable populations and settings. It has been translated into many languages and has been tested in many practice settings. However, most studies exclude neuroscience patients from any type of delirium screening studies, because feature number one of the CAM-ICU instrument is contingent upon the assessors' ability to identify whether a patient is having acute or fluctuating changes from baseline mental (Ely, Margolin et al., 2001).

Neuroscience Challenges

An important controversial issue specific to diagnosing delirium in neuroscience patients when using the CAM-ICU is that clinicians need to know patients' baseline mental status. This is necessary because the examining clinician has to determine if a patient is having changes from the baseline exam. There are two distinct schools of thought regarding the definition of baseline neurological status that create a dichotomy in the literature for clinicians seeking clarification: (a) The baseline exam is what the patient's pre-hospital exam was (DiLibero et al., 2018); and (b) the baseline exam is the initial neurologic exam findings on admission to the ICU after a disease process may have altered their prior status (Mitasova et al., 2012). Interestingly, both are correct under the right circumstances according to the CAM-ICU Training Manual (Ely,

Boehm, Pun, & Stollings, 2016). The patient's pre-hospital condition should be considered the baseline exam, unless there has been a new, permanent change in condition on or during the current admission (Ely et al., 2016). Integrating the Richmond Agitation-Sedation Scale (RASS; see Appendix B) with the CAM-ICU is expected. If an acute change from a patient's pre-hospital condition cannot be determined, the nurses have to refer to previously documented RASS scores and establish if patient's RASS scores is fluctuating, which is consistent with the CAM-ICU delirium training manual. "**Yes**" is documented if the patient's pre-hospital condition changes acutely or their RASS score fluctuates. Most patients should not be deemed 'unable to assess' (UTA).

The majority of neuroscience patients do not present to the ICU at their pre-hospital mental status, adding a layer of difficulty to the application and documentation process for this complex population. Clinicians tend to claim they do not know patients at their baseline, rather than using recommended guidelines for obtaining information such as contacting loved ones or performing a chart review (Ely et al., 2016). Therefore, in neuroscience settings, feature one on the CAM-ICU is frequently marked UTA. In fact, all four of the assessment features of the CAM-ICU are frequently documented not applicable (N/A) or UTA at the bedside in neuroscience areas. Inherent changes neuroscience patients experience that coincide with the CAM-ICU features may be attributable to structural changes from the underlying disease process, rather than from delirium. Ely, Inouye et al., (2001) also acknowledged early in the rollout of the CAM-ICU, that assessment findings in neurologically devastated patients confounded use of the instrument.

If patients are considered UTA, it immediately disables further delirium assessment. In this patient population, it is imperative to remember that the CAM-ICU is an instrument used to

screen for the presence or absence of delirium and early detection improves patient outcomes. J. DiLibero posits that it is wiser to place emphasis on the sensitivity of the test by using pre-admission mental status as a baseline because it casts a wider net, placing more patients who might be experiencing delirium on clinicians' radars (personal communication June 5, 2018). Early recognition of delirium may foster shortened episodes of ICU delirium, as it is reversible and has a profound effect on patient outcomes and healthcare costs.

In more recent studies specific to patients in neuroscience settings (Pandharipande et al., 2017; Mitasova et al., 2012; Frenette et al., 2016) the CAM-ICU has been accepted as an appropriate screening tool for delirium in patients with post-stroke and traumatic brain injury (TBI). RASS scores enable clinicians to monitor level of consciousness (LOC), which is imperative in patients in the neuroscience setting who are receiving sedation medications. The RASS has been robustly validated in many ICU settings, neuroscience included (Sessler et al., 2002), and is considered to be the most reliable tool to use to determine LOC, feature 3**,** of the CAM-ICU (Ely et al., 2016). Generally speaking, use of the CAM-ICU is deferred if a patient's RASS is ≤ - 4 because that indicates a patient is too sedated to evaluate mental status and LOC. The details required for describing the criterion of each of these assessment scales are beyond the scope of this report.

The association to poor patient outcomes and the economic burden that is incurred as a result of delirium has been discussed, making prompt identification and treatment a clinically relevant priority. The high prevalence rate of delirium creates an important issue for clinicians and there are validated tools to identify it across all patient populations, including neurologically devastated. However, because of the challenges posed by this particular patient population, there is a paucity of research related to neuroscience patients.

Purpose of the Project

The purpose of this quality improvement project was to design, implement, and evaluate an educational intervention to improve screening for delirium using the CAM-ICU instrument in a Neuroscience ICU (NICU) at an academic medical center in Central Virginia. Given the compelling evidence for associations between delirium and poor outcomes, there has been a growing interest in early identification. In addition to all of the epidemiological adversity, delirium affects patients personally. Early identification and treatment of delirium in this challenging patient population may mitigate the short and long-term adverse effects.

Theoretical Framework

The development of this project was based on Donabedian's framework for quality improvement in healthcare settings. The conceptual model links structure and processes to healthcare outcomes. The application of the model in this quality improvement study was to assess the impact of an educational intervention on CAM-ICU documentation accuracy rates and ultimately, delirium detection in a NICU. According to Donabedian (1997), to begin assessing quality, the researcher must first think about the who, what, and how before launching a project. Determining the end goal is also a critical component of the project development. Donabedian's framework is built on the assumption that there is a relationship between structure, process, and outcome (S-P-O). Until the association between the S-P-O components is established, quality cannot be assessed (Donabedian, 1997). In the S-P-O model, structure defines the healthcare setting and process outlines activities involved in the implementation phase of the project. The outcomes measured reflect the impact of the interventions implemented, which may directly improve quality of care being provided to patients.

The structured setting for this project was an intensive care unit where physicians, nurse practitioners, a clinical nurse specialist (CNS), a Doctor of Pharmacy (Pharm. D.), registered nurses (RNs), and a registered respiratory therapist (RRT) collaborate to identify and treat delirium. Part of the **structure** of the ICU is for the RNs to conduct bedside examinations specifically to identify the level of agitation and sedation of a patient and to proceed to screen for the presence or absence of delirium. The recommendation is for assessments to be conducted every eight to twelve hours (Ely et al., 2016). After screening patients, RNs document assessment findings in the EHR and communicate with physicians or nurse practitioners if a patient's CAM-ICU score is positive for delirium.

Improving the **process** required assessment of the existing use of the CAM-ICU and RASS instruments, formally training RN's on proper use of the instrument with specific instruction related to the assessment of the neuroscience patient population and providing coaching and mentoring for correct use throughout the implementation phases of the project. Upon completion of the educational interventions, the **outcome** measured unit-based documentation accuracy rates for the CAM-ICU (see Figure 1) using a validated data collection tool.

Quality Improvement Question

Does participation in formal instruction on use of the delirium screening instrument, CAM-ICU, during a six-week time period, by nurses in a neuroscience ICU improve documentation accuracy rates and increase delirium detection when compared to the current informal approach of nurses being taught by preceptors during the orientation period?

Review of the Literature

The review of literature addressed the following question: “What is currently known about the accuracy of assessing neuroscience ICU patients for delirium using the CAM-ICU instrument?”

The electronic databases searched included PubMed, CINAHL, Web of Science, and ERIC using a combination of keyword search terms. The search strategy was created with the assistance of the research librarian in the health sciences library to ensure a comprehensive search. Year of publication and age were not restricted. Any article with an abstract in English was reviewed. Search terms included “neuroscience patient”, “neuroscience intensive care unit”, “neuro intensive care unit”, “neurosurgery intensive care unit”, and “Confusion Assessment Method”. The fully constructed Boolean search string was, (neuroscience patient OR neuroscience intensive care unit OR neuro intensive care unit OR neurosurgery intensive care unit) AND “Confusion Assessment Method”.

Articles that addressed recognition of delirium in the ICU by nurses using the CAM-ICU were included. Additional studies that investigated implementation of the CAM through clinician training sessions or compared the accuracy of the CAM-ICU and another checklist to DSM IV assessments were retained. For the sake of focusing on the patient population of interest, inclusion criteria and search terms were narrowed to specifically include studies related to neurosciences due to the tremendous amount of literature published on delirium and the CAM-ICU instrument. All levels of evidence that were identified in the search were included, but not all levels existed.

The gray literature search did not have a time limit set and was an ongoing process using Google Scholar for articles and information regarding delirium detection specific to neuroscience

patients using the CAM-ICU instrument. There were no additional articles retained as a result of Google Scholar searches.

Selection of Articles

The initial literature search led to the identification of 55 unique articles. Following title review, 15 abstracts were read. Of these, nine articles were read in full and seven relevant articles were included in the final analysis (see Figure 2). Of these seven articles, four excluded neuroscience patients; two were about epidemiological findings but highlighted the need to define baseline mental status exams, specific to neuroscience; and one was a quality improvement project. The quality improvement project served as a replication framework for designing the current study that allowed for the evaluation of a training intervention related to improved accuracy of documentation and identification of delirium on a neuroscience unit.

The hand searches of reference lists retrieved two articles of relevance and both articles were reviews of studies that compared delirium detection tools using the CAM-ICU to other methods. By way of comparison, the CAM-ICU was validated for specificity and sensitivity, and the importance of training clinicians in proper use of the instrument was emphasized. The studies retained for this project are reviewed in Table 1.

The Literature Summary

Ramaswamy et al., (2010) noted the importance of identifying and treating patients at risk for developing delirium and reported that it is under-recognized among elderly patients on a unit in a 350-bed community hospital. The researchers designed and implemented an educational series using didactic and small group sessions to inform clinicians about the significance of delirium. One cohort attended one didactic educational session and the second cohort attended two or more educational sessions. The attendees took a pre- and post-test related

to delirium. One question on the test related to participants' confidence level using the CAM to identify delirium. Cohort one self-assessed their ability to administer the CAM after the intervention at 56% ($p < .22$), compared to 33% pre-intervention. Cohort 2 self-assessed their ability to administer the CAM after the intervention at 69% ($p < .001$).

DiLibero, DeSanto-Madeya, Dottery, Sullivan, and O'Donoghue (2018), performed a quality improvement project based on the premise that application of documenting assessment findings using the CAM-ICU instrument is deficient, especially in neuroscience patients. The instrument is often regarded as inaccurate when used to assess neuroscience patients because clinicians are often confused by the inherent confounding mental status examinations. Clinicians in neuroscience settings received didactic education and real-time feedback with coaching to improve accuracy using the CAM-ICU. Assessment results were compared between medical ICU patients and neuroscience intermediate care and ICU patients. Accuracy after the intervention was 95.07%, with no significant differences between patient populations. The authors also identified that using patients' preadmission mental status as baseline resulted in higher sensitivity, which is not consistent with other studies. Using the patient's preadmission mental status as determined through notes or conversations with those closely associated with the patient, is the recommendation in the CAM-ICU training manual (Ely et al., 2016).

Panitchote et al., (2015) noted that delirium is under-recognized by nurses who use the CAM-ICU. In a Thai hospital, though the ICU was not neuroscience specific and the patients assessed were ≥ 65 years old, the tool was both under-utilized and used incorrectly. In the Thai study, the results of the CAM-ICU assessments performed by the ICU nurses on 99 patients were compared to those performed by researchers; the assessors were blinded to each other's results. The disparity between the cohorts was significant: the researchers identified delirium in 44

patients, while the nurses identified delirium in only 13 patients. There is no information about how the researchers were trained to use the CAM-ICU versus the nurses. There is speculation that the nurses did not identify patients as delirious because they considered factors such as benzodiazepine administration and heart failure, which may confound delirium assessments.

Adams et al., (2015) published clinical guidelines to be used in Kaiser Permanente Hospitals in Northern California in response to the Institute of Healthcare Improvement's (IHI) directive for quality and safety improvement initiatives. Kaiser Permanente formed a Critical Care Collaborative Group (CCCG) to address the deleterious effects of delirium and promote the use of the CAM-ICU and RASS to assess patients. The team carefully and thoroughly considered use of the CAM-ICU with neuroscience patients, but ultimately chose to exclude them. However, didactic and return demonstration classes were held for clinicians, including physicians, in 21 ICU's. Detection and compliance rates were reported as 5% and 74% pre-intervention, respectively. The rates increased to 20% and 90%, respectively post-intervention.

Two studies (Pisani et al., 2006 & Gusmao-Flores, Salluh, Chalhub, & Quarantini, 2012) compared sensitivity and specificity rates between the CAM-ICU and other validated delirium screening instruments and concluded the CAM-ICU is the superior instrument to use for ICU patient screenings. However, the studies were not tested in neuroscience units.

Pisani et al., (2006) conducted a prospective cohort study looking at use of the CAM-ICU with the RASS tool, compared to a validated chart review method performed by researchers. The results were used to identify which method was more reliable in detecting delirium in medical ICU patients. The final analysis revealed the chart audit method had a 64% sensitivity rate and 85% specificity rate compared to the CAM-ICU assessments, which underscores the usefulness of the CAM-ICU, but does not address the accuracy of its' use. Gusmao-Flores et al., (2012)

conducted a systematic review with meta-analysis comparing detection rates of delirium using the CAM-ICU in nine hospitals (969 patients) v. the intensive care delirium screening checklist (ICDSC) in four hospitals (361 patients) against the DSM IV criteria, which is a test that cannot be performed by a bedside ICU nurse. This study compared the use of instruments, but not the accuracy with which they were used. In the study, the pooled results demonstrated an 80% sensitivity rate at a (95% confidence interval (CI): 77.1 to 82.6%) and a 95.99% specificity rate (95% CI: 94.8 to 96.8%) regarding the CAM-ICU tool. The ICDSC pooled results demonstrated a 74% sensitivity rate (95% CI: 65.3 to 81.5%) and a 81.9% specificity rate (95% CI: 76.7 to 86.4%).

While the evidence argues for use of the CAM-ICU instrument to be used in conjunction with the Glasgow Coma Scale (GCS) or RASS to assess LOC, not all researchers are convinced due to complexity of the neuroscience patient population. Singh et al., (2017) conducted a retrospective cohort study and used acute brain failure (ABF) synonymously with delirium. This large study (n = 67,333) was conducted on medical and surgical patients in ICU settings across a seven-year span, focusing on risk factors and outcomes of delirium with the exclusion of neuroscience patients. According to Singh et al., (2017), delirium screening should only be assessed in patients who are cooperative and can answer questions. This finding is not consistent with the aim of the developers of the CAM-ICU.

