Educational Intervention to Improve Delirium Recognition by Nurses

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Abstract

Delirium poses significantly increased morbidity and mortality for the hospitalized patient. Under-recognition by healthcare providers, especially nurses, contributes to poor patient outcomes. A lack of literature regarding education on the use of the confusion assessment method for the intensive care unit (ICU) (CAM-ICU) delirium screening was noted. The purpose of the project was to evaluate the effectiveness of an educational intervention for medical ICU nurses to improve their knowledge and skills regarding delirium and delirium recognition. An educational intervention was conducted in the MICU of an academic medical center in the south eastern US. Effectiveness was evaluated in a quasi-experimental design using a pre and post assessment. Procedural correctness of the participants performing the CAM-ICU delirium screening was also measured. Thirty-four nurses participated in the sessions from June to September 2016 and completed pre and post assessments. The sample consisted of predominantly BSN-prepared nurses (55.9%) with one to five years of experience (58.8%). Statistical significance ($p < .001$) was noted in both the overall and knowledge sub-scale mean score differences. The sub-scales of knowledge of tools and scales were not significantly improved by the intervention. Performance of the CAM-ICU was demonstrated as procedurally correct by 79% of participants after the intervention. No pre assessment observations of the CAM-ICU were obtained. The educational intervention conducted for MICU nurses provided additional validation to the literature regarding benefits of an educational program about delirium knowledge. The content of the educational intervention should be targeted for the setting, patient population-specific risk factors, and the specific delirium screening tool used in practice.

Keywords: CAM-ICU, critical care, delirium assessment, delirium recognition, educational intervention, medical ICU, nursing knowledge

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Educational Intervention to Improve Delirium Recognition by Nurses

Delirium is defined as an acute confusional state characterized by fluctuating mental status and inattention (American Psychiatric Association, 2013) and is essentially acute organ failure of the brain. Trogrlic et al., (2015) quoted the work of Engel and Romano (1959): 'the problem of delirium is far from an academic one' (p. 158) and the insufficiencies in the education of healthcare professionals to recognize and respond to delirium are of crucial importance. Delirium prevalence rates vary from 20-27% in acute care and up to 87% in intensive care unit (ICU) patients (Lawlor & Bush, 2014). Barr et al., (2013) recommended the use of validated tools to perform assessments and the initiation of guidelines and protocols to improve the care of delirious hospitalized patients. Under-recognition of delirium is an extensive problem and delirium is estimated to be overlooked in 30% to 75% of cases (Ryan et al., 2013). The inadequate knowledge of nurses regarding delirium manifestation and risk factors is complicated by the fluctuating and varied presentation of symptoms thus contributing to overlooked diagnoses of delirium (Middle & Miklancie, 2015). The enhancement of nurses' knowledge and skill regarding delirium and delirium recognition is of significant importance in improving delirium screening performance. Increased nursing knowledge and skill regarding delirium could positively impact patient outcomes and prevent the occurrence of negative events. The purpose of this project was to implement and evaluate the impact of an educational program on nurses' knowledge and skill regarding delirium and delirium recognition.

Background

The pathophysiology of delirium is poorly understood and involves neurotransmitter imbalances from a variety of causes; thus identification, treatment, and prevention strategies are often challenging (Flaherty, 2011). Hospitalized acute and critically ill patients who develop

delirium experience prolonged mechanical ventilation, development of healthcare-acquired infections, increased lengths of stay, long-term cognitive defects, increased discharges to skilled nursing facilities or long-term acute care hospitals, and increased mortality rates (Balas et al., 2009). Pun and Ely (2007) wrote that the average medical ICU patient may have predisposing and precipitating risk factors of 11 or more. The vulnerability of geriatric patients exacerbates these risk factors when a minor illness occurs (Brummel & Girard, 2013). Paucity exists in the full engagement of healthcare professionals to address the critical patient safety issue of delirium due to a lack of knowledge and skills to accurately recognize it.

Steis and Fick (2008) described the complexities of knowledge, communication with physicians, and a lack of comprehension of delirium risk factors as significant influences on nurses' ability to recognize delirium. There is often a misinterpretation of patient presentation, baseline cognitive status, and over-looked subtleties associated with delirium development by nurses without adequate education and experience with delirium, delirium recognition, and management. The systematic review by Steis and Fick (2008) reported that nurses recognized confusion and patient distress but without specific knowledge and a framework to delineate symptoms, nurses will not recognize delirium. The use of validated assessment tools to screen for delirium and sedation are fundamental elements of delirium recognition and require a variety of educational strategies for nurses to incorporate into daily practice (Middle & Miklancie, 2015). The motoric subtypes of delirium are also a consideration in the lack of recognition. Hypoactive delirium is the most common subtype and thus the most often overlooked (Barr et al., 2013). Brummel et al., (2013) wrote that in addition to didactic training, nurses benefitted from a continual learning process involving daily rounding, immediate feedback on assessment accuracy, and refresher training. Lawlor and Bush (2014) described a framework to improve

delirium recognition that stratified educational initiatives as an institutional and leadership priority. Institution of evidence-based guidelines and protocols regarding delirium are important to guide the care of these vulnerable patients and to assist interdisciplinary teams to manage and prevent delirium. Dammeyer et al., (2012) described the statewide initiative in Michigan by the Health and Hospital Association utilizing a bundled approach of interventions regarding decreasing or mitigating delirium and negative sequelae which included highlighting educational strategies as a key component in the management of hospital delirium.

The accurate performance, both procedural and outcome, of delirium screening is of paramount significance in delirium management. There are numerous validated delirium screening tools available for use in the hospitalized patient. The most widely validated tool for the ICU patient is the confusion assessment method for the ICU (CAM-ICU; see Figure 1). The CAM-ICU is a screening assessment tool utilized by healthcare providers, usually nurses, to determine if the patient is experiencing delirium at the time of the screening. The fluctuating nature of delirium necessitates that a screening be conducted with changes in mental status. The CAM-ICU is divided into four distinct features including the two required features for a determination of delirium to be present; fluctuating or altered mental status from baseline and inattention. The CAM-ICU is scored algorithmically determining either a positive or negative delirium status (Ely et al., 2001). The sensitivity and specificity of the CAM-ICU were found to vary widely based on operator experience in a systematic review by De and Wand (2015) with ranges from 18% sensitivity to 100% specificity. Ely et al., (2001) described a very high sensitivity and specificity (93% and 100%) with high interrater reliability ($\kappa = .96$; 95% CI [0.92-0.99]) in the initial validation of the CAM-ICU. An issue in the initial validation was that the research study nurses performed all of the assessments. The caveat of study nurses

performing all of the assessments demonstrates a substantial responsibility and necessity to ensure bedside nurses possess advanced knowledge and skill with using the tool.

The communication of a positive delirium screening as an important patient finding requires action on the part of the receiver. Brummel et al., (2013) commented that a discussion and investigation of the potential underlying cause is warranted upon receipt of a positive delirium screen and should serve as a warning signal for the interdisciplinary team. Brummel et al., (2013) also noted that a lack of response from physician colleagues could potentiate decreased nursing interest concerning delirium recognition assessments. Pun et al., (2005) described that in a survey given to nurses after implementation of a delirium screening tool that a significant barrier to the practice was lack of value placed on the screening by physicians. Daily rounding checklists have become an invaluable practice in the ICU environment (Winters et al., 2009) and therefore can provide nurses with a primary communication tool regarding delirium status and further interventions in the ICU (Dammeyer et al., 2012). Electronic medical records (EMR) are also an adjunct communication tool. Bassett et al., (2015) described case studies of institutions transitioning to delirium monitoring protocols and noted the addition of delirium screening scores to the EMR as a strategy for enhancing team communication.

Adverse outcomes for the critically ill patient experiencing delirium are widely published and include prolonged mechanical ventilation, lengths of stay, persistent cognitive impairment, and increased mortality (Pandharipande et al., 2008; Ely, et al., 2004; Pandharipande et al., 2013; Witlox et al., 2010). Van den Boogaard and colleagues (2012) described statistically significant increases in ventilator days, re-intubation rates, and accidental removal of tubes. Further validation of negative outcomes for the critically ill delirious patient was published by Mehta et al., (2015) and revealed increased negative clinical sequelae such as increased use of

vasopressors or inotropes, increased antipsychotic administration, and increased use of physical restraints.

Theoretical Framework: Rogers' Diffusion of Innovation

Knowledge translation is a significant component in the adoption of evidence-based practice. Rogers' theory of the Diffusion of Innovation (DoI) theory, developed in the early 1950s, has been used extensively in nursing research to explain the process of adoption and spreading of new knowledge and advancement of practice (Estabrooks et al., 2006). The DoI theory construct was used to perform the literature review for the project, the creation of the project intervention, and evaluation of changes in knowledge and skill regarding delirium and delirium recognition.