Mitasova et al., (2012) performed a prospective observational cohort study on the validation of the CAM-ICU that was retained because it is specific to neuroscience patients who are post-stroke. Although the researchers looked for incidence rates and outcomes in these patients, they also validated the reliability of using the CAM-ICU for post-stroke patients in conjunction with the GCS and RASS, but the instrument was not used by nurses. When

compared to DSM evaluations, the CAM-ICU had a 76% sensitivity rate (95% CI: 55%-91%) and a 98% specificity rate (95% CI: 93%-100%). A key component of the study was the importance of identifying the baseline mental status to be used in the delirium assessment and the timing when assessments should occur, as both are deemed critical in improving accuracy using the CAM-ICU with neuroscience patients.

Pandharipande et al., (2017), reported the conclusions of a consensus panel which incorporated current knowledge of delirium, acknowledged the existence of gaps, and recommended opportunities to further the current body of knowledge. It is included in this review because of the discourse surrounding delirium assessment in neurologically injured patients and recommendations for optimal timing of evaluations, both of which will improve the accuracy for nurse performed CAM-ICU assessments.

Gaps in the Literature

Based on a review of the literature, there are gaps regarding the accuracy of identification of delirium in neuroscience ICU patients by bedside registered nurses. Beyond the use of the validated CAM-ICU instrument, coupled with the RASS score, one would be remiss not to investigate bedside nurses' ability to interpret and use the instrument and document results accurately in this highly at-risk patient population. The problem is fueled by the fact that there is not consistent agreement in the literature regarding what to use as a patient's baseline mental status exam, impeding the clinicians' ability to establish whether there is fluctuation, a critical component of screening for delirium. Additionally, most studies excluded neuroscience patients because waxing and waning neurologic exams created by underlying structural brain abnormalities confound an examiner's ability to detect delirium.

Accurate delirium assessment is an important clinical challenge that warrants healthcare providers' attention. The CAM-ICU instrument is a strong predictor of delirium and has been validated across many patient populations. Research including using the CAM-ICU to screen for delirium among neuroscience patients is limited because assessments can be challenging. Identifying baseline mental status is a complex issue. Many neurologically devastated patients have fluctuating mental status exams due to underlying structural causes which confound a clinician's ability to determine a patient's baseline. Consistent practices for identifying a baseline mental status exam in neuroscience patients must be established following the guidelines in the CAM-ICU training manual (Ely et al., 2016). Bedside nurses should be educated and coached on best practices in an effort to promote early identification of delirium through use of the validated screening instruments used as standards of practice at their institution.

Methods

The purpose of this quality improvement (QI) project was to improve neuroscience nurses' ability to accurately document the presence or absence of delirium using the CAM-ICU after a formal educational intervention and follow up coaching sessions as needed. The investigator was trained by a delirium and CAM-ICU instrument expert for face validity.

Operational definitions of terms used in this study are as follows:

Delirium is characterized by alterations in cognition, specifically inattention and disorganized thinking, as defined by the American Psychiatric Association, DSM-5 criteria (European Delirium Association, 2014).

Training Materials. The investigator used Vanderbilt University's complete training manual as a self-training guide for using the CAM-ICU and RASS screening instruments (Ely et

al., 2016). Before the implementation phase of this project, a PowerPoint presentation was developed as a guide to be used during the 30-minute formal education session. The PowerPoint contained information from the literature review, epidemiological facts about delirium, and instructions for use of the CAM-ICU and RASS with screenshots of the criteria for scoring. The PowerPoint was screened by the faculty advisor, NICU clinical nurse specialist, and practice mentor for feedback prior to use.

Coaching and mentoring is defined as the APRN investigator working individually with a nurse or small group (no more than three nurses) who need additional training to accurately complete the CAM-ICU assessment tool based on a review of documentation in the EHR or nurse who asked for additional support completing documentation of the CAM-ICU.

Instruments - The CAM-ICU and RASS instruments are the current standards of practice to screen for delirium and agitation/sedation at the institution. The platform to document assessments using those instruments is already built into the EHRs at the institution.

The EHR data collected were patients' RASS scores, recorded four CAM-ICU assessment features, CAM-ICU score (positive, negative, or unable to assess), and determination if the CAM-ICU instrument was used accurately or inaccurately based on the criteria as delineated in the Vanderbilt training manual (Ely et al., 2016).

CAM-ICU criteria - The CAM-ICU should only be scored positive if the patient is ***positive*** in both features one and two plus either feature three or four (Ely et al., 2016). The CAM-ICU score may be ***negative*** in one of three scoring situations: If feature one (**mental status**) is negative, the assessor may stop because the CAM-ICU is negative; If feature two (**inattention**) is negative the assessor may stop because the CAM-ICU is negative; or if feature three (**altered level of consciousness**) is a RASS score of zero and feature four (**disorganized**

thinking) is negative, then the CAM-ICU score is negative (Ely et al., 2016). A negative result indicates that a patient is not currently positive for delirium. The only scenario in which a patient is ***unable-to-assess*** is if the RASS score is ≤ - 4, because the patient's level of consciousness is too altered to assess for the presence or absence of delirium.

If an acute change from patients' pre-hospital condition cannot be determined from the patient or outside resources such as the chart or other people, the nurses have to refer to previously documented RASS scores and establish if patients' RASS scores are fluctuating, which is consistent with Vanderbilt's ICU delirium training manual. "**Yes**" is documented if the patients' pre-hospital conditions have changed acutely or their RASS scores are fluctuating, most patients should not be deemed UTA. This establishes baseline criteria for the unit's standard of care. The educational intervention included teaching the RNs to embrace the ability to accurately document **feature one** on the CAM-ICU as exercising this proper standard of care was a new process for the nurses to learn.

Valid positive CAM-ICU assessment is defined as having a patient present as positive in <u>both</u> features one and two, <u>plus</u> either feature three or four (Ely et al., 2016).

Valid negative CAM-ICU assessment is defined as feature one is negative; <u>or</u> feature two is negative; <u>or</u> if feature three is a RASS score of zero <u>and</u> feature four is negative (Ely et al., 2016).

Unable-to-Assess (UTA) is defined as a RASS score ≤ - 4 (Ely et al., 2016).

Measures

The investigator and practice mentor conducted a telephone interview with a content expert identified during the literature review, Justin DiLibero (DiLibero, J., personal communication, June 5, 2018). DiLibero electronically shared the audit tool developed and used

for his study and initial data collection (see Appendix C). Permission to use a modified version of DiLibero's audit instrument was obtained both verbally (personal communication June 5, 2018) and by electronic mail (see Appendices D and E). The modified audit instrument was selected for use in this study because it was validated for use in delirium screening using the CAM-ICU instrument in neuroscience patients (DiLibero et al., 2018). The CAM-ICU delirium screening instrument and the RASS, which may be used to determine LOC (Ely et al., 2016), are the current instruments in use at the institution as the standard of care (SOC).

The modified audit instrument consists of two parts for data collection, with no patient specific identifiers recorded. To de-identify patients, only the last three digits of the patients' room numbers were recorded to eliminate duplication of audit information. The first portion of the instrument allowed the investigator to record the nurses' documentation as it was in the EHR. There are columns to code a patient's room number; document the RASS score; each of the four features of the CAM-ICU assessment instrument; total CAM-ICU score; and auditor comments. The second portion of the instrument is for the investigator to record the accuracy with which the nurse documented the delirium assessment score using established criteria (Ely et al., 2016). There are columns to code the room number; primary neurologic diagnosis, if one exists; current RASS; possible outcomes if the CAM-ICU was used correctly—indicating positive (delirium present), negative (delirium absent), UTA due to RASS ≤ - 4, language barrier, or other reason a patient was UTA. The second set of columns was used to record how the CAM-ICU was used incorrectly—assessment inaccurately scored positive (delirium present), negative (delirium absent), or UTA.

According to DiLibero (2018), unit champions used the instrument to collect and analyze data for correct usage of the CAM-ICU instrument. Through appropriate use of the data

collection instrument, champions demonstrated interobserver reliability. DiLibero utilized a training manual designed and published by Vanderbilt University delirium scholars (Ely et al., 2016) to further his knowledge and train others: i.e., unit champions.

Instrument Modification. The audit instrument was modified to remove hospital identifiers, patient record numbers, and benzodiazepine use. Using the modified instrument, the investigator audited patients' EHR's in the NICU to calculate unit-based accuracy rates.

Unit pre-audit baseline documentation accuracy rates were computed after EHR review using the modified audit instrument. Documentation results were recorded as accurate or inaccurate. Inaccurate documentation includes documentation that was either incomplete or not performed. The statistical mean was computed to establish a baseline rate of correct documentation by current NICU RN's using the CAM-ICU instrument.

Unit post-audit overall. After the six-week training period, patient EHR's of all eligible NICU RN's were audited for unit documentation accuracy and data was collected for comparative analysis to the baseline unit rate. The goal was for the investigator to record the documentation accuracy from a minimum of six audits per RN who participated in the formal education, using the same empirical formula as in the unit pre-audit overall. Additionally, the investigator recorded comments regarding errors made in documentation so that trends may be identified in a retrospective qualitative analysis.

Project Description

The project took place from September 2018 until December 2018. Pre- and post-intervention unit-level audits of EHRs using a modified validated data collection instrument were conducted. There were four phases of the project.

Phases of the Project

Phase one – A pre-intervention unit audit was conducted using EHRs for four weeks by the advanced practice registered nurse (APRN) investigator for documentation of delirium screening features using the CAM-ICU instrument, which is the institution's current standard practice. The goal was to obtain six audits per nurse for a unit base-line on detection and accuracy of documentation.

Phase two – Following the audit period, the neuroscience nurses were invited to attend one 30-minute didactic training session with a PowerPoint presentation conducted by the APRN investigator. The educational sessions were offered by the investigator over the course of three weeks. Aggregated demographic information was obtained and nurses were de-identified when data was shared.

Phase three – For three weeks, real-time coaching by the APRN investigator was provided to nurses who attended the formal educational sessions based on need as determined by EHR audit results or if nurses asked for feedback, coaching, or mentoring.

Phase four – After the coaching period, the APRN investigator conducted post-intervention unit audits for CAM-ICU documentation by the nurses who participated in the education session. The goal was to obtain a minimum of six audits per nurse who had participated in phases two and three of the study.

Setting

This project took place in a neuroscience intensive care unit (NICU) at an academic medical center in central Virginia. The NICU consists of 12 beds and has a dedicated ICU nursing staff with specialty training in neurocritical care. Although each patient has an attending physician with an assigned team of resident physicians, the day to day management of patients is

led by an intensivist who is board certified in Neurocritical Care and conducts morning rounds with the interdisciplinary team. The interdisciplinary team consists of the daily intensivist; two resident physicians certified in either neurology, neurosurgery, or anesthesiology; acute care nurse practitioners; the CNS; a PharmD. ; bedside RNs; and a unit-based RRT.

Description of the Sample

A convenience sample of neuroscience ICU nurses was used. Thirty-three current nurses employed in the NICU were invited to participate in the study. Nurses currently on orientation, staffing resource office nurses, and travel nurses were excluded from participation.

Procedures

- Obtained Institutional Review Board for Health Sciences Research (IRB-HSR) review prior to conducting this study.
- This project was not deemed human subjects research, it was considered quality improvement and nurses' consent to participate was assumed by attendance at educational sessions (IRB-HSR tracking # 20949).
- Investigator obtained face validity to use CAM-ICU instrument and accurately document assessment of patients from institution's delirium content expert.
- Investigator obtained interrater reliability using the modified data collection instrument through discussion with J. DiLibero (personal communication, June 5, 2018).
- Following IRB-HSR determination, investigator, nurse educator, and nurse manager made announcements of the project in the NICU approximately one month prior to educational sessions. Reminder e-mails were sent by the nurse educator to the NICU list serve prior to some of the educational sessions.

- Investigator developed the PowerPoint used in the 30-minute didactic training sessions. The sessions were set for 30-minutes as that was the timeframe allotted by the nurse manager.
- A pre-intervention EHR audit was conducted for four weeks to calculate current unit accuracy rate of nurses' documentation of delirium assessment through use of the CAM-ICU screening instrument. The goal was to collect a minimum of six assessments conducted by each of the 33 RNs employed in the NICU during the first two weeks of the project. The number of assessments is an empirical estimate based on the probability that each nurse worked three shifts per week and would have a minimum of two patients per shift, resulting in six CAM-ICU assessments on record per week. An additional three weeks of audits were conducted to increase the likelihood of obtaining six assessments per RN.
- The investigator provided multiple 30-minute formal education sessions tailored to improve knowledge and skills in applying the CAM-ICU criteria in a neuroscience ICU. The sessions were held at various times to offer the educational opportunity to the majority of nurses over three weeks. At the time of project implementation, there were 33 RNs employed in the NICU who were eligible to participate. The goal was to formally educate 70% (23) of the nurses how to use the CAM-ICU with the RASS to screen for delirium.
- Using the modified DiLibero audit instrument, EHR audits of CAM-ICU documentation performed by the nurses who attended the formal educational intervention were conducted by the investigator. Real time coaching took place for three weeks with nurses if their delirium screening assessments were documented inaccurately or if they requested

consultation with the investigator independently. The specific aim was to attain a minimum of 90% unit accuracy in using the CAM-ICU instrument for delirium screening.

- The goal was to collect six assessments conducted by each of the RNs who participated in the project in the NICU for two weeks post-formal education and coaching/mentoring, using the same empirical estimate as above.

Protection of Human Subjects

The Institutional Review Board for Health Sciences Research (IRB-HSR) was sought before commencing the educational intervention and determined the project is quality improvement and was assigned a tracking identification number (see Appendix F). A request to review the medical records of patients in the NICU during the study timeframe was filed with Health Information Services (HIS) prior to implementation. Permission to access nurses' documentation was not required as this is a quality improvement study consistent with the standard of care and the investigator already has access to the EHR's for professional role in NICU. This was verified in a personal communication with the health information services document completion and transcription manager and in a joint phone interview with a corporate compliance and privacy analyst at the institution (Johnson, G., Lowe, A., personal communication, July 20, 2018).

Permission to conduct formal educational interventions was obtained from the Medical Director and Nurse Manager of the NICU prior to beginning the project (see Appendix G). The CAM-ICU and RASS instruments were already in use for delirium, agitation, and sedation screening, respectively, at the academic medical center and did not require special permissions for use. The NICU CNS reviewed the project proposal and ensured that it was consistent with

expected standards of practice (Mahanes, S.D., personal communication, July 10, 2018). No patient protected health information (PHI) was collected or stored. Room numbers were recorded without the first digit to de-identify patient locations. Limited demographic information regarding participating nurses was collected and de-identified prior to any data sharing with anyone in a managerial or leadership role over the RNs.

Data Analysis

The data analysis began with audits of all patient records in the NICU to record findings of delirium assessments to establish the delirium unit rate prior to educational interventions conducted by the investigator. Peer chart audits are a standard operating procedure in the NICU for documentation completion based on needs assessments by unit champions, the CNS, or nurse manager. The nurse who documented the assessment was tracked by initials for pre- and post-intervention comparison, nurse initials have been de-identified using a numeric coding system. A baseline mean statistic for documentation accuracy for the NICU was obtained after four weeks of auditing and was compared to the post-intervention mean statistic. The unit of analysis is individual documentation accuracy. The goal was to record six assessments per nurse from each of the 33 RNs before the intervention and after so pre- and post-intervention unit rates could be compared by individual nurse using a paired t-test. Also, a comparison between the change in rates for those who participated in the intervention and those who did not can be evaluated by computing the mean differences.

Statistical Analysis

The collected data were recorded on the modified data audit tool and transferred into Statistical Package for the Social Sciences (SPSS), version 24, for analysis. Demographic statistics were collected from the RNs who attended educational sessions (see Figure 3).

Descriptive statistics were used to summarize the nurses' demographic data. The recorded RN assessments were de-identified using a random numeric coding system. The pre- and post-audits were coded as dataset one and dataset two, respectively. Dataset one contained RN assessments from phase one and dataset two contained the RN assessments from phase four. The number of assessments recorded for each nurse was combined in each of the two auditing phases to demonstrate the accuracy rates as dependent variables. Accurately documented CAM-ICU scores and inaccurately documented CAM-ICU scores were coded as, *yes* and *no* respectively and then defined as two variables, accurate and inaccurate in SPSS syntax.

The accuracy rate was coded as a new variable "success rate", which was the number of correct assessments divided by the number of assessments done by individual nurses from each of the two auditing phases. Frequencies and percentages were computed for each RN retained in the study (n = 18) for pre- and post- intervention accuracy rate. Changes in accuracy for each RN were calculated by subtracting the accuracy rate in dataset two from the accuracy rate in dataset one. The unit accuracy rates pre- and post- intervention were calculated using means, mean differences, and standard deviations for normally distributed continuous data, as this is what the NICU leadership sought to support evidence of value-based unit practice education.

Results

Sample

There were 33 nurses who were eligible to participate in the study after exclusion criteria were applied. There were 30 nurses representing 91% of the group eligible to participate in the educational interventions who participated in the 30-minute didactic educational session. The educational interventions were conducted in two phases and provided over a six-week timeframe in October and November 2018. The groups ranged in size from one to five during the didactic

educational training sessions. The one-to-one coaching sessions expanded to include one to three nurses at a time to examine documentation and answer questions. There were 18 nurses who could be paired by a minimum of five audits in each of the two audit phases. Therefore, unit documentation accuracy rates were calculated, and reported for 18 nurses retained in this study; 55% of the original unit eligible nurses.

A paired-samples t-test was analyzed to detect significant differences in normally distributed continuous data between pre- and post-delirium screening scores on the subset of RNs who received the formal education and coaching intervention when documentation was incorrect. To use the paired-samples t-test, the distribution of the pre-post differences must be fairly normal. The distribution was examined by running an explore procedure on the merged set's variable representing the pre-post difference in success rates in SPSS®. The variable was not skewed but had high kurtosis. In an abundance of caution, a Wilcoxon Signed Rank Test was also run. Statistical significance (α) of $\leq .05$ was used.

Demographics

Demographic data for the reduced sample ($n = 18$), those who were audited at least five times in each of the two phases, are shown in Table 2.Demographic information was collected in ranges of age, years of nursing experience, years of ICU experience, years of neuroscience ICU experience, and educational level. There were no missing demographic values for the participants.

Age ranges. The 20-30 years age range represented 66.7% of the participants ($n = 12$), 31-40 age range was 22.2% ($n = 4$), and the 61+ age group represented 11.1% of the sample ($n = 2$).

Years of nursing experience. Participants reporting one to five years of nursing experience represented 72.2% (*n* = 13) of the sample. Completion of six to ten years of experience was reported by 16.6% (*n* = 3) of the participants, and 21+ years of experience was reported by 11.1% (*n* = 2).

Years of experience in ICU setting and years of neuroscience ICU experience. The majority of participating RNs, 88.9% (*n* = 16), reported 1-5 years of experience in the ICU. Of those, all of them reported the same amount of time in the neuroscience ICU setting. Nurses reporting working in an ICU setting for 21+ years represented 11.1% (*n* = 2) of the sample, the same RNs reported 21+ years of experience in a neuroscience ICU.

Level of education. Responses for the category of level of education were recorded as: associate degree of nursing (ADN), Bachelor of Science in nursing (BSN), Master of Science in nursing (MSN), and doctorate. The BSN-prepared group represented the largest segment of the sample with 83.3% (*n* = 15). ADN-prepared nurses represented 16.6% (*n* = 3) of the participants. There were no Master's or Doctorally-prepared nurses.

Documentation Accuracy Rates of CAM-ICU

Nursing documentation accuracy rates using the CAM-ICU were documented on a modified validated data collection tool during audits of EHRs pre- and post-educational intervention and one-to-one coaching sessions. Following data collection, a paired-samples t-test was conducted to compare the unit-based documentation accuracy rates using the CAM-ICU instrument pre- and post-educational intervention. The overall mean score of accurately documented CAM-ICU assessments was 44.3% before the intervention. After the educational intervention, the overall mean score of accurately documented CAM-ICU assessments was 83%. There was a statistically significant difference in the accuracy rates pre-education (M = 0.44, SD

= 0.22) and post-education (M = 0.83, SD = 0.22); t (17) = -7.30, p = < .001 (see Table 3). A Wilcoxon Signed Ranks Test indicated the post-education unit documentation accuracy rank was significantly higher than the pre-education unit documentation accuracy rank, p < .001. This result suggests that when nurses are educated and coached in documentation practices, there is a significant improvement in documenting CAM-ICU assessments accurately.

CAM-ICU category analysis. Frequencies were run on each of the possible responses for CAM-ICU documentation accuracy or inaccuracy (see Table 4 and Table 5). In each of the two audit phases there were 124 documentation audits and there were no missing data. In phase one the majority of the assessments were documented as UTA, 45.2% (*n* = 56). A large number of assessments were recorded accurately as negative 37.9% (*n* = 47), indicating delirium was not present. There was one assessment that indicated a patient was delirious 0.8% (*n* = 1). Inaccurate assessments were documented in 55.6% (*n* = 69) cases.

In phase four, the accuracy of documentation improved, as previously reported. The majority of assessments were accurately documented as negative 58.9% (*n* = 73), indicating those patients were not experiencing delirium. Patients screening positive for delirium accounted for 20.2% (*n* = 25) of the patient assessments retained in phase four of the project. There were only 3.2% (*n* = 4) patients who were inaccurately documented as UTA in phase four.

Individual nurse improvement analysis. Of the 18 nurse participants who were retained for analysis in this project, 17 of them improved. The largest improvement in accuracy went from 17% accuracy pre-education intervention to 100% accuracy post-education intervention for one nurse, for a mean change in accuracy of 83%. For the change in individual nurse's documentation accuracy rate change see Table 6.

Discussion

The results of this study support the use of an educational intervention tailored to neuroscience nurses to improve the accurate use and documentation of point of care CAM-ICU assessment in neuroscience patients. This study further supports nursing's contribution to interdisciplinary initiatives to minimize the risk of adverse outcomes from delirium through early detection and intervention in intensive care settings. The results of this study indicate accuracy of delirium assessment documentation using the CAM-ICU is challenging for neuroscience ICU nurses who are not formally trained in the application of its' features. When auditing assessments prior to conducting an educational intervention, there were fewer patients who screened positive for delirium. Specifically, there was a much higher rate of patients who were inaccurately categorized as UTA. The results of this study suggest subjective responses were being recorded for the four features of the CAM-ICU, rather than the intended objective testing which is an important component of using the instrument accurately.

In this project, there was nearly a two-fold increase in documentation accuracy, 39% ($p < .001$), when nurses participated in formal training sessions (pre-intervention, 44%; post-intervention, 83%). Time spent in delirium can impact patient outcomes and it is frequently underdiagnosed. Early identification is an important component to facilitate better treatment management plans that will mitigate the effects of delirium.

This study increased both the nurses' and licensed independent providers' (LIP) satisfaction. The nurses had a desire to accurately document findings to support early detection and improve patient care. The LIPs had a positive response to the early flags for delirium detection as it is of interest to the institution to improve quality of care by improving patient outcomes, impacting length of stay and hospital costs. Specialized training within a neuroscience unit closes the gap in the literature by addressing the unique challenges in assessing

neuroscience patients, establishing baseline criteria within the standard of care, creating a unit specific response to unique challenges.

Strengths and Limitations

Strengths of the design were multiple. The study took place in an academic medical center with a dedicated neuroscience ICU. The project replicated a previously successful study for the purpose of improving delirium screening using a similar documentation auditing tool used to record CAM-ICU and RASS responses. The project was implemented in the ICU where the investigator has practiced for many years and has established relationships with the RNs. Use of the CAM-ICU and RASS instruments were already standards of practice and are built into the EHR. This study demonstrated the transferability of the previous study to another setting, expanding evidence-based quality improvement practices. The project was implemented in a single ICU with a specific patient population which is transferable to other clinical settings.

Limitations of the study included, the number of subjects was limited due to both setting and timeframe. The number of audits conducted was limited by unforeseen things such as low census in the ICU for a prolonged period, 13 RNs were shift managers and therefore had limited documentation available for analysis. There were four RNs functioning as preceptors with orientees during the study. The four orientees performed and documented assessments under supervision, however orientees were excluded from the study, which inadvertently decreased the number of documentations for the preceptors.

Implications for Practice

This study established that assessments can be documented accurately to reflect the presence or absence of delirium in neuroscience patients using the CAM-ICU instrument. The results of this study indicate when there is formal training on assessment documentation, there is

increased identification of delirium in neuroscience ICU patients, a complex and vulnerable population. It also indicated that in a unique population, such as neuroscience patients, defining baseline assessment criteria is also critical. As nurses increase communication regarding the CAM-ICU, it enhances their contribution to the healthcare team. An increase in positive screenings for delirium has an impact on the medical team's list of differential diagnoses, fostering team collaboration. Early recognition of delirium has heightened practitioners' awareness of delirium in the clinical setting. Noting this critical, reversible clinical process drove the need to establish a unit protocol to adopt the clinical standard baseline mental status to improve documentation accuracy using the CAM-ICU delirium screening instrument. Placing delirium on the clinicians' list of differentials will force the inter-collaborative team to look at potential causes of delirium and further develop treatment protocols to minimize delirium occurrences and time spent in delirium in the NICU. The presence of delirium has been identified more often as a result of the project and has increased the practitioners' awareness of delirium in a challenging patient population. Next steps will include discussions regarding how patients with screenings indicating the presence of delirium will be managed in the NICU. Additionally, there is a need for the development or adoption of tools that may guide treatment protocols.

Products of the Doctor of Nursing Practice Project

The abstract was submitted and has been accepted for presentation at the 2019 12th National Doctors of Nursing Practice Conference as a poster abstract. Submission guidelines can be found in Appendix H. The completed manuscript will be submitted for publication to the *Journal of Neuroscience Nursing*. Guidelines for authors can be found in Appendix I and a draft copy of the completed manuscript is attached as Appendix J.

Next steps. The NICU will continue to train and coach RNs on documentation which is expected to facilitate accuracy and increase early identification of presence of delirium in this highly at-risk patient population. Adding delirium screening to the RN checklist during daily interdisciplinary rounding reinforces nurses' commitment to document assessments accurately and flags the team's attention to delirium. Additional training and continued auditing of documentation is warranted for sustainability of this study. To maintain the upward trend of documentation accuracy, ongoing audits of documentation every six months is recommended. Sustainability is important to promote early identification and treatment as well as foster improved patient care outcomes. Another recommended sustainability initiative is the creation of name badge CAM-ICU scoring tags to reinforce scoring accuracy for all members of the interdisciplinary team.

Conclusions

Neuroscience ICU nurses have contributed to closing the research-practice gap through participation in this project. If delirium is recognized early in a patient's ICU course, interventions can be put in place to prevent it from getting worse, potentially shortening the time a patient spends in delirium. Further studies of accurate assessment documentation using the CAM-ICU by neuroscience nurses will play a central role in contributing to this body of knowledge and increase identification of delirium, lowering the risk of adverse outcomes.