The theory explains the progression of innovation adoption through the four main elements of the theory. These elements include the innovation, communication channels, time, and a social system (Rogers, 2003; see Figure 2). An innovation is communicated through channels, over time through a social system to reach full adoption of the innovation (Rogers, 2003). The innovation is considered to have five attributes; each partially impacting whether or not the diffusion of the innovation will occur and be adopted (Sanson-Fisher, 2004). Each of the attributes of Rogers' DoI theory can be associated with fundamental elements of delirium knowledge and skill and are further defined in this context below:

Relative advantage

Relative advantage is to what degree the innovation is viewed as improvement over the previous practice (Rogers, 2003). In the case of delirium recognition, relative advantage is applicable to utilizing a systematic approach to delirium recognition and the use of validated screening tools.

Compatibility

Compatibility is to what degree the innovation is perceived as compatible with current values and needs (Rogers, 2003). Compatibility with practices in delirium recognition is contingent on nurses valuing best practices in caring for delirious patients and an empathetic understanding of delirium's impact on patient outcomes.

Complexity

Complexity is to what degree the innovation is perceived as difficult to understand and use (Rogers, 2003). Complexity is associated as one of the primary issues with delirium recognition. Complexity is closely related to the fluctuating nature of delirium and varied symptomatology demonstrated by delirious patients. There is an inherent complexity in assessing neurologic disorders such as dementia (Morandi et al., 2012) or post-stroke delirium (Mitasova, et al., 2012).

Trialability

Trialability is to what degree the innovation can be trialed and modified (Sanson-Fisher, 2004). Rogers (2003) describes trialability as instituting innovations on the "installment plan" (p. 231). Trialability is challenging when examining delirium educational efforts. Educational efforts in the literature are often combined with the implementation of evidence-based practices provided in bundles and guidelines. This combination approach can limit the nurses' perceived ability to fully absorb the educational intervention and trial the practices before full implementation occurs.

Observability

Observability is to what degree the innovation is visible to others (Rogers, 2003). Observability as an aspect of innovation diffusion is full saturation and adoption of practices. It

is the cumulative effect of knowledge and skill acquisition and practice with delirium recognition and management. Equating the severity of delirium to other medical disorders in the lay public literature and nursing/medical communities is critical to adoption of these practices (Teodorczuk, Reynish, & Milisen, 2012).

Purpose

The purpose of the project was to implement and evaluate the effectiveness of a multimodal educational intervention for medical ICU nurses on their knowledge and skills regarding delirium and delirium recognition.

Literature Review

The literature review for the project focused on studies examining improving nursing knowledge and skills regarding delirium and delirium recognition through educational interventions. An integrative methodology was used to include a broad range of empirical literature including quality improvement publications (Soares et al., 2014). The literature search was confined to electronic databases and each was individually searched: MEDLINE, CINAHL, PsycINFO, Web of Science, Google Scholar, and Joanna Brigg Institute. The keywords utilized for the search were *delirium, delirium assessment, delirium recognition, nursing knowledge, nursing education, critical care, continuing education, and medical ICU*.

In Ovid MEDLINE, the keywords were combined with the suggested headings of *Delirium, Intensive Care, Critical Care, and Nursing Education* using Boolean operators of "OR" and "AND." The searches returned 26, 37, and 303 articles. The articles identified were then restricted to the publication years of 2009-2015 with a remainder of 91 articles. The same search was performed in CINAHL and the keywords were combined using the Boolean operators of "OR" and "AND" returning another 91 articles.

In PsycINFO, Web of Science, Joanna Briggs Institute, and Google scholar, the keywords *delirium assessment, nursing knowledge,* and *critical care nursing* were combined using the Boolean operator "AND." Eighty-three articles were returned with 44 duplicates from the OVID MEDLINE and CINAHL searches.

Inclusion criteria for the literature review were as follows: (1) primary research articles; (2) quality improvement projects which included statistical analyses; (3) publication years of 2009 to 2015; (4) conducted on adult in-patient acute care hospital units; (5) included educational interventions to improve delirium recognition knowledge or skills for predominantly nurses. Exclusion criteria were as follows: (1) Non-English language; (2) articles confined to physician education only; (3) non-acute care hospital settings; (4) editorial or opinion papers, case studies, or quality improvement projects without statistical analyses; (5) restricted to geriatric practices. An ancestry search of bibliographies of relevant articles was also performed (see Figure 3 for search strategy diagram). Fourteen articles met criteria for final review including two quality improvement projects and one systematic review. A summary of the literature search results can be found in Table 1.

Descriptive Study Findings

Four of the selected studies for the literature review were descriptive in nature and provided data about nurses' knowledge of delirium, nurses' own competency perception, facilitation of practice-change adoption, and perceived barriers in the use of delirium screening tools.

The prospective descriptive study by Baker, Taggart, Nivens, and Tillman (2015) reported use of a previously developed and studied tool: the nurses' knowledge of delirium survey, a 36-item questionnaire developed by Hare et al., (2008). Seventy-five percent of the

nurses described by Baker et al., (2015) reported no previous education on delirium and averaged a score of 64.2% on the questionnaire. Twenty percent of the respondents scored ≥ 75%. The predominant lack of knowledge by nurses was in specific delirium risk factor knowledge where the average score was 21.6%. Baker et al., (2015) also sought to correlate nursing demographics such as level of education and years of experience with general knowledge of delirium and delirium risk factors. No statistically significant correlation was found in the 59 participants. Fifty-five percent of the nurses rated an average competency level.

The descriptive case study by Bowen, Stanton, and Manno (2012) described compliance of CAM-ICU performance and correlation of expert and nurse assessments after implementation of an education program. Bowen et al., (2012) implemented the CAM-ICU screening tool over an eight-week period using an extensive educational campaign of didactic sessions, journal article distribution, creation of confusion assessment method (CAM) champions, and a weekly visual communication board of the program status in a medical ICU and surgical ICU. The benchmark for successful implementation was set at a compliance rate of 80% of screenings performed. An 85% compliance rate was achieved. The Pearson correlation of interrater reliability of nurse-researcher assessments demonstrated high correlation ($r = .97$, $p < .0001$). The authors did not include demographics of nurses or patients or graphical representations of the data.

Elliott (2014) addressed nurse and physician knowledge of screening tools and the perceived barriers to their use. In the cross-sectional study, Elliott (2014) compared the knowledge and understanding of delirium and perceived barriers across three hospitals. An author-generated survey tool was used and included open and closed-ended questions. There was a response rate of 51% of which 68% was nursing staff. Forty-four percent of the respondents

reported no previous ICU delirium education. Delirium knowledge was reported as high for 79% of the medical staff and 67% of the nursing staff. Medium knowledge was described for risk factors and delirium complications with the scores of 67% and 50% respectively. Elliott (2014) also described no knowledge demonstrated for higher six-month mortality rates and dementia as key consequences. The barrier to screening results indicated only 18% of the respondents identified the screening tool as time-consuming to complete. One confounding factor was that hospital B had most recently adopted use of a delirium screening tool and 64.3% of the respondents in hospital B reported delirium education in the preceding year. Open-ended responses were not disclosed.

Flagg et al., (2010) described nurses' ability to recognize delirium, delirium knowledge, and confidence in the knowledge. In addition, Flagg et al., (2010) also queried nurses on their confidence with delirium recognition. A "barrier to delirium assessment" survey with three sub-scales was created and tested for reliability with Cronbach α which indicated good internal consistency with scores ranging from .81 to .87. The convenience sample of 79% of nurses identified delirium as a common problem. The confidence scores were rated on a five-point scale where one indicated no confidence and five indicated extreme confidence. The average mean score for identifying delirium was 3.32, managing delirium 3.42, and explaining delirium to patients' families 3.25 demonstrating an average confidence level.

Quasi-experimental Study Findings

There were seven quasi-experimental studies included in the literature review. One of the most important inclusion criteria for the literature review was that an educational intervention for nurses was included in the studies' methodology. Several of the studies included pre and post assessments and questionnaires. There was a great deal of variability in the assessment measures

used, the origin of the survey, or the assessment used. The measures were typically author-generated and were not included in the description of methods or graphical representations within the articles.

The study by Akechi et al., (2010) examined the usefulness of a delirium training program for 390 nurses compared to a control group receiving no delirium education or training by measuring confidence scores. The program consisted of workshops and creation of a champion RN model to provide step two of the education for other nurses. Akechi et al., (2010) described the training as workshops with case presentations and question and answer sessions over a period of two months. Prior to initiation of the educational effort an author-developed questionnaire using the Likert scale (1-10, one being not at all confident) was given to the intervention and control groups. The groups' mean score differences were not statistically significant ($p > .15$). The overall posttest improved from a mean score of 42.1 to 57.4 ($p = .001$) in the intervention group and the change for the control group went from 38.9 to 40.8. Further analysis of individual questionnaire items revealed three areas with statistically significant improvement: early detection of delirium, explanation of delirium to the patient's physician, and appropriate environment provision for the delirious patient. Notably the completion rate for the control group was 26% versus 88% for the intervention group and the overall self-confidence scores remained low.

A three-phased multi-faceted educational program was implemented in a 29-bed surgical trauma unit by Gesin et al., (2012). Knowledge scores from a ten-point multiple choice assessment tool of delirium, specifically regarding the validated screening tool ICDSC (ICU delirium screen) were reported from each phase. The phases were as follows: (1) no education, (2) minimal education with distribution of article on ICDSC only, and (3) a didactic lecture,

web-based education module, and bedside training. There was no difference in the mean score between phases one and two. Statistical significance was noted in nursing delirium knowledge when comparing phases one and two to phase three (p = .001). Gesin et al., (2012) also measured RN and researcher-expert agreement of delirium assessments with Cohen's kappa coefficient. Fair agreement was noted in phase 1 (κ = .40; 95% CI [0.11-0.69]) which improved to substantial agreement in phase three (κ = .74; 95% CI [0.69-0.95]). The authors noted that there was no standardization between education delivery and assessment comparison which may have affected information recall and the improvements reported.

Meako, Thompson, and Cochrane (2011) focused on increasing the baseline knowledge of delirium by adherence to the American Association of Colleges' of Nursing and Hartford Institute on Geriatrics geriatric nursing education consortium curriculum (GNEC) for orthopedic specialty nurses. The researchers described a lecture format in-service presented over two days. The pre and posttest tool was an author-created, non-validated ten question assessment. The pretest mean score for the 21 RNs was 5.42 (SD 1.2) and the posttest mean was 8.9 (SD 1.01) indicating a statistically significant change (p = .0005). Meako et al., (2011) performed an ad hoc analysis of the mean scores and the nurses' years of experience. The largest statistically significant difference was between those with 0-2 years of experience versus the other experience levels (df = 2, F = 3.92, p = .039).

A specific methodology of a *CSI* (*comprehensive sequential intervention)* was used by Ramaswamy et al., (2010) whereby an educational intervention was provided and measured knowledge and confidence in delirium identification. CSI was not well-defined nor did the description of the intervention provide clarity. The two-day intervention consisted of a four-part didactic series of lectures with intermittently interspersed small group practice case conferences.

The subjects were nurses (68%), physicians (12%), and other allied healthcare providers (20%) and a matched pair analysis was conducted. The authors divided responses into cohorts; cohort one attended one of the didactic sessions, cohort two attended two or more sessions. The results demonstrated an overall improvement in the mean knowledge score of 2.9 ($p < .001$) and significant confidence score change of 52% pre-intervention to 80% post ($p < .001$). Group stratification did not demonstrate a statistical difference in cohort one scores. Cohort two scores demonstrated a mean change of 3.8 ($p < .001$) and change in confidence score of 53% to 84% ($p < .002$). The authors noted that many pre (77) and posttest (89) scores were not matched and therefore not analyzed.

Scott, McIlveney, and Mallice (2012) evaluated the feasibility and effectiveness of using the CAM-ICU delirium screening tool by measuring pre and post-education surveys. The researchers utilized the previous survey tool used by Pun et al., (2005) and Devlin et al., (2008). An educational intervention of half-hour group sessions was conducted over four weeks and was comprised of didactic content, a video of CAM-ICU demonstration, and followed by bedside instruction. Results were presented in percentages and no statistical analysis of the data was provided. The post surveys demonstrated several areas of increase; understanding what delirium is, awareness of under-recognition and increased mortality, and understanding of prolongation of mechanical ventilation related to delirium. Ninety-eight percent of the nurses reported no previous delirium education.

Swan (2014) compared the incidence of inappropriate unable to assess (UTA) ratings on the CAM-ICU delirium screen before and after an educational campaign. The educational intervention was designed by the author, a clinical pharmacist, and taught to RNs by three nurse educators. The educational intervention consisted of ten-minute one to one instruction reviewing

the general concepts of CAM-ICU assessments and provision and review of a two-page educational brochure including data from the pre-intervention cohort which included 93 patients and 423 CAM-ICU ratings. Prior to education the UTA rate was 32% versus 19% post-education ($p = .03$). Additional findings reported were that the median CAM-ICU ratings per patient documented pre-education was four versus seven post-education ($p < .001$). The predominant patient population receiving inappropriate ratings pre-education were the mechanically ventilated, (70%) whereas post-education inappropriate UTA ratings were reduced to 44% ($p < .001$). Swan (2014) reported that the ratings were not confirmed by expert reviewers and the Hawthorne effect may have contributed to the findings.

Varghese et al., (2014) evaluated the effectiveness of an educational program for an intervention group and a comparator group. The pre and posttest method was used with the added measure of practice observation. Each subject had eight practice observations. The knowledge and practice scores were not statistically significantly different for the pre-intervention cohorts. The mean knowledge score in the intervention group was 14.27 versus 20 ($p < .001$) and the mean practice score was 18.28 versus 37.63 ($p = .003$). There was no statistically significant difference in the non-intervention group for the knowledge scores, 12.41 and 14 ($p = .292$), nor the practice scores, 19.58 and 28.33 ($p = .079$). The educational intervention was not described and the sample sizes of the groups were small; intervention group $n = 15$, control group $n = 17$.

Performance Improvement Findings

There were two performance quality improvement articles included in the literature review because the projects were conducted in a quasi-experimental design with an educational intervention, and statistical analysis was presented in the results.

Gordon et al., (2013) conducted a quality improvement intervention to increase neuroscience nurses' knowledge of delirium and evaluate the effectiveness of a combination approach to improve delirium recognition. The project was implemented in the quasi-experimental design utilizing a retrospective chart review for pre-intervention practice norms. The nurses' delirium knowledge tool (Hare et al., 2008) was used as the pre and posttest. The educational intervention included a didactic session, a frequently asked questions compilation related to neuroscience patients, a journal article, and bedside coaching of delirium screening which included a return demonstration. The education was provided in small groups (2-4) for 30 to 40 minute sessions. The pretest mean score was 17.7 (SD 8.2) and posttest score 20.7 (SD 4.9) (p = .1366). The pre-intervention retrospective chart review was of 25 patients and no delirium screenings were performed. After the intervention the compliance rate for delirium screening increased to 92%. The coach and registered nurse (RN) assessment agreement was 94.4% following the educational intervention. Although this was a quality improvement project, the specifics regarding the educational intervention were well-described and the authors noted that the small sample potentially hindered statistical significance.

The quality improvement project described by Layne et al., (2015) identified delirium risk patients and earlier delirium recognition by implementation of an evidenced-based protocol after an educational intervention. The curriculum of the educational intervention included one-hour sessions based on the GNEC initiative and case study analyses. The authors did not describe the evaluation measure nor sample size. There was statistical significance in each category reported; assessment for delirium, risks of delirium, CAM criteria, medications implicated in delirium, interventions to prevent and treat, and physiologic causes (p = .001), and for types of delirium (p = .01). Compliance rates were reported for ten negative CAM patients and ten

positive CAM patients as 90-100%. Providing and documenting family education on delirium demonstrated ten to 20% compliance and for the CAM positive patients a 20% compliance rate for pharmacist collaboration was noted.

Systematic Reviews

The systematic review by Yanamadala, Wieland, and Heflin (2013) included 26 studies. The studies were categorized according to the PRECEDE model for education and the Kirkpatrick (1994) model for outcome classification. The studies were classified as follows: nine as predisposing, 11 as predisposing and enabling, one as predisposing and reinforcing, and five as a combination of all three factors. According to the Kirkpatrick model (1994), level two indicates learning, staff knowledge and attitude effects, level three indicates behavior changes and staff practice, and level four indicates changes in patient health outcomes. Kirkpatrick levels three and four are considered optimal. The distribution of Kirkpatrick levels described by Yanamadala et al., (2013) was as follows: predisposing (type one) studies were 11% at level four and none at level three, predisposing and enabling (type two) and predisposing and reinforcing (type three) were reported combined at 8% at Kirkpatrick level three and 17% at level four, the combination of all factors (type four) studies were 40% at Kirkpatrick level three and 40% at level four. The reported findings indicated multifaceted and comprehensive educational plans which enabled and reinforced specific techniques and which tools were most effective. Yanamadala et al., (2013) identified the limitations of their review to be exclusion of studies with inadequate descriptions of the educational intervention and the use of the PRECEDE model for nurses and other allied health professionals as it is normally applied to medical education or health promotion program design.