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Table 1

Summary Table of Studies on Assessing Neuroscience ICU Patients for Delirium Using the CAM-ICU Tool

Author (Year)	Study Design	Subjects & Setting/Period of Data Collection	Outcomes Based on Stated Aims	Limitations
Ramaswamy et al., (2010)	Prospective Cohort study with 4-part didactic series Cohorts were defined by how many educational sessions participants attended. Cohort 1=1 didactic session; Cohort 2 ≥ 2 sessions.	Average of 71 healthcare professionals attended each didactic session. (2-day sessions w/ 4-part didactic series)	Aim: Effect change in clinician behavior by improving knowledge about delirium prevention, ***recognition***, and management. Outcomes: Pre and Posttests to assess knowledge scores. Cohort 1 (1.3, $p < .12$) point change post. Cohort 2 (3.8, $p < .001$) point post change. Pre-& post surveys to evaluate self-assessed capacity to administer CAM for delirium ***identification.*** Cohort 1 post 56% ($p < .22$). Cohort 2 post 69% ($p < .001$)	*Study participants were not all in the same location, limiting ability to interact & precluded test/survey matching for analysis *data collection captured knowledge change vs. behavior change.
DiLibero, DeSanto-Madeya, Dottery, Sullivan, & O'Donoghue, (2018)	Quality Improvement Project (Nurse-led intervention implemented. Compared pre-& post intervention assessments and compared accuracy)	NIMU nurses on orientation 7 sessions of phase I of the model between 2/1/16-5/31/16 (each nurse attended one educational session) Phase II after 6/22/2016	Aims: Improve nurses' delirium assessments to > 80% in neuroscience patients -compare effectiveness of the intervention (in improving accuracy of assessment) between medical and neuroscience (NS) patients (patient population, RASS score, and ICU vs. IMU) Outcomes:	*Author notes this is the first study comparing efforts to improve accuracy of CAM-ICU use between medical and NS pts. *Assessing NS pts for delirium is complicated by the fact that structural and nonstructural neurologic changes illicit the same signs and symptoms *Single center *Built on previous work at

Author (Year)	Study Design	Subjects & Setting/Period of Data Collection	Outcomes Based on Stated Aims	Limitations
		(opening of NIMU)- nurse champions provided feedback & coaching on assessment	1-Compliance of 95% completing delirium assessment 1x/shift 2-effectiveness: accuracy pre-intervention among NS patients 56.82% vs 77.72% in medical pts; RASS score 29.79%, $P \leq .01$. Post-intervention accuracy: 95.07% among all pts; 92.98% RASS +	this center *No systematic randomization of data collection-convenience collections by unit champions *Focus only on improvement at nursing level.
Panitchote et al., (2015)	Blinded Prospective Cohort Study (trained clinical researchers vs. ICU nurses w/ at least 5yrs experience)	Pts ≥ 65 admitted to the ICU at Khon Kaen University hospital in Thailand. May 1, 2013-August 31, 2014 *Excluded from study if: readmitted during same hospital stay; no consent; RASS ≤ -3; severe aphasia or hearing impairment.	Aims: Identify under-recognition rate of delirium by ICU RNs using CAM-ICU -Identify factors r/t under-recognition Outcomes: *99 patients examined for delirium. Delirium detected in 44 pts by researchers; 31 pts by nurses. *Nurses attributed symptoms of delirium to underlying medical condition or pts. Therapies. *Factors associated with under-recognition: age, baseline low functional status & sensory impairment, presence of hypoactive delirium, dementia, increased LOS.	*Tertiary care hospital/low nurse turnover limits generalizability *low sample size *Needs intervention/training to facilitate identification of delirium.
Pisani et al., (2006)	Prospective Cohort study (CAM-ICU w/	178 Medical ICU pts ≥ 60 yrs. September 3, 2003- September	Aim: To improve detection of delirium in the ICU Outcomes: comparing the CAM-	*One nurse performed the chart audits and may introduce bias and limit generalizability.

Author (Year)	Study Design	Subjects & Setting/Period of Data Collection	Outcomes Based on Stated Aims	Limitations
	RASS by trained nurses M-F vs. daily validated chart review method to detect delirium)	30, 2003 *Excluded: Age; no available proxy to provide information about the pt.; Expired before proxy available; transferred from another ICU- because of missing baseline data; < 24hr stay; non-English speaking	ICU to chart review indicated 64% sensitivity and 36% false-negative rate and a specificity of 85% w/ 15% false-positive rate. Positive-predictive rate: 87% and negative-predictive accuracy: 60%. (absence of chart documentation couldn't exclude the presence of delirium) *Using CAM-ICU and validated chart review demonstrates a more comprehensive way to detect delirium. *ICU nurses need to be trained to use the tool and use it in conjunction with RASS	*Proposed chart algorithm is for research studies, not clinical purposes *The chart algorithm was not available for assessment as an attachment to the article *Older study, more has been done with delirium detection since this study.
Gusmao-Flores et al., (2012)	Systematic review with meta-analyses. (Compare tools CAM-ICU and ICDSC against the DSM IV criteria (gold standard) to detect delirium in critical care).	Search of 4 databases with keywords from January 2001 – November 2011. 189 articles found for CAM-ICU; 9 retained (969 pts). 33 articles found for ICDSC; 4 retained (391 pts).	Aims: Perform a systematic review and pool previously published articles and use a meta-analysis to compare assessment tools: CAM-ICU vs. ICDSC for delirium diagnosis in ICUs, when compared to DSM IV. Outcomes: CAM-ICU determined to be an excellent tool and ICDSC was "good". Either can be used for detection of delirium in ICU.	*Validity study. Considers the specificity and sensitivity of the tools, but not the accuracy with which the tools were used/evaluator method/competence.
Singh et al., (2017)	Retrospective cohort study	Patients in surgical and	*Aims:* Determine acute brain failure (ABF) incidence, risk factors, and	*States that delirium should only be assessed in pts who

Author (Year)	Study Design	Subjects & Setting/Period of Data Collection	Outcomes Based on Stated Aims	Limitations
		medical ICU's that were ≥ 18yo. (# of patients screen= 67,333) Chart reviews between 2006-2013 in a tertiary academic medical center.	outcomes. ABF = + CAM-ICU or GCS >8=Grade 1; GCS ≤ 8= Grade 2, if RASS ≥ -3. (Also used FOUR score, not familiar). *Outcomes:* ABF occurs more often in older pts. w/ worse acute illness prognosis and more co-morbidities; short & long-term prognosis is increased. Multiple risk factors were identified, but recommend add'l studies to see which can be modified.	are alert enough to answer questions b/c it reflects thought content; determined delirium based on chart audits/Neuroscience pts. excluded *Strength: acknowledges since scores are entered by nurses, accuracy is important & did a prospective study validating the correlation between RNs & MDs re: CAM-ICU.
Mitasova et al., (2012)	Prospective observational cohort study	129 pts w/ ischemic or hemorrhagic stroke in a university hospital's stroke unit	*Aims*: Validate CAM-ICU using DSM IV criteria in post-stroke patients. *Outcomes*: Comparison sensitivity was only 76%; specificity 98% & overall accuracy was calculated at 94%. CAM-ICU is a valid instrument for the dx of delirium in post-stroke pts., but serial screenings should be performed over at least 5 days to see the fluctuations in mental status.	*CAM-ICU instrument used by "junior physicians", not nurses. *symptoms as a result of recent stroke establish a new baseline for pts which makes assessments complicated. **in pts who have subtle OR complex neuro changes a more thorough exam should be performed by neuropsychologists.
Adams et al., (2015)	Clinical Practice Guideline Implementation-quality	*Education was provided to nurses and physicians across	*Kaiser Permanente Health System identified need to implement guidelines to prevent, screen for, and treat delirium. The CAM-ICU	*Neuroscience patients were excluded because their mental status baseline could not be established/confusion

Author (Year)	Study Design	Subjects & Setting/Period of Data Collection	Outcomes Based on Stated Aims	Limitations
	improvement process. This is one initiative to improve care for ICU patients: Detection of Delirium	the hospital system on how to use the tools	assessment tool coupled with RASS were the validated tools used. *Consultation with author of CAM-ICU tool *Compliance w/ use of tool measured at average of 90% across 21 hospitals. No note of accuracy of use. However, authors note that monitoring of performance including accuracy will be a factor for success of their initiative.	between attributing mental status changes to structural vs. non-structural changes. At the time of this article, baseline had not been established for neuro pts.
Pandharipande et al., (2017)	Evidence-based paper		*Goal was to bring experts together to answer questions about what is known about delirium and raise questions regarding the next steps for future research. *Supports that new baseline neurologic exam should be accurately documented and if there are fluctuations, consider delirium as a differential diagnosis, but address primary brain etiology first.	*Conclusion: recommendation for large RCT to test safety and efficacy of different treatment protocols for pts experiencing delirium.

Table 2

Demographics of Nurses Retained for Study

Characteristic	*n* = 18	%
Age Range		
20-30	12	66.7
31-40	4	22.2
41-50	-	-
51-60	-	-
61+	2	11.1
Years of Nursing Experience	-	-
1-5	13	72.2
6-10	3	16.7
11-15	-	-
16-20	-	-
21+	2	11.1
Years of ICU Experience	-	-
1-5	16	88.9
6-10	-	-
11-15	-	-
16-20	-	-
21+	2	11.1
Years of NICU Experience	-	-
1-5	16	88.9
6-10	-	-
11-15	-	-
16-20	-	-
21+	2	11.1
Educational Level	-	-
ADN	3	16.7
BSN	15	83.3
MSN	-	-
DNP	-	-

Note. Nurses retained for the study had their CAM-ICU documentation in the electronic health record audited a minimum of five times pre- and post-intervention by the investigator, participated in the formal educational intervention, and had a minimum of one coaching and mentoring session. ADN = Associate Degree in Nursing; BSN = Bachelor of Science in Nursing; MSN = Master of Science in Nursing; DNP = Doctor of Nursing Practice.

Table 3

Paired Samples t-test Results of Pre and Post Documentation Accuracy Rates at the Unit Level (n = 18)

Documentation Accuracy Rates	M *(SD)* Pre	M *(SD)* Post	*t*(17)	*p*	95% CI
Unit Level	0.44 *(0.22)*	0.83 *(0.22)*	-7.30	< .001	[- .48 , - .27]

Note. CI = confidence interval. Unit level documentation accuracy rate improvement from minimum of five audits per each of 18 registered nurses retained in the study for paired samples comparison pre and post-intervention. Based on total electronic health record audits pre-intervention n = 124 and post-intervention n = 124.

Table 4

Accurate Documentation Findings of the CAM-ICU / RASS Pre/Post Audit Intervention (n = 124)

Possible Accurate Assessment Outcomes	Pre-Audit		Post-Audit	
	n = 124	%	*n* = 124	%
Positive	1	0.8	25	20.2
Negative	47	37.9	73	58.9
UTA due to RASS	7	5.6	5	4
Total Accurate	55	44.3	103	83

Note. UTA = unable to assess. RASS = Richmond Agitation-Sedation Scale. There are three possible outcomes when documenting assessments using the CAM-ICU instrument. The screening may be positive, negative, or UTA. The CAM-ICU has an algorithm with criteria used to score assessments of patients. If features one and two plus either three or four are positive, a patient screens positive for delirium. If either feature one or two is negative, the patient screens negative for delirium. If the patient's RASS score is ≤ 4, the patient's status is UTA.

Table 5

Inaccurate Documentation Findings of the CAM-ICU / RASS Pre/Post Audit Intervention (n = 124)

Possible Inaccurate Assessment Outcomes	Pre-Audit		Post-Audit	
	n = 124	%	*n* = 124	%
Inaccurate Positive	1	0.8	-	0
Inaccurate Negative	1	0.8	14	11.3
Inaccurate UTA	56	45.2	4	3.2
Screening not documented	11	8.9	3	2.4
Total Inaccurate	69	55.6	21	16.9

Note. UTA = unable to assess. RASS = Richmond Agitation-Sedation Scale. There are three possible outcomes when documenting assessments using the CAM-ICU instrument. The screening may be positive, negative, or UTA. The CAM-ICU has an algorithm with criteria used to score assessments of patients. If features one and two plus either three or four are positive, a patient screens positive for delirium. If either feature one or two is negative, the patient screens negative for delirium. If the patient's RASS score is ≤ 4, the patient's status is UTA.

Table 6

Documentation Accuracy Rate for Each Nurse Pre- and Post- Intervention

RN	Pre-	Post-	Difference in Rates
1	.67	1.00	.33
2	.75	1.00	.25
3	.33	1.00	.67
4	.50	.86	.36
5	.33	.80	.47
6	.50	.83	.33
7	.40	1.00	.60
8	.43	.83	.40
9	.44	.86	.42
10	.71	.50	-0.21
11	.67	1.00	.33
12	.00	.20	.20
13	.50	.88	.38
14	.17	1.00	.83
15	.43	.80	.37
16	.00	.50	.50
17	.67	.86	.19
18	.50	.83	.33

Note. The nurses in the study had a statistically significant improvement in documentation accuracy rates after the intervention (M = [0.38], SD = [0.22]) from before the intervention, t (17) = [-7.30], p = [< 0.001].

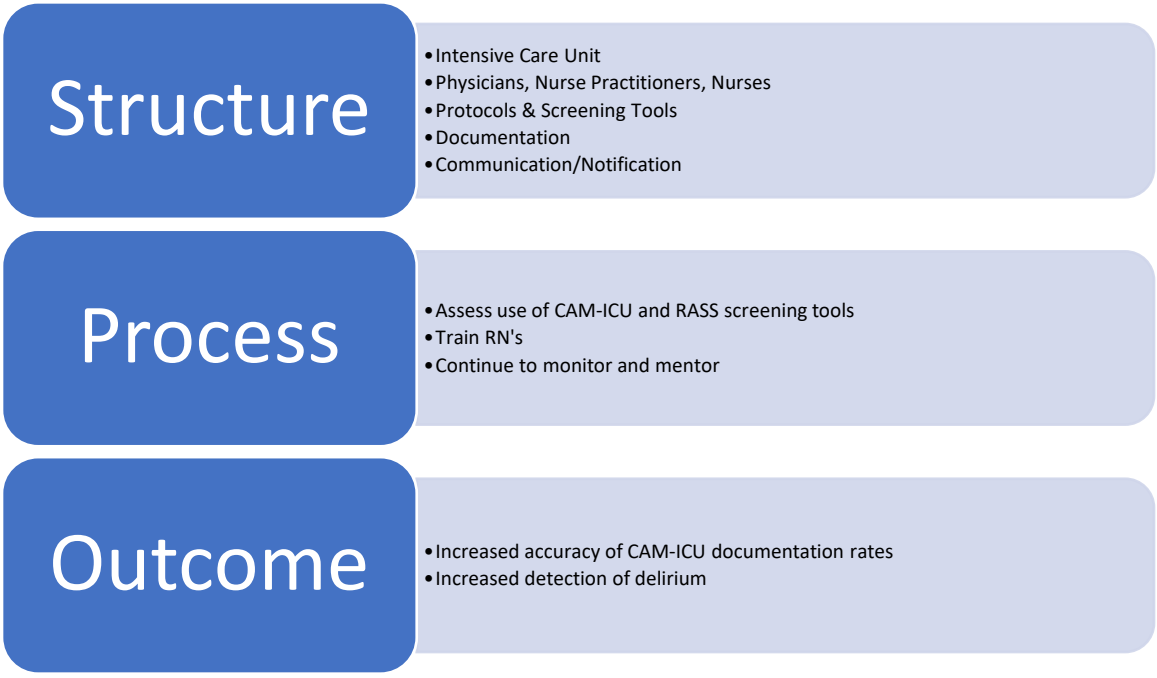


Figure 1. Donabedian's Structure-Process-Outcome Quality of Care Model.