Discussion

The intent of this literature review was to assess the general knowledge of delirium and delirium recognition of nurses through assessments conducted via questionnaires and surveys before and after educational interventions. The literature reviewed revealed no published studies directly measuring patient outcomes or assessing the accuracy of nurses' assessments prior to the intervention.

A common finding was that the knowledge level of nurses was determined to be average when examined for delirium and risk factors and complications from delirium (Baker, et al. 2015; Gesin et al., 2012; Meako, Thompson, & Cochrane 2011; Ramaswamy et al., 2010; Varghese et al., 2014). Scott et al., (2012) explained that although the nurses deemed delirium a significant issue they did not identify delirium screening as necessary prior to the educational intervention. The overall findings from the quasi-experimental studies demonstrated educational interventions were effective in improving knowledge and skills regarding delirium and delirium recognition. Confounding factors noted in the literature review were the wide variety of educational interventions and the amount of author-created measurement tools used. Several studies did not publish which tools were utilized or clearly describe the educational interventions tested. The study by Gesin et al., (2012) which utilized a phased educational intervention and demonstrated statistically significant improvement when using a multimodal educational intervention is supported in the findings of the systematic review by Yanamadala et al., (2013).

The quality improvement projects reviewed demonstrated favorable results regarding improvement of delirium knowledge. Gordon et al., (2013) demonstrated improvement in knowledge scores, although not statistically significant, and a high level (94.4%) of agreement with expert-RN assessments. Layne et al., (2015) described statistically significant improvement

in seven delineated categories after an educational intervention and reported a very high compliance rate (90-100%) for adherence to the delirium management protocol after education.

Confidence in knowledge and skills are an important part of practice for any healthcare provider and especially nurses. Akechi et al., (2010), Flagg et al., (2010), and Ramaswamy et al., (2010) addressed nurses' confidence in caring for the delirious patient. Akechi et al., (2010) described three key areas where confidence was not present: early detection of delirium, explanation of delirium to patients' physicians, and provision of an appropriate environment of the delirious patient. Although improvement was demonstrated, confidence scores continued to be low. Flagg et al., (2010) observed that nurses reported only moderate confidence in identifying, managing, and explaining delirium to families. Ramaswamy et al., (2010) also demonstrated significant improvements for those who attended the most educational sessions.

Effects on patient outcomes were not well characterized by the studies in the review. Bowen, Stanton, and Manno (2012) reported exceeding their target benchmark for performance of CAM-ICU screenings. Gesin et al., (2012) and Swan (2014) demonstrated improved accuracy of delirium screenings as did the quality improvement project by Gordon et al., (2013). Layne et al., (2015) reported high compliance rates with a delirium protocol. The definitive improvement of patient outcomes cannot be determined from the studies reviewed.

The literature review revealed a lack of detailed evidence about the performance of CAM-ICU screenings by nurses and improvement in nurses' knowledge through clearly defined and closely controlled educational interventions. Gaps in knowledge discovered in the literature were specifically targeted in the project. A clearly defined multimodal educational intervention was designed with matched pre and post intervention knowledge assessments. The educational intervention component of bedside instruction and return demonstration of skill of delirium

screening with the CAM-ICU permitted the Advanced Practice Nurse (APN) investigator to observe performance of the delirium screening for verification of procedural correctness. Establishing accuracy of the delirium recognition screenings was not specifically addressed in this project, however is essential to further implement interventions to mitigate short and long-term consequences from delirium (Lawlor & Bush, 2014) and could be a natural evolution for this project.

Methods

The purpose of the project was to evaluate the effectiveness of an educational intervention for nurses to determine if their knowledge and skills concerning delirium and delirium recognition improved. The multimodal educational intervention, *Delirium Refresh,* was conducted and evaluated. The pre and post assessments were done immediately prior to and immediately after the educational intervention. Delirium screening procedural correctness was determined by observation during the bedside instruction and return demonstration of the educational intervention.

Definition of terms

Delirium was defined as an acute confusional state characterized by fluctuating mental status and inattention (American Psychiatric Association, 2013).

Delirium recognition was the use of a validated screening tool (CAM-ICU) to detect the presence or indicate the absence of delirium.

Delirium Refresh was the multimodal educational intervention consisting of a ten minute delirium survivor video (Andrews, 2013), a 30 minute didactic presentation, a 20 minute case-study analyses, and a 15 minute bedside instruction and return demonstration of delirium the CAM-ICU delirium screening (see Appendices B and C for the training outline and program).

Procedural correctness was the observation of the CAM-ICU delirium screening performed according to the procedure and determined by the APN investigator.

Design

A quasi-experimental pre and post assessment design was used to determine if changes occurred in nurses' knowledge and skills regarding delirium and delirium recognition after participation in the educational intervention.

Setting

The project was conducted in the Medical Intensive Care Unit (MICU) at an academic medical center on the east coast of the United States. The MICU is a 28-bed unit in two physical locations within the 612-bed medical center. The diagnoses of patients admitted to the unit include pneumonia, chronic obstructive pulmonary disease (COPD) exacerbations, acute respiratory distress syndrome (ARDS), sepsis and septic shock, liver, pancreatic, and kidney disorders, metabolic disarray, complications from malignancies, alcohol and drug withdrawal, intentional overdoses, and post-cardiac arrest.

Sample

A convenience sampling method was used. Ninety-eight bedside nurses and eight APNs employed in the MICU were invited to participate. Exclusion criteria for participation included MICU RNs with less than one year experience, non-unit based RNs, or travel RNs.

Procedures

Notice of the project and request for participation was conducted via email invitation, flyers, and verbal announcements during shared governance meetings on the unit for one month prior to the start of the intervention. Participants provided email or verbal agreement of participation. Scheduling was coordinated to ensure small groups of two to three participants per

session. Participants attended only one educational session during non-patient care scheduled days but were permitted to clock-in for time spent attending the educational session. Participants were verbally read the approved IRB consent form (see Appendix A) and then provided signatures on the form. Participants were offered and provided a copy of the signed consent form as requested. The assessment surveys were completed immediately prior to and immediately following the educational session. The completed surveys were returned to a specially marked collection box provided in the educational classroom.

Delirium Refresh consisted of a ten minute delirium survivor video (Andrews, 2013), a 30 minute didactic presentation, a 20 minute case-study analyses, and a 15 minute bedside instruction and return demonstration of delirium screening. The training outline can be found in Appendix B. Appendix C demonstrates the educational presentation in its entirety. Delirium screening procedural correctness was assessed during the bedside instruction and return demonstration observed with the APN investigator.

Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained from the Social and Behavioral Sciences IRB (see Figure 6). Permission to perform the project was provided by the nurse manager and medical director of the MICU (see Figure 7). Permission for use of the nurses' delirium knowledge assessment (NDKA) was obtained from Mr. Hare (see Figure 8). The CAM-ICU is the current standard of care for assessment of delirium at the institution and did not require permission from patients for assessment. No patient identifiers were collected. The procedural correctness of the CAM-ICU performed was recorded by the APN investigator as either yes: procedurally correct or no: not procedurally correct and was not associated with participants' information or demographics.

The pre and post intervention assessments were alpha-numerically labeled for matching and no personal identifiers were included.

Measures

The pre and post intervention assessment tool was an adapted version of the NDKA designed by Hare et al., (2008). The demographics of the survey were modified to reflect the setting and United States nursing educational preparation. The origin of the survey is Australian and the survey was revised to reflect American English, however intent of each question on the survey was preserved.

The NDKA measure (see Figure 4) is a 36-item assessment evaluating specific delirium knowledge components. The measure is a combination of general delirium knowledge, knowledge of screening tools and scales, and knowledge of delirium risk factors. The assessment includes a multiple-choice question, a section involving matching scales/tools to the appropriate condition, and a scale of agree, disagree, and unsure responses for the remainder of the questions. Sub-scales of knowledge, knowledge of assessment screening tools and scales, and delirium risk are scored independently and a total score is computed overall (Hare, personal communication, January 22, 2017).

The internal consistency and reliability of the survey was evaluated using the Kuder-Richardson Formula 20. The tool was found to have a .66 for the delirium definition and knowledge of delirium, dementia, and depression tools and scales and a .80 for the section of the tool concerning the delirium statements testing knowledge of delirium and risks of delirium (M. Hare & C. Toye, personal communication, February 21, 2016).

The CAM-ICU (see Figure 1) is the delirium recognition tool currently performed in the intensive care units at the facility. The CAM-ICU was initially evaluated and validated by Ely et

al., (2001) for use in the mechanically ventilated patient. Ely et al., (2001) reported a high interrater reliability (κ = .96; 95% CI [0.92-0.99]) between study nurses and 96.5% sensitivity and 99% specificity. In 2011, Vasilevskis et al., (2011) reported on a prospective cohort trial of 510 patients and 627 nurses; reliability between bedside RNs and study RNs was found to be κ = .67(95% CI [0.66, 0.70]) and stable over three years of data collection. Vasilevskis et al., (2011) also found sensitivity to be .81 (95% CI [0.78, 0.83]) and specificity of .81 (95% CI [0.7, 0.85]).

The CAM-ICU is divided into four features and scored algorithmically as positive or negative depending on the answer to each feature. Feature one is fluctuating mental status or different from baseline mental status. Feature two is a measurement of inattention by use of an alphabetic identification mechanism. Feature three is determined by use of the current sedation score of the patient using the Richmond agitation sedation score (RASS; see Figure 5) and feature four is a series of questions to measure disorganized thinking (Ely et al., 2001).

Data Analysis

The statistical analysis of the data was conducted via the statistical software package of SPSS® 24. Descriptive statistics were performed on the NDKA data of demographics and assessment responses. Frequencies and valid percentages were computed for all nominal and ordinal level data. Means, mean differences, and standard deviations were computed for normally distributed continuous data.

The paired t-test was used to detect significant differences in normally distributed continuous data between pre and post assessment overall scores and the three sub-scales. Comparative statistics as appropriate were computed to identify if significant differences between demographic groups and assessment mean differences were found. Statistical significance (α) of .05 or less was used.

Results

Thirty-four nurses representing 32% of the group eligible participated in the educational sessions. The educational interventions were provided over nine weeks from July to September 2016 via 15 educational sessions. Group size ranged from one to 5 participants with the mean group size of two participants. Thirty-four participants completed pre and post assessments. Demographic data for the sample are illustrated in Table 2.

Demographics

Demographic information was collected in ranges of age, years of nursing experience, educational preparation, clinical ladder level, and years working in the MICU and institution. Self-reported amount of delirium education received (none, small, moderate, or large) was also collected pre and post. There were no missing demographic values for the participants.

Age ranges and gender. The age range of 20-30 years represented 55.9% of the participants (*n* = 19), 31-40 range was 17.6% (*n* = 6), and the remainder of the ages of 41-61+ comprised 26.5% (*n* = 9). The sample consisted of 94.1% female participants (*n* = 32).

Years in nursing practice. Participants reporting one to five years of nursing experience was 58.8% (*n* = 20). Six to 15 years of experience was reported by 20.6% (*n* = 7) and sixteen years and greater by 20.5% (*n*= 7).

Years in the MICU and institution. The predominant range of years at the institution was one to five representing 70.6% (*n*= 24). The group with twenty plus years at the institution was 17.6% (*n*= 6). The group with one to five years in the MICU also represented 76.5% (*n* = 26) of the sample.

Educational preparation. The categories of diploma, associate degree of nursing (ADN), BSN, and MSN were offered. The BSN-prepared group comprised the majority of the

participants with 55.9% (*n* = 19). MSN-prepared nurses represented 35.3% (*n* = 12) of the participants.

Self-reported delirium education levels. The majority of participants reported a moderate level of education prior to the intervention at 55.9% (*n* = 19). Those reporting a small amount of education were 41.2% (*n* = 14). Post assessments revealed self-reported moderate level of delirium education at 61.8% (*n* = 21) and those reporting a large amount of delirium education increased from 2.9% (*n* = 1) pre assessment to 17.6% (*n* = 6) post assessment.

Nurses' Delirium Knowledge Assessment

For this 36-item measure, the overall mean score of correctly answered questions was 75.7% for the pre assessment and 80.3% for the post assessment. The sub-scale mean scores were as follows: knowledge questions 88.8% pre and 96.9% post, knowledge of assessment tools and scales 80.7% pre and 81.1% post, and risk questions 59% pre and 62.2% post (see Table 3). The mean differences (post minus pre) in the overall score, and the three subscales: knowledge questions, knowledge of assessment tools and scales, and risk questions, were also computed and are summarized in Table 3. Paired *t*-tests were computed and were statistically significant for the overall mean score difference ($p < .001$) and for the knowledge questions sub-scale mean difference ($p < .001$). There was some evidence of improvement in the risk sub-scale mean ($p = .100$), but no evidence of improvement in the knowledge of assessments tools and scales mean ($p = .872$) (see Table 3).

The effects of different levels of two demographic variables on the pre-post differences in the overall scale and the 3 subscales were also investigated (see Table 4). In order to have categories of sufficient size for analysis for years of nursing experience, the five categories were collapsed to three (one to five years, six to 15 years, and ≥ 16 years). The Kruskal-Wallis *H*-test

found no statistically significant differences between the distributions of the pre-post differences in the four scales, over the three categories of years of nursing experience: overall scale score pre-post difference (p = .534), knowledge subscale score pre-post difference (p = .284), knowledge of tools and scales subscale score pre-post difference (p = .889), and risk subscale score pre-post difference (p = .699). The four levels of educational preparation were collapsed into three categories: Diploma/ADN, BSN, and MSN/Doctorate. The number of Diploma/ADN prepared nurses was low (n = 3) and those three nurses were not included in the analysis. Independent t-tests were computed comparing the mean pre-post score differences for the BSN and MSN/Doctorate groups. No significant differences between the two education groups were found in the mean overall score differences, t (29) = 0.38, p = .708, or in the knowledge of tools and scales, t (29), = 0.13, p = .987, or risk, t (20) = 0.05, p = .964, sub-scales. The knowledge sub-scale score difference data were skewed and analyzed using the Mann-Whitney U-test with no statistical significance (p = .484) found (see Table 4).

Knowledge questions. Participants demonstrated a substantial baseline knowledge of delirium with a mean of 88.8% on the pre assessment. One-hundred percent of participants correctly answered the knowledge questions regarding delirium treatment and sedation and alcohol withdrawal as the typical cause of delirium on the pre assessment. The questions with the lowest percentage of participants answering correctly on the pre assessment were on the Mini Mental Status Exam (MMSE) as the best tool for assessing delirium at 61.8% and the difficulty to arouse and lethargic patients as having delirium at 67.6%. Eight of the 15 knowledge questions demonstrated improvement to 100% of participants answering correctly after the educational intervention (see Figure 9).

Knowledge of tools and scales. The sub-scale on the knowledge of tools and scales

assessed participant knowledge of MMSE, delirium rating scale (DRS), clinical institute of withdrawal of alcohol (CIWA), Glasgow Coma Scale (GCS), confusion assessment method (CAM), and Beck's Depression Inventory to detect delirium, dementia, or depression. The question with the lowest number of correct answers at baseline was the MMSE at 8.8% of participants and the highest baseline score (100%) was identifying the Braden score as a scale not associated with delirium, dementia, or depression. The MMSE correct responses improved to 32.4% of participants on the post assessment. Table 5 displays the percentage of correctly answered questions of each the tools and scales for the pre and post assessments.

Risk Questions. The baseline sub-scale mean scores on risk were very low. The questions with the lowest percentage correctly answered were regarding diabetes and male gender as risk factors at 11.8% and hip fracture repair risk at 23.5%. The other questions with lower numbers of participants answering correctly were on dementia (32.4%), obesity (35.3%), and family history of dementia (32.4%). The risk of dementia question improved to 82.4% of the participants answering correctly on the post assessment and the diabetes question improved to 23.5%. Figure 10 displays the pre and post intervention percentages of correctly answered risk sub-scales questions.

Procedural Correctness of CAM-ICU Performance

Procedural correctness was determined via return demonstration of performing the CAM-ICU at patients' bedsides during the educational intervention after bedside instruction. Seventy-nine percent of the participants correctly performed the delirium screening during the observation. The most common error (85%) observed in the return demonstration for procedural correctness was continuing with the screening although technically completed based on the progression of assessment algorithm (see Figure 1).