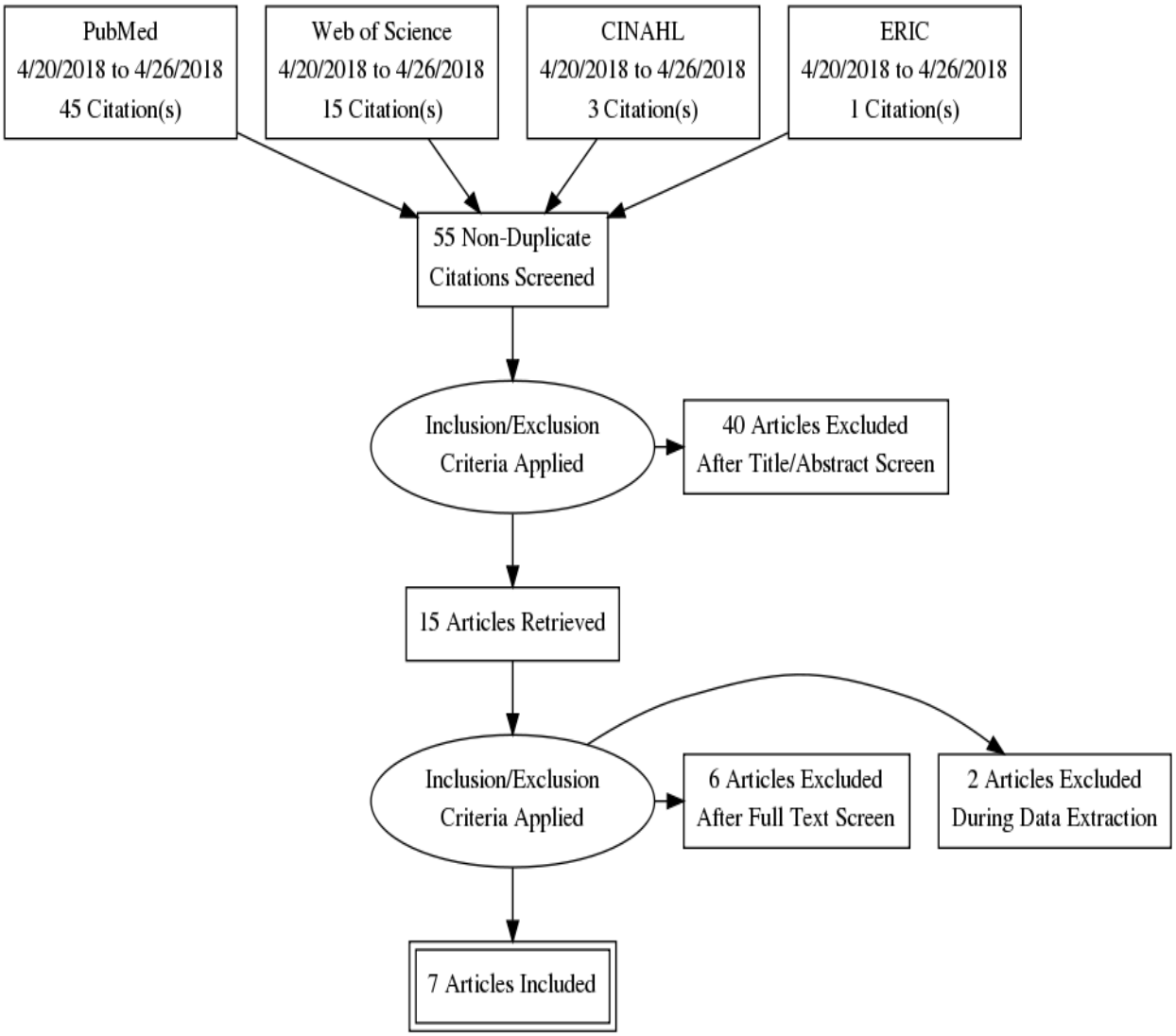


Figure 2. PRISMA flow chart for article selection based on search strategy

Study Tracking # 20949

EDUCATION ON DELIRIUM SCREENING IN THE NEUROSCIENCE ICU

Educational session date & time_____

Participant's Initials____

Please circle the correct response regarding your demographic data:

1. Your age (years):
   a. 20-30 b. 31-40 c. 41-50 d. 51-60 e. 61+

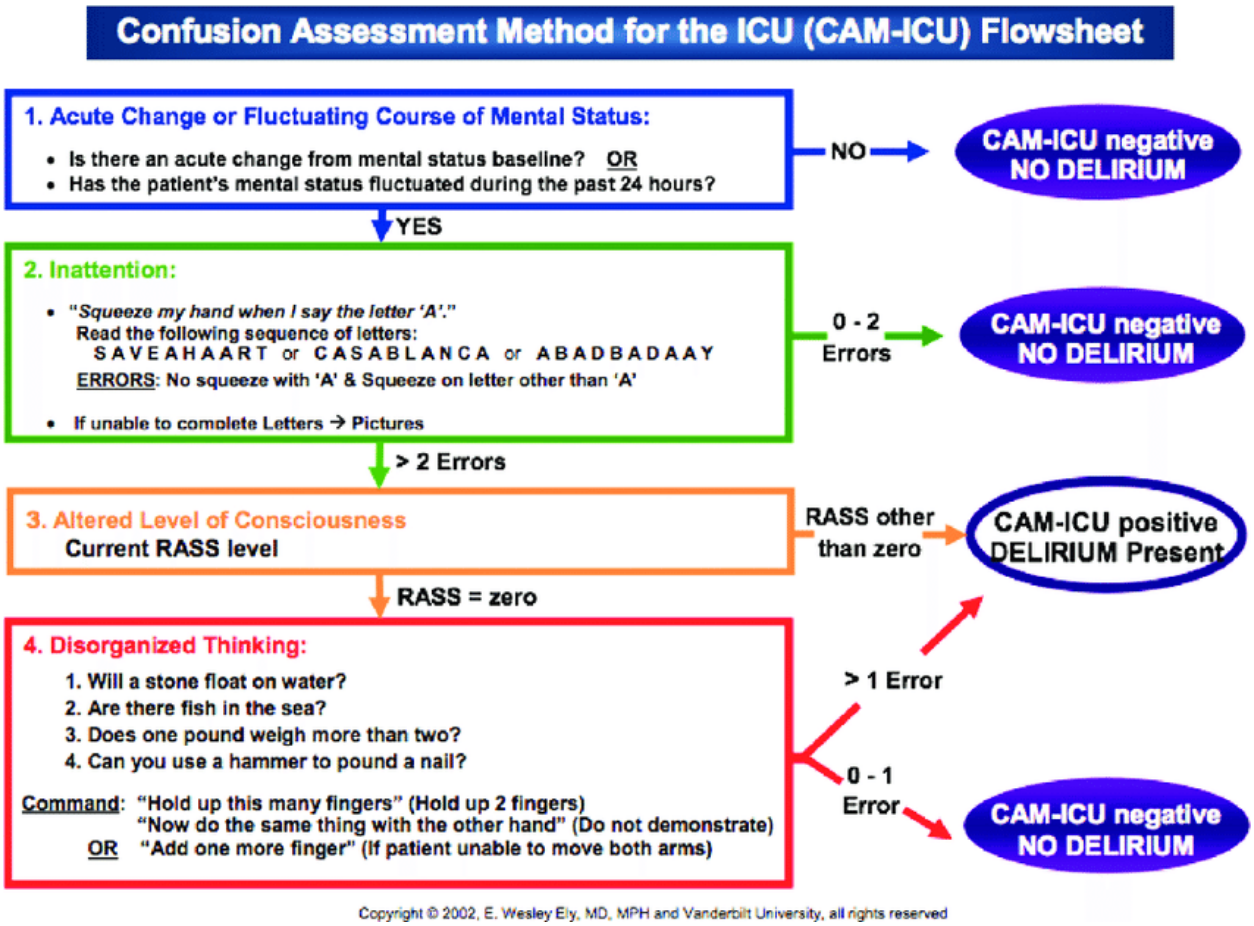
2. Years of Nursing experience:
   a. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

3. Years of ICU experience:
   a. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

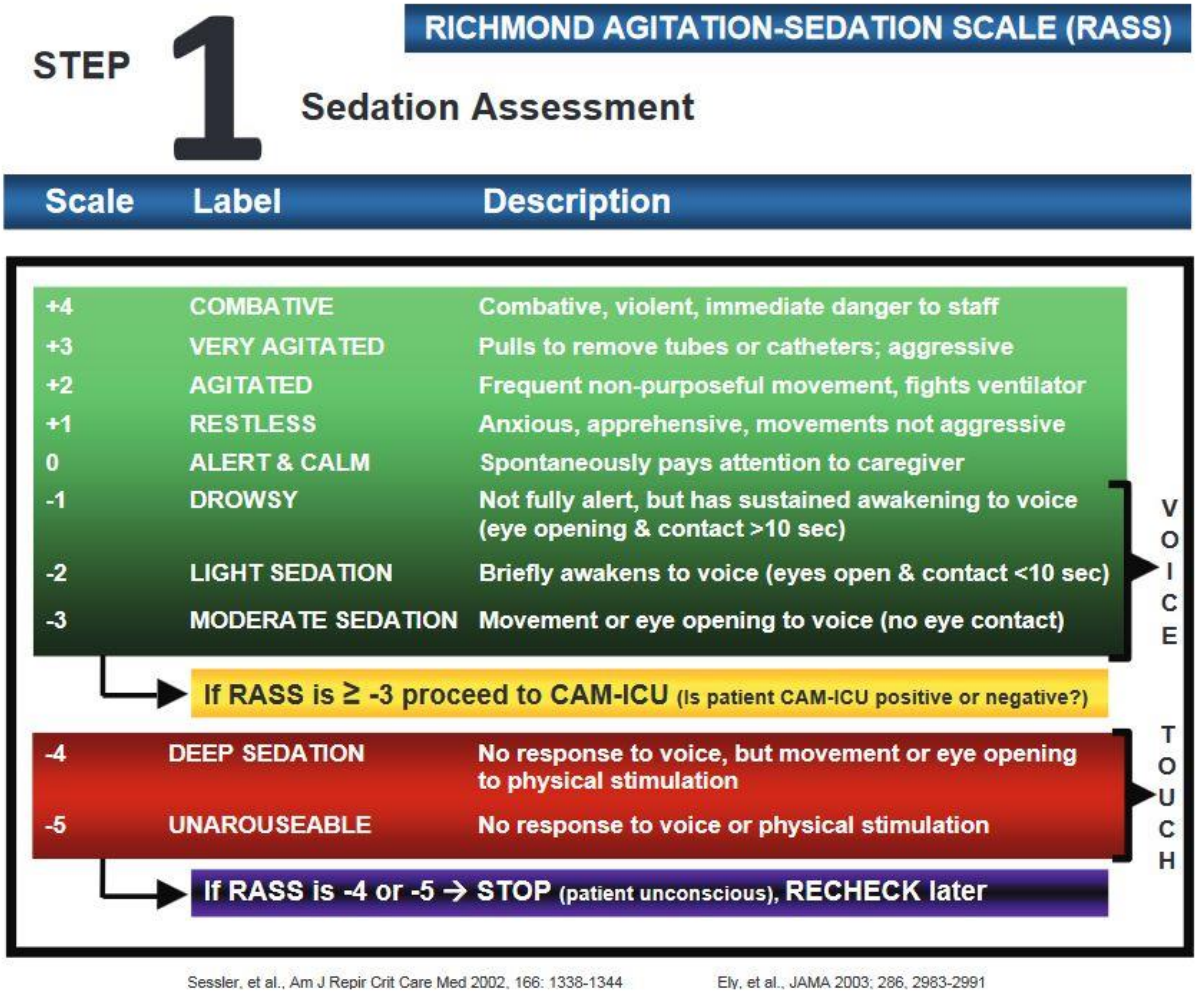
4. Years of neuroscience ICU experience:
   a. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

5. Educational level:
   a. ADN b. BSN c. MSN d. Doctorate

Figure 3. Demographic data collection tool.



Appendix A. CAM-ICU Algorithm for delirium screening. Used with permission from www.icudelirium.org Copyright © 2002, E. Wesley Ely, MD, MPH and Vanderbilt University, all rights reserved.



Appendix B. Richmond Agitation-Sedation Scale. Sessler et al., (2002).

Unit			Auditor:					
Date:								
Shift:								
		RASS	Cam ICU Assessment					
		Transcribe the Delirium Assessment as it was documented in this section						
RN Initials	Room Number	RASS	Feature 1: Change in Mental Status	Feature 2: Inattention	Feature 3: Altered Level of Consciousness (RASS)	Feature 4: Disorganized Thinking	CAM-ICU Score	Comments:
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Instructions: Categorize the documented delirium score (positive, negative, UTA, or not done) according to whether the CAM was used correctly. Check Only One.

				CAM Used Correctly					CAM Used Incorrectly				
RN Initials	Room Number	Does patient have a primary Neuro Dx? Please specify: SAH, IPH, TBI, SDH, EDH, Sz, Tumor, CVA	Current RASS	Positive	Negative	UTA (RASS)	UTA (Language)	UTA (Other)	Inappropriate Positive	Inappropriate Positive	Inappropriate UTA	Not Done	Comments:
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

Appendix C. Modified data collection tool for EHR audits. Used with permission from DiLibero, J. (2018)

From: DiLibero, Justin (BIDMC - SICU) <jdiliber@bidmc.harvard.edu>
Fri 6/15/2018 10:26 AM
To:
Dube, Kim *HS;

1 attachment

Hi Kim,

We had added the copyright to the audit tool to make sure we received the appropriate credit for the tool. You are more than welcome to use it for your project purposes. We are using the current version on a project I am working on with a group of hospitals in my area. If we were to publish the tool I would just want to make some small changes such as removing the names of the other hospitals from the top. But again - you are welcome to use the tool for data collection purposes.