Discussion

The importance of nurses' knowledge and skill of delirium and delirium recognition is well-demonstrated in the literature. Middle and Miklancie (2015) described that an invaluable component to ensure bedside nurses possess the proper knowledge to anticipate care for delirious patients is the provision of effective education. Steis and Fick (2008) noted that the assumption that nurses will pursue and apply the vast amount of evidence supporting delirium recognition and intervention is problematic. Wells (2012) suggested that the use of informal delirium assessments led to ineffective and inappropriate nursing care. Banerjee, Vasilevskis, and Pandharipande (2010) shared that implementation and continuation of delirium assessment by bedside nurses should be conducted with a structured plan and conceptual model. The Rogers' DoI theory was applied as the theoretical framework for *Delirium Refresh* to provide a structure for promotion of early adoption of accurate delirium screening skills using the well-validated CAM-ICU. The attributes of an innovation's adoption in a practice setting as identified by Rogers' are relevant to delirium recognition and screening. A perceived lack of appropriate recognition of delirium in the MICU was noted prior to implementation of the project as evidenced by delirium point prevalence rates of ten to 20 %, far below published reports for the intensive care environment. Semancik, Waszynski, and Udeh (2014) shared that "the consequence of under-diagnosing delirium is suboptimal management" (p. 106). *Delirium Refresh* was implemented as an educational intervention with pre and post assessment testing to determine if a multimodal approach impacted MICU nurses' knowledge and skill regarding delirium and delirium recognition. Brummel et al., (2013) noted that methods used to train bedside nurses about delirium should be deliberate and focused in order to maximize the use of bedside screening tools.

The analyses of the data demonstrated statistically significant improvement in the overall and knowledge sub-scale scores using the NDKA. Certifying knowledge of delirium as a cornerstone to nursing practice was described by Malik, Harlan, and Cobb (2016). No participant scored 100% on the overall or any sub-scale of the assessments, however, the improvement to 100% of the participants answering correctly on some key characteristics of delirium such as the length of delirium, perceptual disturbances experienced by patients, and the increased mortality associated with delirium, may contribute to improved recognition of delirium.

The knowledge of tools and scales sub-scale also indicated the limited awareness of how to correctly identify delirium and which tools are appropriate. There was a profound lack of knowledge of the MMSE as a tool to identify delirium and depression noted on the pre assessment. There was an improvement in knowledge by 24% of participants for the MMSE on the post assessment. The complexity and variety of delirium screening tools contributes to the confusion for nurses. A literature review by Hussein, Hirst, and Salyers (2014) highlighted that the deficiencies in knowledge and use of valid and reliable delirium recognition tools by nurses is an area of needed research.

The low scores on the risk sub-scale demonstrated a significant lack of awareness for those patients prone to delirium. Nurses' inability to recognize risk factors constitutes a substantial patient safety risk. Steis and Fick (2008) explained that in order for nurses to appropriately care for delirious patients they must be educated about the variable and discreet manifestations associated with delirium. The mitigation of contributing risk factors is a key contributor to prevention and improved patient outcomes and is primarily a nursing concern (Faught, 2014). Commonly known risk factors such as advanced age, impaired vision, and impaired hearing were identified correctly by 91.2%, 97.1%, and 100% participants,

respectively, and remained unchanged from pre to post assessment. Co-morbidities not considered to contribute to delirium such as obesity and diabetes were incorrectly identified by participants as risks by 64.7% and 88.2% pre assessment and 73.5% and 76.5% post assessment.

The internal consistency and reliability of the NDKA knowledge of tools and scales section (KR_{20} = .66) may have negatively impacted demonstration of statistical significance for this subscale. The risk and knowledge subscales were noted to have a higher internal consistency and reliability score (KR_{20} = .8) and thus the results for these subscales were presumed to be accurate in evaluating the effectiveness of the educational intervention.

Performing the CAM-ICU at the patients' bedside after coaching was anecdotally considered beneficial by participants. The lack of observational data of participants prior to the educational intervention prohibited any conclusions regarding the effectiveness of the educational intervention on the skills of nurses to perform the screening correctly. Gordon et al., (2013) described that bedside coaching in combination with other educational methods may increase nursing practice for delirium recognition.

Delirium Refresh was designed to determine if a multimodal approach would improve knowledge and skill of nurses regarding delirium recognition. The inclusion of a delirium survivor video highlighted the long-term impact of delirium. Pollard, Fitzgerald, and Ford (2015) described that in order to enhance nurses' abilities to provide holistic evidence-based nursing care that insight into the patients' experience of delirium is necessary. The content of the intervention specifically focused on the CAM-ICU delirium screening tool due to its established use in the setting. There was marginal reference to the numerous risk factors identified on the NDKA during the educational intervention; instead focusing on the most obvious risk factors associated with usual MICU patients. The case study analyses portion of the intervention also

used specific examples common in the MICU setting; patients with liver disease and respiratory failure. These detailed aspects of the educational intervention may have impacted the statistical significance of the results.

The time commitment of providing *Delirium Refresh* was approximately 75 minutes per small group and each participant attended one session. There was no formal evaluation completed by the participants which could have proven beneficial. Anecdotal reports indicated insight into the predicament of ICU survivors who experienced delirium and an increased comfort with performing the CAM-ICU.

Limitations

The project was limited by the restriction to one medical intensive care nursing unit, a low participation rate of 32% in volunteering participants, the quasi-experimental design, and time constraints which prohibited the collection of baseline data for procedural correctness during the performance of the CAM-ICU. The restriction to one medical nursing unit limits the generalizability of the effectiveness of the content of the *Delirium Refresh* program especially regarding the case study analyses and bedside instruction/return demonstration of delirium screening. The voluntary sample could indicate participation only by those motivated to learn. The demographics analyses indicated that the predominant volunteers were those with one to five years nursing experience and thus nursing units with more experienced nursing staff may not benefit from the educational design of the intervention. The lack of pre intervention data for the procedural correctness of screenings performed prohibited any analyses that the educational intervention demonstrated impact on the skill of performing the CAM-ICU by the nurse participants.

Implications for Practice

Providing small group multimodal instruction for nurses' on delirium knowledge and recognition is a valuable strategy and not heavily-resource laden. The inclusion of this type of educational intervention in either an orientation or continuing education program on nursing units where delirium screening is current practice or as the pre-education before launching a delirium recognition program could improve the knowledge and skills of nurses in recognizing delirium. The content of the educational intervention should be targeted to the setting and patient population and include specific instruction on risk factors of that setting and population. Advanced practice nursing expertise and a theoretical framework should be utilized for the design and implementation of these educational programs. Reimers and Miller (2014) concluded that the clinical nurse specialist's expertise and influence in change processes and spheres of influence enabled success in delirium recognition and prevention in the ICU.

Products of the Project

The products of this project are the structured multimodal educational intervention, *Delirium* Refresh, for use as a program for continuing education and orientation in the MICU, this final report of the DNP project, abstract submission to a local evidence-based practice symposium in 2017, abstract submissions for poster presentations to the American Association of Critical Care Nurses' National Teaching Institute and National Association of CNS conferences in 2018, and a manuscript for publication submission to the *American Journal of Critical Care* (AJCC) (see Appendix D for *AJCC* author guidelines and manuscript).

Conclusions

This project has provided additional validation that a multimodal educational intervention improved nurses' knowledge regarding delirium. Reinforced and targeted education to improve

nursing knowledge of delirium is a foundation to improve patient outcomes. Pun et al., (2005) noted that on-going effective education on delirium assessment was necessary to sustain accurate delirium identification. Neither the knowledge of screening tools and scales nor the risks of delirium were impacted by the educational intervention as designed. Skills of performing delirium screening using the CAM-ICU may be improved by bedside instruction and return demonstration. Collection of pre-intervention baseline data for skills of performing delirium screening should be incorporated into iterations of this project to determine efficacy of the educational method on RN delirium screening skills. Further research on pedagogical methods is needed to determine the most effective strategies to improve RN knowledge of tools and scales to measure delirium, dementia, and depression and delirium risk factors. The impact of improved methodologies to recognize delirium is vital to patients' healthcare outcomes and lives. The burden of negative long-term outcomes for patients mandates continued efforts to improve the knowledge and skills of nurses' about delirium and delirium recognition.