With regards to the sharing of data - this is a process that I have gone through for a multicenter project I have worked on in the past, so I completely understand. Because the tool does not include any patient identifiers, it does not constitute a limited data set, and should not need any special permissions for data sharing - So hopefully this won't be an issue. If necessary I am sure we can set up a data use agreement pretty easily if we needed to. If you have any questions, or if I can help in navigating this process in anyway please let me know.

Thank you also for the invitation to participate as an author - that is so kind of you. I would be happy to consider this and would like to discuss further as to what level of involvement would be best for you.

Also, I am so sorry for not sending a copy of the presentation sooner. A copy is attached here. I am happy to find time to go through it with you and Bill if that would be helpful.

Looking forward to hearing from you. Please tell Clareen hello from me!

Best,

Justin

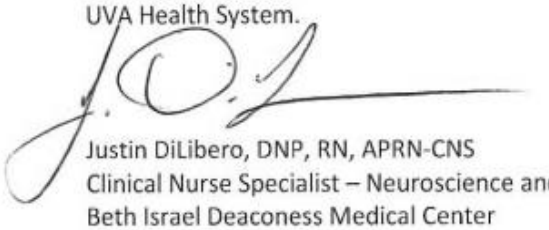
Appendix D. Electronic mail communication with permission to use the audit tool with revisions.

July 6, 2018

Kim Dubé
Nerancy Neuroscience ICU
University of Virginia Health System
Charlottesville, Virginia 22908

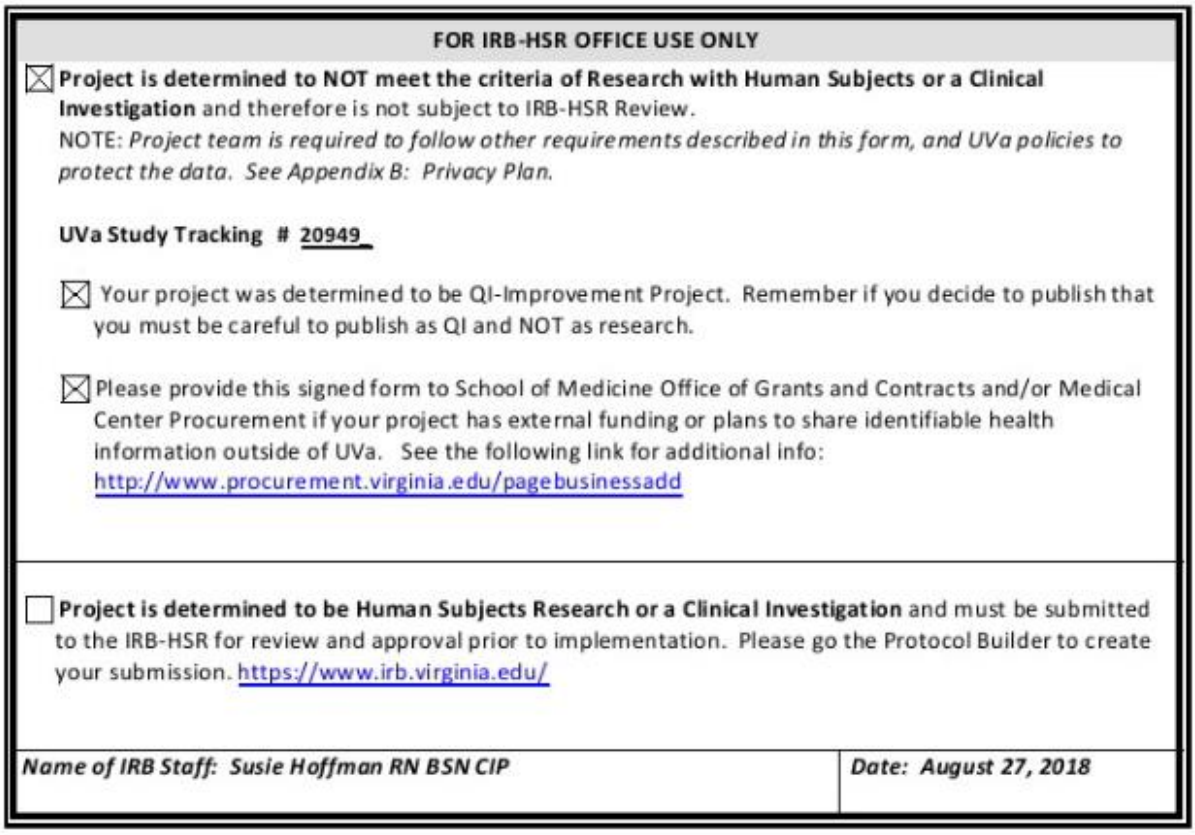
Kim,

Please let this letter represent permission given to you to use the CAM-ICU audit tool as a means to conduct your DNP scholarly project to improve delirium risk screening among neuroscience patients at UVA Health System.



Justin DiLibero, DNP, RN, APRN-CNS
Clinical Nurse Specialist – Neuroscience and Surgical Critical Care
Beth Israel Deaconess Medical Center
Boston, MA 02215
617-632-7024 (w) 774-277-0766 (c)
Jdilibero01@gmail.com

Appendix E. Permission to use the audit tool for data collection.



FOR IRB-HSR OFFICE USE ONLY

☒ **Project is determined to NOT meet the criteria of Research with Human Subjects or a Clinical Investigation** and therefore is not subject to IRB-HSR Review.
NOTE: *Project team is required to follow other requirements described in this form, and UVa policies to protect the data. See Appendix B: Privacy Plan.*

UVa Study Tracking # 20949

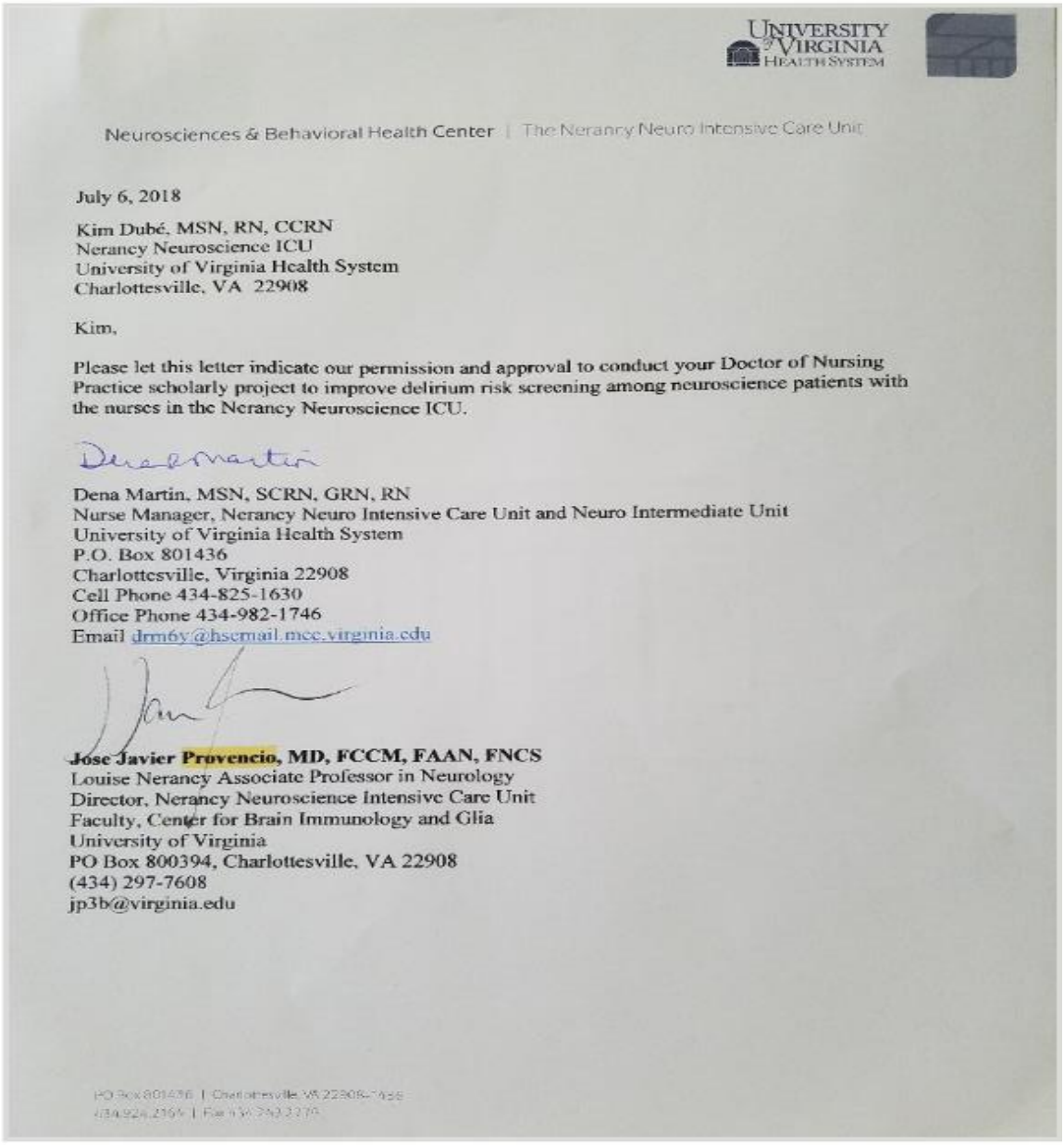
☒ Your project was determined to be QI-Improvement Project. Remember if you decide to publish that you must be careful to publish as QI and NOT as research.

☒ Please provide this signed form to School of Medicine Office of Grants and Contracts and/or Medical Center Procurement if your project has external funding or plans to share identifiable health information outside of UVa. See the following link for additional info: http://www.procurement.virginia.edu/pagebusinessadd

☐ **Project is determined to be Human Subjects Research or a Clinical Investigation** and must be submitted to the IRB-HSR for review and approval prior to implementation. Please go the Protocol Builder to create your submission. https://www.irb.virginia.edu/

Name of IRB Staff: Susie Hoffman RN BSN CIP	***Date: August 27, 2018***

Appendix F. Institution's Tracking Identification Number



UNIVERSITY of VIRGINIA HEALTH SYSTEM

Neurosciences & Behavioral Health Center | The Nerancy Neuro Intensive Care Unit

July 6, 2018

Kim Dubé, MSN, RN, CCRN
Nerancy Neuroscience ICU
University of Virginia Health System
Charlottesville, VA 22908

Kim,

Please let this letter indicate our permission and approval to conduct your Doctor of Nursing Practice scholarly project to improve delirium risk screening among neuroscience patients with the nurses in the Nerancy Neuroscience ICU.

Dena Martin, MSN, SCRN, GRN, RN
Nurse Manager, Nerancy Neuro Intensive Care Unit and Neuro Intermediate Unit
University of Virginia Health System
P.O. Box 801436
Charlottesville, Virginia 22908
Cell Phone 434-825-1630
Office Phone 434-982-1746
Email drm6y@hscmail.mcc.virginia.edu

Jose Javier Provencio, MD, FCCM, FAAN, FNCS
Louise Nerancy Associate Professor in Neurology
Director, Nerancy Neuroscience Intensive Care Unit
Faculty, Center for Brain Immunology and Glia
University of Virginia
PO Box 800394, Charlottesville, VA 22908
(434) 297-7608
jp3b@virginia.edu

PO Box 801436 | Charlottesville, VA 22908-1436
434.924.2164 | Fax 434.243.2279

Appendix G. Permission to conduct project in practice setting.

Doctors of Nursing Practice

1200 4th Street, Suite #232
Key West, FL 33040
V 888.651.9160, F 888.316.6115
www.DoctorsofNursingPractice.org

2019 DNP National Conference
August 7-9, 2019
The Fairmont Washington, DC, Georgetown

Abstract Submission Criteria

This document provides information about abstract submission, review, selection, and presentation preparation and delivery. Please download and review the criterial carefully as the process has changed.

Conference Theme: Contributions of the DNP Prepared Nurse: Policy Influencing Outcomes

Abstracts submitted, must be aligned with the conference theme and address the conference objectives:

Objectives

After participation in the 2019 Twelfth National Doctors of Nursing Practice Conference Washington, DC, attendees will be able to:

1. Identify processes of developing and implementing policy to improve healthcare outcomes.
2. List examples of how the DNP prepared nurse participates in policy development and implementation in academia, clinical practice, administration, research and informatics.
3. Describe ways that DNP prepared nursing professionals collaborate to influence change.

Submission Deadline

All submissions must be completed by **11:59 PM Eastern, February 15, 2019.** No submissions or edits will be accepted after the deadline.

***All presenters attending the conference* listed on the abstract submission are expected to register and attend the full three-day conference.** Every author listed on the abstract will be required to provide biographic and conflict of interest disclosure information during the abstract submission. The provided Biographical/Conflict of Interest (BIO/COI) form must be completed for each author. It is the responsibility of the primary author to assure that all documents are included before submitting the abstract. The abstract will not be reviewed if this information is missing.

A maximum of four presenters may be listed per abstract submission. Once an abstract is accepted for presentation, changes to this list of presenters including credential and affiliations may not be made. Presenters cannot be added, and substitutions will not be accepted. The primary author must attend and present.

The primary author is the point of contact for all communications regarding the 12th National DNP Conference. This person will be responsible for assuring that the abstract submission process is complete, and all presenter BIO/COI forms are complete and uploaded for review by the conference nurse planner.

Appendix H. 2019 DNP National Conference Abstract Submission Guidelines.

Journal of Neuroscience Nursing
Online Submission and Review System

Author Resources
Instructions for Authors (this page)
Reprint Ordering
Permissions Requests

Guidelines for Authors

Manuscripts are accepted for exclusive publication in the *Journal of Neuroscience Nursing*. The editor reserves the right to accept or reject manuscripts. Accepted manuscripts become the property of the *Journal*. Rejected manuscripts will be returned to the author. Authors are not reimbursed for articles.

Peer Review
All manuscripts are subject to blind review by a minimum of two reviewers. Review criteria include scientific merit, relevance to neuroscience nursing, and logical development of ideas. All revisions require a Response to the Reviewers to be uploaded along with the manuscript files. Accepted manuscripts are subject to editorial revision.

Manuscript Submission
All manuscripts must be submitted online through the new Web site at http://www.editorialmanager.com/neuronurse. Manuscripts are limited in length to ≤2,500 words, not including the abstract, tables and references. **Our peer review process is now double blind: author and institution names should ONLY be included in the separate title page file, but not in any other files or file names.** Large tables should be submitted, instead, as Supplemental Digital Content (SDC). **First-time users:** Please click the Register button from the menu above and enter the requested information. On successful registration, you will be sent an e-mail indicating your user name and password. Print a copy of this information for future reference. Note: If you have received an e-mail from us with an assigned user ID and password, or if you are a repeat user, do not register again. Just log in. Once you have an assigned ID and password, you do not have to re-register, even if your status changes (that is, author, reviewer, or editor). **Authors:** Please click the log-in button from the menu at the top of the page and log in to the system as an Author. Submit your manuscript according to the author instructions. You will be able to track the progress of your manuscript through the system. If you experience any problems, please e-mail the Editorial Office at **jnn@aann.org**. Requests for help and other questions will be addressed in the order received.

Use *Stedman's Medical Dictionary* for correct spellings. Abbreviate only after term has been used in full with abbreviation in parentheses. Use metric system. Use generic (nonproprietary) name of a drug with trade (proprietary) name in parentheses after first usage. Capitalize the first letter of trade, proprietary, or brand names. Do not use author name(s) anywhere in text.

On a separate sheet, list both work and home addresses, telephone numbers, fax numbers, e-mail address, educational credentials, current position, and title for each author.

Conflicts of interest
Authors must state all possible conflicts of interest in the manuscript, including financial, consultant, institutional and other relationships that might lead to bias or a conflict of interest. If there is no

conflict of interest, this should also be explicitly stated as none declared. All sources of funding should be acknowledged in the manuscript. All relevant conflicts of interest and sources of funding should be included on the title page of the manuscript with the heading "Conflicts of Interest and Source of Funding:". For example:

Conflicts of Interest and Source of Funding: A has received honoraria from Company Z. B is currently receiving a grant (#12345) from Organization Y, and is on the speaker's bureau for Organization X – the CME organizers for Company A. For the remaining authors none were declared.

In addition, each author must complete and submit the journal's copyright transfer agreement, which includes a section on the disclosure of potential conflicts of interest based on the recommendations of the International Committee of Medical Journal Editors, "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (www.icmje.org/update.html).

A copy of the form is made available to the submitting author within the Editorial Manager submission process. Co-authors will automatically receive an Email with instructions on completing the form upon submission.

Figures
Digital art should be created/scanned and saved and submitted as a TIFF (tagged image file format), an EPS (encapsulated postscript) file, or a PPT (Power Point) file. Electronic photographs—radiographs, CT scans, and so on—and scanned images must have a resolution of at least 300 dpi (dots per inch). Line art must have a resolution of at least 1200 dpi. If fonts are used in the artwork, they must be converted to paths or outlines or they must be embedded in the files.

Detailed Figure Instructions: For a step by step guide for submitting Digital Art, please visit www.LWWonline.com. Click "For Authors," then click "Artwork" in the menu to the right. Visit the "Digital Art Checklist" and "5 Steps for Creating Digital Artwork" for specific guidelines.

Tables
***Only 2* tables, or 2 figures, or 1 table and 1 figure will be included in the PRINT version of your manuscript.** All other tables should be submitted as Supplemental Digital Content (SDC) when your manuscript is first submitted and will then be linked to our online site. The guidelines for SDC files appear below.

Abstracts
Abstract length should be consistent with the AMA Manual of Style (10th ed.) guidelines (150-400 words). If you are interested in submitting a video abstract, in addition to a written abstract, please contact the Editor-in-Chief.

Supplemental Digital Content

Supplemental Digital Content (SDC): Authors may submit SDC via Editorial Manager to WKH journals that enhance their article's text to be considered for online posting. SDC may include standard media such as text documents, graphs, audio, video, etc. On the Attach Files page of the submission process, please select Supplemental Audio, Video, or Data for your uploaded file as the Submission Item. If an article with SDC is accepted, our production staff will create a URL with the

SDC file. The URL will be placed in the call-out within the article. SDC files are not copy-edited by WKH staff, they will be presented digitally as submitted. For a list of all available file types and detailed instructions, please visit http://links.lww.com/A142.

SDC Call-outs
Supplemental Digital Content must be cited consecutively in the text of the submitted manuscript. Citations should include the type of material submitted (Audio, Figure, Table, etc.), be clearly labeled as "Supplemental Digital Content," include the sequential list number, and provide a description of the supplemental content. All descriptive text should be included in the call-out as it will not appear elsewhere in the article.
Example:
We performed many tests on the degrees of flexibility in the elbow (see Video, Supplemental Digital Content 1, which demonstrates elbow flexibility) and found our results inconclusive.

List of Supplemental Digital Content
A listing of Supplemental Digital Content must be submitted at the end of the manuscript file. Include the SDC number and file type of the Supplemental Digital Content. This text will be removed by our production staff and not be published.
Example:
Supplemental Digital Content 1. wmv

SDC File Requirements
All acceptable file types are permissible up to 10 MBs. For audio or video files greater than 10 MBs, authors should first query the journal office for approval. For a list of all available file types and detailed instructions, please visit http://links.lww.com/A142.

Reporting Guidelines

The links below provide authors with sets of standards and guidelines to best report the results of a variety of studies, research and reviews. Also included is a link to the Committee on Publications Ethics (COPE) site that helps guide authors, editors and publishers on all aspects of publication ethics. These links are provided to help authors submit papers that include the elements critical to a particular type of work and that make a sound evaluation of the work possible.

www.prisma-statement.org
www.consort-statement.org
www.strobe-statement.org
www.equator-network.org
www.publicationethics.org

Institutional Review Board Approval
If your research or a quality review project met any of the following criterion (intervention to evaluate new or existing practices, adds human subject risks beyond the institutional standard of care, generates new knowledge, and/or the findings have implications beyond the unit or institution), you should provide information in the manuscript about your Institutional Review Board (IRB) process and informed consent. A manuscript reporting a quality improvement initiative generally does not need IRB approval if it meets these criteria: assesses internal process improvement, results are specific

only to author's institution and are not intended for use in other organizations, describes standard of care, and is informational in nature, lessons learned).

Permissions
Obtain written permission from the publisher for use of artwork, illustrations, tables, or other figures that are not your original work. Supply original copy of permission form; retain a copy.

References
The journal uses AMA style for citations and references. All references should be numbered in the order in which they appear in the text. Follow AMA style guidelines (AMA Manual of Style: A Guide for Authors and Editors, 10th ed.) and abbreviate journal names as they appear in PubMed. List up to 6 authors/editors; if there are more than 6, list on the first 3 followed by "et al." **The journal requests that you limit the number of references to 30 unless absolutely required**. References over 5 years old should be used sparingly unless they are considered 'classic' works.

Examples
Campbell GB, Carter T, Kring D, Martinez C. Nursing Bedside Dysphagia Screen: Is it Valid? *J Neurosci Nurs.* 2016;48(2):75-79.

Livesay S. *Comprehensive Review for Stroke Nursing.* Chicago, IL: American Association of Neuroscience Nurses; 2014.

Agency for Healthcare Research and Quality, Rockville MD. Appendix C. Research Questions and PICO(TS). http://www.ahrq.gov/research/findings/evidence-based-reports/stakeholderguide/appendixc.html. Accessed October, 2015.

Corrections
Authors are responsible for providing final manuscript corrections on request. Authors are required to read galleys and make only necessary corrections. Compliance with deadlines is essential.

Checklist for submission.

- Cover letter
- Author identification page
- Acknowledgments
- Permission letter(s)
- Manuscript
    - title page
    - abstract
    - introduction: includes purpose and scope of manuscript
    - text pages
    - summary
    - references
    - figures or tables with legends

Appendix I. Guidelines for Article Submission to *Journal of Neuroscience Nursing*

Targeted Education to Improve Delirium Screening Among Neuroscience Patients

Kim Dubé, MSN, RN, CCRN, CNL, AGACNP-BC
University of Virginia
Charlottesville, VA

Elizabeth Friberg, DNP, RN
University of Virginia
Charlottesville, VA

William Lombardi, DNP, RN, CCRN, AG-ACNP
University of Virginia
Charlottesville, VA

Regina DeGennaro, DNP, RN, CNS, AOCN, CNL
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Abstract

Delirium is a significant clinical concern that results in longer hospital and intensive care unit lengths of stay; increased morbidity, mortality, and healthcare costs; and is associated with long-term cognitive deficits and neuropsychological disorders. Considering healthcare system burdens and poor patient outcomes related to delirium, there has been emphasis on early recognition of patients experiencing delirium. The literature supports the importance of screening for delirium at the bedside and identifies tools used to meet this end. However, most studies exclude use of the tools in neuroscience settings because of the complexity assessing delirium in neuro-compromised patients.

The Confusion Assessment Method for the intensive care unit (CAM-ICU) is a validated screening tool for delirium in neuroscience patients, yet there is still a gap in the literature regarding application of the CAM-ICU for neuroscience patients. The purpose of this project was to increase neuroscience nurses' ability to accurately document delirium assessments using the CAM-ICU by minimizing the use of "unable to assess" and increase detection of delirious patients in a neuroscience intensive care unit. A pre- and post-test design was used to evaluate changes in mean baseline documentation accuracy rates. Audits of electronic health records (EHRs) were conducted pre- and post-educational intervention to determine unit level documentation accuracy rates. A formal 30-minute educational presentation was offered to eligible registered nurses (RNs) in the neuroscience intensive care unit, with subsequent coaching sessions for those who attended the presentation. There were 124 documentation audits retained in the pre- and in the post-education intervention phase of the study. The mean pre-audit documentation accuracy rate increased from .44 to .83 ($p < .001$) in the post-audit. The results provide further evidence that formal education for RNs on use of the CAM-ICU instrument

improves documentation accuracy and delirium identification in this highly at-risk patient population. Future research should focus on the impact formal education has on each of the outcome possibilities of the CAM-ICU and the collaborative development of protocols to prevent and mitigate delirium.

Keywords: CAM-ICU, RASS, delirium, delirium screening, neuroscience, baseline mental status, quality improvement

INTRODUCTION

Early recognition of inpatient delirium is important because delirium can be life-threatening; prevention and treatment may be associated with improved patient outcomes. Delirium is characterized by alterations in cognition, specifically inattention and disorganized thinking, as defined by the American Psychiatric Association, DSM-5 criteria.[1] Delirium is frequently manifested in behavior changes and fluctuates during a patient's hospital course.

It is important to know the extent to which patients are at risk for delirium, given the association with longer lengths of stay in the hospital,[2] increases in mortality rates,[3] healthcare costs,[4] long-term cognitive deficits and neuropsychological disorders,[5] and generally poorer patient outcomes. A prospective cohort study demonstrated the association between intensive care unit (ICU) delirium and higher mortality within one-year post-discharge and a positive correlation between the number of days of ICU delirium and mortality was established.[3] A prospective cohort study concluded patients who experienced delirium had longer stays both in the ICU and in the hospital overall.[2]

Gaps in the Literature

The Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) is the most commonly used instrument for delirium assessment in intensive care units and has withstood many rigorous studies for validity, reliability, and feasibility across variable populations and settings.[6] It has been translated into many languages and has been tested in many practice settings. However, most studies exclude neuroscience patients from any type of delirium screening studies because feature number one of the CAM-ICU instrument is contingent upon the assessors' ability to identify whether a patient is having acute or fluctuating changes from baseline mental status or even within the last 24 hours.[7]

Based on a review of the literature, there are gaps regarding the accuracy of identification of delirium in neuroscience ICU patients by bedside registered nurses. There are inconsistencies in the literature regarding what to use as a patient's baseline mental status exam, impeding clinicians' ability to establish whether there is fluctuation in mental status, a critical component of screening for delirium. Most studies excluded neuroscience patients because waxing and waning neurologic exams created by underlying structural brain abnormalities confound examiners' ability to detect delirium.

Neuroscience Challenges

There is a dichotomy in the literature for clinicians seeking clarity regarding the definition of baseline neurological status 1) The baseline exam is the patient's pre-hospital exam[8] 2) the baseline exam is the initial neurologic exam on admission to the ICU after neurologic pathology alters mental status.[9] Interestingly, both are correct under the right circumstances according to the CAM-ICU Training Manual.[7] The patient's pre-hospital condition should be considered the baseline exam, unless there has been a new, permanent change in condition on or during the current admission.[7] The majority of neuroscience patients do not present to the ICU at their pre-hospital mental status, which adds a layer of difficulty to the application and documentation process for this complex population. Clinicians tend to claim they do not know patients at their baseline, rather than using recommended guidelines for obtaining information such as contacting loved ones or conducting a chart review.[7]

If an acute change from patients' pre-hospital condition cannot be determined, nurses have to refer to previously documented RASS scores and establish if patients' RASS scores are

fluctuating. "**Yes**" is documented if the patients' pre-hospital condition has changed acutely or their RASS scores are fluctuating, most patients should not be deemed 'unable to assess' (UTA). Frequently all four of the assessment features of the CAM-ICU are documented 'not applicable' (N/A) or UTA at the bedside in neuroscience areas. Inherent changes neuroscience patients experience that coincide with the CAM-ICU features may be attributable to structural changes from the underlying disease process, rather than from delirium.

If patients are considered UTA, it immediately disables further delirium assessment. In this patient population, it is imperative to remember that the CAM-ICU is an instrument used to screen for the presence or absence of delirium and early detection improves patient outcomes. In a conversation with J. DiLibero (June 2018) sensitivity of the CAM-ICU is increased when pre-admission mental status is used as the baseline, it casts a wider net, raising clinicians' index of suspicion for patients experiencing delirium. Early recognition of delirium may foster shortened episodes of ICU delirium, as it is reversible and may have a profound effect on patient outcomes and healthcare costs.