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Table 1

Summary Table of Studies on Improvement in Nurses' Knowledge of Delirium

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
Akechi et al., (2010)	Investigate usefulness of delirium screening training program to nurses' self-confidence in delirium care.	Quasi-experimental Pre/Posttest design Two-step training program. Measurement: 15 item self-report measure on self-confidence-Likert scale (1-10; ranging from "not at all confident" to "extremely confident"), author-developed.	RNs (n = 390/33) Japanese university-affiliated 808 bed hospital Demographics: (subjects/control): Mean age: 29/28 Experience(yrs.): 7.3/7.1 Education: Jr. College (40%/36%) University (35%/33%)	Pretest: Mean confidence scores 42.1 (intervention) vs. 38.9 (control) ($p > .15$) Posttest: Intervention mean score of 42.1 to 57.4 ($p = .001$) No statistically significant change for control group (38.9 to 40.8)
Baker, Taggart, Nivens, & Tillman (2015)	1. Assess nurses' knowledge of delirium & risk factors & correlate demographics. 2. Evaluate nurses' self-perception of competency with delirium recognition and management.	Descriptive Measure: Nurses' Knowledge of Delirium 36-item questionnaire (Hare et al, 2008).	RNs (n = 59) University-affiliated hospital in US Southeast Demographics: Female:83% Education: BSN: 56.7% ADN: 30% MSN: 10% Diploma: 3.3% Experience (yrs.) ≥20: 23.3% 4-7: 33% < 3: 15% Setting: Med-surg floor: 58.3% Critical care: 33.3% Surgical: 3.3% Rehab/primary	40% completion rate Average score: 64.2% 20% of respondents scored ≥ 75% Specific delirium knowledge (22 questions): Average 15.32 (42.6%) 35% scored ≥ 75% Specific delirium risk factor knowledge (14 questions): Average: 7.78 (21.6%) 10% scored ≥ 75% No correlation between demographic groups. Competency perceptions: Advanced: 1.7% Above average: 15% Average: 55%

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
			care: 3.3% PACU: 1.7%	Minimal: 18.3% No competence: 10%
Bowen, Stanton, & Manno (2012)	Use of Rogers' Diffusion of Innovations Theory to facilitate adoption of a practice change	Descriptive Case Study Implementation of CAM-ICU education program over 8 week period: Measured compliance of CAM-ICU assessments performed and correlation of expert and nurse assessments.	RNs in a 9-bed MICU and 6 bed SICU (n = 34) University Hospital in New Jersey No demographics included	85% of expected CAM-ICU screenings performed (exceeded 80% benchmark). Interrater reliability by on 14% of assessment performed, (r = .97, p < .0001).
Elliott (2014)	Assess nurses' and physicians' knowledge & understanding of ICU delirium & screening tools. Assess current delirium screening tools in use & perceived barriers of the tools.	Descriptive-prospective, cross-sectional Author-developed survey used (pilot-tested and validated by test-retest methodology). Open and closed-ended question format.	Nurses and physicians (n = 76, 52 nurses/24 physicians) in 3 district general hospitals in Scotland, each with 5 ICU beds. Demographics: RNs: Experience level: >10 years: 47% 6-10 years: 26% 1-5 years: 24% < 1 year: 4% Physicians experience level: >10 years: 38% 6-10 years: 12% 1-5 years: 25% < 1 year: 25% Hospitals A/B/C responses: A: 30.3% B: 31.6% C: 38.3%	Overall response rate: 51% (68% nursing staff/32% medical staff) 44% of the respondents reported no prior training on ICU delirium. For those receiving education, methods reported: Bedside: 42% Tutorials: 18% Knowledge: High level MD 79%/RN 67% Medium level knowledge: Risk factors 67% Complications from delirium: 50% Barriers to screening: 18% identified as time-consuming (60% MD/40%RN)

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
Flagg et al., (2010)	Describe nurses' ability to recognize delirium, nurses' knowledge of aspects of delirium, and confidence in identifying delirium	Descriptive Cross-sectional Measurement: Barriers to Delirium Assessment (author-created 25 question survey) 3 sub-scales with Cronbach α for internal consistency & reliability:	Convenience sample of nurses (n = 61) 2 Midwestern small community hospitals 280/350 beds Demographics: Experience (yrs.): < 5: 38% >10: 52% Education: ADN prepared: 44% BSN prepared: 28% Diploma: 10% MSN 18%	79% stated delirium common problem 90% identified hyperactive delirium symptoms 77% identified hypoactive delirium symptoms Mean confidence scores on 1-5 point scale (1-not at all confident; 5 extremely confident): To identify delirium: 3.32 (SD 0.76) To manage delirium: 3.42 (SD 0.80) To explain delirium to patients' family: 3.25 (SD 0.87)
Gesin et al., (2012)	Evaluate impact of multifaceted educational intervention on nurses' knowledge & ability to correctly evaluate delirium	Quasi-experimental Phased multi-faceted educational program:	Convenience sample of nurses (n = 20, 1 lost to follow-up) Patients(n = 73) 29-bed STICU/813-bed community teaching hospital in Charlotte, NC. Demographics: Mean age: 33.8 (SD, 8.7) Length of employment in STICU: 6.7 (SD, 4.4) years BSN prepared: 63% CCRN certified: 53% Patients: Mean age: 55 (SD, 18) 63% male APACHE II score	90 paired assessments/73 patients. Phase 1: 32 assessments Phase 2: 32 assessments Phase 3: 26 assessments Agreement measure with κ statistic. Phase 1: fair (69% agreement) (κ = .40; 95% CI [0.11, 0.69]) Phase 2: substantial (81% agreement) (κ = .62; 95% CI [0.39, 0.69]) Phase 3: substantial (88% agreement) (κ = .74; 95% CI [0.69, 0.95]) Nurses' knowledge (10 point score) Phase 1: mean score 6.1 (SD 1.4) Phase 2: 6.5 (SD 1.4) Phase 3: 8.2 (SD 1.4) Phases 1 and 2 compared: $p = .08$

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
			on admission: Mean 16.5 (SD, 7.7) Mechanically vented: 55% Hospital service: Trauma: 39% (30% with TBI) General surgery: 25% Transplant: 14%	Phase 3 compared to 1 and 2: $p = .001$
Meako, Thompson, & Cochrane (2011)	Describe specialty practice RNs baseline knowledge about delirium, test the effectiveness of educational intervention, & describe factors associated with differences.	Quasi-experimental Pre/Posttest design Lecture format 50 minute in-service Geriatric Nursing Education Consortium presented over 2 days. Measurement: 10 multiple choice questions with order rearranged for posttest.	Orthopedic RNs on 39 bed unit (n = 21) Demographics: Educational preparation: Diploma: 14% ADN: 33% BSN: 52% Experience (years): 0-2: 19% 2+ -10: 29% 10+: 52%	Pretest mean score: 5.42 (SD 1.20) Posttest mean score: 8.9 (SD 1.01) $p = .0005$ Ad hoc analysis indicated RNs with 0-2 years of experience had largest changes in mean scores: 3.47 (SD 1.5) for other experience levels vs. 5.0 (SD 1.82), (df = 2, F 3.92, $p = .039$).
Ramaswamy et al., (2010)	Determine change in clinician behavior by improving delirium knowledge & confidence through implementing a comprehensive sequential intervention (CSI).	Quasi-experimental Pre/Posttest design 2-day CSI consisting of 4-part didactic series with small group sessions and practical case conference.	RNs/physicians, Trainees, and allied healthcare providers (i.e., pharmacists, lab technicians, therapists) (n = 50 matched pairs of responses). Average attendance at CSI: 71 305 bed community hospital with university affiliation Demographics of matched pairs: MD: 12%	50 matched pairs divided into cohorts. Cohort 1 attended 1 didactic session, cohort 2 attended 2 or more sessions. Mean pretest score: 7.9 (SD 2.6) Mean posttest score: 10.8 (SD 3.0) Mean change in score: 2.9 ($p < .001$) Confidence pre-intervention 52% Confidence post-intervention 80% $p < .001$ Cohort 1: Mean pretest: 9 (SD 2.9) Mean posttest: 10.3 (SD 2.2) Mean change in score