In more recent studies specific to patients in neuroscience settings,[5, 9, 10] the CAM-ICU has been accepted as an appropriate screening tool for delirium in patients with post-stroke and traumatic brain injury (TBI). The continuous use of the Richmond Agitation-Sedation Scale (RASS) to monitor level of consciousness (LOC), is imperative in patients in the neuroscience setting who are receiving sedation medications. The RASS has been robustly validated in many ICU settings, neuroscience included[11] and is considered to be the most reliable tool to use to determine LOC in feature 3 of the CAM-ICU.[7] Generally speaking, use of the CAM-ICU is deferred if a patient's RASS is ≤ - 4 because it indicates a patient is too sedated to evaluate

mental status and LOC. The details required for describing the criterion of each of these assessment scales are beyond the scope of this report.

The purpose of this quality improvement (QI) project was to increase neuroscience nurses' ability to accurately document the presence or absence of delirium using the CAM-ICU after a formal educational intervention and follow up coaching sessions as needed.

METHODS

The project took place from September 2018 until December 2018. Pre- and post-intervention unit-level audits of EHRs using a modified validated data collection instrument were conducted. The Institutional Review Board for Health Sciences Research (IRB-HSR) reviewed the project proposal prior to conducting this study. This project was not deemed human subjects research, it was considered quality improvement and nurses' consent to participate was assumed by attendance at educational sessions.

Face validity to use the CAM-ICU instrument and accurately document assessments was obtained from the institution's delirium content expert. An introduction of the project and educational sessions offered were announced in the NICU approximately one month in advance. The educational intervention was a 30-minute didactic training session which included an instructional PowerPoint presentation.

A pre-intervention EHR audit was conducted for four weeks to establish a unit level baseline CAM-ICU documentation accuracy rate. Multiple 30-minute didactic training sessions were conducted to improve knowledge and skills in the application of CAM-ICU criteria to foster accurate documentation. Real time coaching took place for three weeks with nurses who attended the didactic training sessions if their delirium screening assessments were documented inaccurately **or** if they consulted the investigator independently. Post-intervention EHR audits

were conducted on all patients to determine changes in overall unit documentation accuracy rates. A minimum of five audits by an individual nurse in both the pre- and post- audit phase was used as the threshold for calculating the unit's mean accuracy rate.

Setting

This project took place in a neuroscience intensive care unit (NICU) at an academic medical center in central Virginia. The NICU consists of 12 beds and has a dedicated ICU nursing staff with specialty training in neurocritical care.

Description of the Sample

A convenience sample of neuroscience ICU nurses was used. Thirty-three current nurses employed in the NICU were invited to participate in the study. Nurses currently on orientation, staffing resource office nurses, and travel nurses were excluded from participation.

Statistical Analysis

Data were recorded on a modified audit tool and transferred into Statistical Package for the Social Sciences (SPSS® v 24). Demographic statistics were collected from the RNs who attended educational sessions. A paired-samples t-test was conducted to compare the unit-based documentation accuracy rates using the CAM-ICU instrument pre- and post-educational intervention. Nurses who were audited a minimum of five times in each phase were retained for the final statistical analysis.

RESULTS

There were thirty-three nurses who were eligible to participate in the study after exclusion criteria were applied. Thirty (91%) nurses participated in the educational interventions. There were 18 nurses who could be paired by a minimum of five audits in pre- and post-intervention.

Demographics

Demographic information was collected in ranges of age, years of nursing experience, years of ICU experience, years of neuroscience ICU experience, and educational level (see Table, Supplemental Digital Content 1, the demographic data collection tool). The 20-30 years age range represented 66.7% of the participants (*n* = 12). Participants reporting one to five years of nursing experience represented 72.2% (*n* = 13) of the sample. The majority of participating RNs, 88.9% (*n* = 16), reported 1-5 years of experience in the ICU and all of them reported the same amount of time in the neuroscience ICU setting. The BSN-prepared group represented the largest segment of the sample with 83.3% (*n* = 15) (see Table, Supplemental Digital Content 2, which represents the demographic data for the RNs retained in the study).

Documentation Accuracy Rates of CAM-ICU

The overall unit mean score of accurately documented CAM-ICU assessments was 44.3% before the intervention. After the educational intervention, the overall unit mean score of accurately documented CAM-ICU assessments was 83%. There was a statistically significant difference in the accuracy rates pre-education (M = 0.44, SD = 0.22) and post-education (M = 0.83, SD = 0.22); t (17) = -7.30, p = < .001 (Table 1).

Documentation Results

Frequencies were run on each of the possible responses for CAM-ICU documentation accuracy or inaccuracy. In each of the audit phases there were 124 documentation audits with no missing data. For the pre-audit assessment baseline, the majority of the inaccurate assessments were documented as UTA, 45.2% (*n* = 56), compared to 3.2% (*n* = 4) post-intervention. In the pre-audit assessment, 37.9% (*n* = 47), were recorded accurately as negative, indicating delirium was not present. In the post-audit assessment, the majority of assessments were accurately documented as negative 58.9% (*n* = 73). There was one assessment that indicated a patient was

delirious 0.8% (*n* = 1) during the pre-audit, whereas patients screening positive for delirium accounted for 20.2% (*n* = 25) of the post-audit assessments (Table 2).

Individual Results

Of the 18 nurse participants who were retained for analysis in this project, 17 of them improved documentation accuracy. The largest improvement in accuracy rate increased from 17% pre-education intervention to 100% accuracy post-education intervention for one nurse, for a mean change in accuracy of 83% (see Table, Supplemental Digital Content 3, which illustrates the documentation accuracy rate for each nurse Pre- and Post- intervention).

DISCUSSION

The results of this study indicate delirium assessment documentation accuracy using the CAM-ICU is challenging for neuroscience ICU nurses who are not formally trained in the application of its' features. The increase in the overall unit mean score suggests when nurses are educated and coached on the criteria of the CAM-ICU features, there is a significant improvement in CAM-ICU assessment documentation accuracy. When auditing assessments prior to conducting an educational intervention, fewer patients were screened positive for delirium (pre-intervention, 0.8%; post-intervention, 20.2%). There was a much higher rate of patients who were inaccurately categorized as UTA (pre-intervention, 45.2%; post-intervention, 3.2%). The results of this study suggest subjective responses were being recorded for the four features of the CAM-ICU, rather than the intended objective testing which is an important component of the instrument.

The findings from this study provide further evidence that the presence or absence of delirium can be documented accurately using the CAM-ICU in neuroscience patients when nurses are

formally trained to use it. In this project, there was a statistically significant increase in documentation accuracy, 38.2% ($p < .001$), when nurses participated in formal training sessions.

Strengths and Limitations

The study took place in an academic medical center with a dedicated neuroscience ICU. Use of the CAM-ICU and RASS instruments were already standards of practice and are built into the EHR. This study demonstrated the transferability of the previous study to another setting, expanding evidence-based quality improvement practices. The project replicated a previously successful study for the purpose of improving delirium screening using a similar documentation auditing tool used to record CAM-ICU and RASS responses.

Limitations of the study included teaching the RNs to embrace the ability to accurately document **feature one** on the CAM-ICU. The RNs must consider patients' pre-hospital condition as their baseline mental status and determine if there has been an acute change from that baseline. The nurses were taught the means to obtain information to determine the baseline or defer to the RASS and the stability thereof in cases of uncertainty. Exercising this proper standard of care was a new process for the nurses to learn.

The project was implemented in a single ICU with a specific patient population which limits generalizability. The number of subjects was limited due to both setting and timeframe. The number of audits conducted was limited by unforeseen things such as low census in the ICU for a prolonged period, 13 RNs were shift managers and had limited documentation, and there were four RNs functioning as preceptors with orientees during the study.

Implications for Practice

This study established that assessments can be documented accurately to reflect the presence or absence of delirium in neuroscience patients using the CAM-ICU instrument. Nurses have

increased communication with the interprofessional team regarding the CAM-ICU outcome on daily rounds, which enhances their collaboration with the healthcare team. An increase in positive screenings for delirium has an impact on the medical team's list of differential diagnoses, promoting collaborative practices. Noting this critical, preventable and reversible clinical course drove the need to establish a unit protocol and adopt the clinical standard baseline mental status. The standardized practice increased documentation accuracy. The presence of delirium has been detected more often as a result of the project and has increased the practitioners' awareness of delirium in a challenging patient population.

Recommendations

To maintain the upward trend of documentation accuracy, a current recommendation is ongoing audits of documentation every six months to promote adherence to standard practice. Another strategy to facilitate continuous process improvement is to train newly hired nurses to use the CAM-ICU instrument correctly during unit-specific orientation sessions. Sustainability is important to promote early identification and treatment which may foster improved patient care outcomes. Future research should focus on the impact formal education has on each of the outcome possibilities of the CAM-ICU and the collaborative development of protocols to prevent and mitigate delirium.

Conclusions

Neuroscience ICU nurses have contributed to closing the research-practice gap through participation in this project. If delirium is recognized early in a patient's ICU course, interventions can be implemented to reverse the causes, potentially shortening time a patient spends in delirium. Further studies of accurate assessment documentation using the CAM-ICU

by neuroscience nurses will play a central role in contributing to this body of knowledge and increase detection of delirium, lowering the risk of adverse outcomes.

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Table 1

Paired Samples t-test Results of Pre- and Post- Documentation Accuracy Rates at the Unit Level (n = 18)

Documentation Accuracy Rates	M *(SD)* Pre	M *(SD)* Post	*t*(17)	*p*	95% CI
Unit Level	0.44 *(0.22)*	0.83 *(0.22)*	-7.30	< .001***	[- .48 , - .27]

Note. CI = confidence interval. Unit level documentation accuracy rate improvement from minimum of five audits per each of 18 registered nurses retained in the study for paired samples comparison pre and post-intervention. Based on total electronic health record audits pre-intervention n = 124 and post-intervention n = 124. ***Statistically significant.

Table 2

Documentation Findings of the CAM-ICU / RASS Pre/Post Audit Intervention (n = 124)

Possible Accurate Assessment Outcomes	Pre-Audit		Post-Audit	
	n = 124	%	*n* = 124	%
Positive	1	0.8	25	20.2
Negative	47	37.9	73	58.9
UTA due to RASS	7	5.6	5	4
Total Accurate	55	44.3	103	83

Possible Inaccurate Assessment Outcomes	Pre-Audit		Post-Audit	
	n = 124	%	*n* = 124	%
Inaccurate Positive	1	0.8	-	0
Inaccurate Negative	1	0.8	14	11.3
Inaccurate UTA	56	45.2	4	3.2
Screening not documented	11	8.9	3	2.4
Total Inaccurate	69	55.6	21	16.9

Note. UTA = unable to assess. RASS = Richmond Agitation-Sedation Scale. There are three possible outcomes when documenting assessments using the CAM-ICU instrument. The screening may be positive, negative, or UTA. The CAM-ICU has an algorithm with criteria used to score assessments of patients. If features one and two plus either three or four are positive, a patient screens positive for delirium. If either feature one or two is negative, the patient screens negative for delirium. If the patient's RASS score is ≤ 4, the patient's status is UTA.

Supplemental Digital Content 1.doc

Supplemental Digital Content 2.doc

Supplemental Digital Content 3.doc

EDUCATION ON DELIRIUM SCREENING IN THE NEUROSCIENCE ICU

Educational session date & time_____

Participant's Initials____

Please circle the correct response regarding your demographic data:

6. Your age (years):
   a. 20-30 b. 31-40 c. 41-50 d. 51-60 e. 61+

7. Years of Nursing experience:
   b. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

8. Years of ICU experience:
   c. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

9. Years of neuroscience ICU experience:
   d. 1-5 b. 6-10 c. 11-15 d. 16-20 e. 21+

10. Educational level:
    e. ADN b. BSN c. MSN d. Doctorate

Supplemental Digital Content 1. Demographic data collection tool completed by RNs who attended the didactic educational sessions.

Demographics of Nurses Retained for Study

Characteristic	*n* = 18	%
Age Range		
20-30	12	66.7
31-40	4	22.2
41-50	-	-
51-60	-	-
61+	2	11.1
Years of Nursing Experience	-	-
1-5	13	72.2
6-10	3	16.7
11-15	-	-
16-20	-	-
21+	2	11.1
Years of ICU Experience	-	-
1-5	16	88.9
6-10	-	-
11-15	-	-
16-20	-	-
21+	2	11.1
Years of NICU Experience	-	-
1-5	16	88.9
6-10	-	-
11-15	-	-
16-20	-	-
21+	2	11.1
Educational Level	-	-
ADN	3	16.7
BSN	15	83.3
MSN	-	-
DNP	-	-

Supplemental Digital Content 2. Table that displays demographics information on the nurses retained for the study. The RNs included had CAM-ICU documentation in the EHR audited a minimum of five times pre- and post-intervention, participated in the formal educational intervention, and had a minimum of one coaching and mentoring session. ADN = Associate Degree in Nursing; BSN = Bachelor of Science in Nursing; MSN = Master of Science in Nursing; DNP = Doctor of Nursing Practice.

Documentation Accuracy Rate for Each Nurse Pre- and Post- Intervention

RN	Pre-	Post-	Difference in Rates
1	.67	1.00	.33
2	.75	1.00	.25
3	.33	1.00	.67
4	.50	.86	.36
5	.33	.80	.47
6	.50	.83	.33
7	.40	1.00	.60
8	.43	.83	.40
9	.44	.86	.42
10	.71	.50	-0.21
11	.67	1.00	.33
12	.00	.20	.20
13	.50	.88	.38
14	.17	1.00	.83
15	.43	.80	.37
16	.00	.50	.50
17	.67	.86	.19
18	.50	.83	.33

Supplemental Digital Content 3. The nurses in the study had a statistically significant improvement in documentation accuracy rates after the intervention (M = [0.38], SD = [0.22]) from before the intervention, t (17) = [-7.30], p = [< 0.001].

Appendix J. Pages 67-86 include the draft manuscript to be submitted to the *Journal of Neuroscience Nursing* for publication consideration when completed.