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
			RN: 68% Other: 20%	1.3, p < .12 Confidence before: 50% After: 72% (*p* < .22) Cohort 2: Mean pretest: 7.3 (SD 2.5) Mean posttest: 11.1 (SD 3.7) Mean change in score: 3.8 (*p* < .001) Confidence before: 53% Confidence after: 84% (*p* < .002)
Scott, McIlveney, & Mallice (2012)	Evaluate the feasibility and effectiveness of the CAM-ICU delirium screening tool in a critical care unit measured by pre/post education surveys.	Quasi-experimental Pre/Posttest of previously studied questionnaire on delirium assessment practice & current knowledge Educational intervention: ½ hour group teaching sessions conducted over 4 week period. Posttests conducted 3 months later.	RNs (pre: n = 72, post n = 47) General district hospital in Scotland, Medical surgical ICU. Demographics: Predominantly female respondents (84.7%/85.1%) Experience (yrs.): >15: 19.4%/19.1% 11-15: 13.9%/17.1% 6-10: 23.6%/34% 0-5: 43.1%/29.7% Pre-group: 98% reported no previous delirium education	Response rates: 92% vs. 60% Responses reported: Understand what it is: 77.8% vs. 91.5% Underdiagnoses problem: 90.3% vs. 95.8% Delirium common response to ICU/hospital: 81.9% vs. 91.4% Higher mortality: 47.2% vs. 76.6% Prolonged mechanical ventilation: 59.7% vs. 65.9% Challenging to assess in ICU: 77.8% vs. 80.8%
Swan (2014)	Compare the incidence of inappropriate CAM-ICU scores of UTA before and after educational campaign	Quasi-experimental Primary outcome: Proportion of patients' receiving inappropriate UTA CAM-ICU ratings before and after educational intervention.	SICU patients 24-bed unit at Houston Memorial Hospital Pre-intervention cohort (n = 93 patients/423 CAM-ICU ratings) Post-intervention	Patients 41% less likely to have inappropriate CAM-ICU UTA after intervention. 32% versus 19% (*p* = .03) Mechanically ventilated patients had majority of inappropriate UTA ratings which decreased

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
		Educational campaign designed by clinical pharmacist & taught by 3 nurse educators.	cohort (n = 96 patients/678 CAM-ICU ratings) Demographics: Mean age: 62 vs 64 Male: 46% vs. 52% Mechanically ventilated: 40% vs. 35%	by 37% post intervention, 70% vs. 44% ($p < .001$).
Varghese et al., (2014)	Evaluate the effectiveness of educational program on the identification & management of delirium.	Quasi-experimental Pre/Posttest questionnaire of 27 questions. Content validity index questionnaire and practice checklist: 0.92 per 3 expert reviewers.	RNs Intervention group (n = 15) Control group (n = 17) South India 2700 bed tertiary care hospital 2 Medical Wards RN demographics: (no statistically significant differences between 2 groups)	No statistically significant differences between groups pre-intervention: Knowledge ($p = .134$) Practice ($p = .664$). Mean knowledge scores: Intervention group: 14.27 vs. 20 ($p < .001$) Cohort: 12.41 vs. 14 ($p = .292$) Mean practice scores: Intervention group: 18.28 vs. 37.63 ($p = .003$) Cohort: 19.58 vs. 28.33 ($p = .079$)
Gordon et al., (2013)	Increase neuroscience nurses' knowledge of delirium, integrate coaching into evidence-based practice, & evaluate the effectiveness of combination approach to improve nurses' recognition of	QI project with quasi-experimental design Comparison of pre-intervention practice and documentation (retrospective chart review). Measurement: Modified version of Fremantle Hospital and Health service Nurses' knowledge of Delirium tool (Hare	RNs (n = 47) Patients' charts retrospective review (n = 25) Academic medical center in Massachusetts Demographics: Experience (yrs.): >20: 11.1% 11-20: 29.6% 6-10: 14.8%	Pretest mean score: 17.7(SD 8.2) Posttest: 20.7 (SD 4.9), $p = .1366$ Delirium screening conducted: Pre: 0 Post: 92% ($p = .000$) Bedside coaching data: Patients assessed: 71 Coach-RN agreement with assessment: 94.4%

Author (Year)	Purpose	Study Design/ Methods	Subjects/Setting	Pertinent Findings
	delirium	et. al. 2008). Education sessions of 30-40 minutes in small groups of 2-4.	3-5: 29.6% 2 or less: 14.8% Education: Diploma: 7.4% ADN: 18.5% BSN: 70.4% MSN 3.7%	
Layne et al., (2015)	Identify patients at risk for delirium & prevent onset, recognize delirium earlier in onset & implement evidence-based delirium prevention protocol.	QI project pre/posttest design Observational measurements via participatory observations. Before and after educational intervention.	RNs (number not provided) 10 Patients CAM-ICU negative/10 patients CAM-ICU positive Southern California 140 bed tertiary care hospital in 40 bed medical-surgical unit.	Testing delineated into 7 categories: Assessment for delirium: 46% vs. 98%** Risks of delirium: 45% vs. 89%** Types of delirium: 74% vs 94%* CAM criteria: 34% vs. 88%** Medications: 52% vs. 91%** Interventions: 55% vs. 100%** Physiologic causes of delirium: 60% vs 100% ** *p = .01, **p = .001 Compliance rates for adherence to protocol in CAM negative patients: 90-100% except for educational brochure provided-20%, education documented 20% Compliance rates for adherence for CAM positive patients: Brochure and documentation: 10% and 20% Collaboration with pharmacist: 20%

Table 2

Demographics of Nurses Participating in Delirium Refresh Educational Intervention

Characteristic	*n* = 34	%
Age Range		
20-30	19	55.9
31-40	6	17.6
41-50	4	11.8
51-60	4	11.8
61+	1	2.9
Gender		
Female	32	94.1
Male	2	5.9
Clinical Ladder Level		
Clinician 2	24	70.6
Clinician 3	2	5.9
Clinician 4	5	14.7
APN 2	3	8.8
Years of Nursing Experience		
1-5	20	58.8
6-10	4	11.8
11-15	3	8.8
16-20	1	2.9
21+	6	17.6
Years at Health System		
1-5	24	70.6
6-10	2	5.9
16-20	2	5.9
21+	6	17.6
Years in MICU		
1-5	26	76.5
6-10	4	11.8
11-15	1	2.9
16-20	1	2.9
21+	2	5.9
Educational Preparation		
Diploma	1	2.9
Associate Degree	2	5.9
BSN	19	55.9
MSN	12	35.3

Note. BSN = Bachelor of Science in Nursing; MSN = Masters of Science in Nursing

Table 3

Paired t-test Results of Pre and Post Assessment Scores on the Nurses' Delirium Knowledge Assessment (n = 34)

Nurses Delirium Knowledge Assessment Scores	*M (SD)* Pre	*M (SD)* Post	Score Ranges Pre	Score Ranges Post	*M difference (SD)*	*p value*	CI (95%)
Overall	.76 (*.07*)	.80 (*.07*)	.58-.86	.67-.94	.047 (*.09*)	< .001	0.02-0.07
Knowledge sub-scale	.89 (*.09*)	.97 (*.05*)	.67-1.0	.80-1.0	.080 (*.09*)	< .001	0.05-0.11
Knowledge of tools and scales sub-scale score	.81 (*.10*)	.81 (*.14*)	.57-1.0	.43-1.0	.004 (*.15*)	.872	-0.05-0.06
Risk sub-scale score	.59 (*.13*)	.62 (.11)	.36-.86	.43- .86	.032 (*.11*)	.100	-0.01-0.07

Table 4

Comparison of Demographic Variables of Years of Nursing Experience and Educational Preparation to Pre and Post Assessment Scores on the Nurses' Delirium Knowledge Assessment

	Nurses' Delirium Knowledge Assessment Scores (n=34)															
	Overall				Knowledge sub-scale				Knowledge of tools/scales sub-scale				Risk sub-scale			
Demographic	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*
	Pre	Post			Pre	Post			Pre	Post			Pre	Post		
Yrs. of experience																
1-5 (*n* = 20)	.765	.811	.046		.893	.973	.080		.836	.836	.000		.593	.625	.032	
6-15 (*n = 7*)	.78	.80	.020	.534 *	.924	.962	.038	.284 *	.755	.755	.000	.889 *	.633	.643	.010	.699 *
≥ 16 (*n = 7*)	.710	.786	.075		.838	.962	.124		.776	.796	.020		.541	.592	.051	
Educational Preparation																
Diploma/ADN (*n = 3)*	Excluded from analysis															
BSN (*n* = 19)	.753 (.075)	.807 (.060)	.054	.708 **	.888 (.094)	.979 (.039)	.091	.484 +	.797 (.099)	.805 (.152)	.008	.897 **	.586 (.155)	.624 (.101)	.038	.964 **
MSN (*n* = 12)	.771 (.061)	.815 (.078)	.044		.894 (.104)	.967 (.045)	.072		.833 (.082)	.833 (.134)	.000		.607 (.089)	.643 (.122)	.036	

Note: *Kruskal-Wallis *H*-statistic. **Independent *t*-statistic. +Mann-Whitney *U*-statistic

Table 5

Proportion of Correct Responses of Knowledge of Tools and Scales to Detect Delirium, Dementia, and Depression from the Nurses' Delirium Knowledge Assessment

Tool or Scale Questions	Pre-intervention (%)	Post-Intervention (%)
Mini Mental Status Exam	8.8	32.4
Glasgow Coma Scale	94.1	88.2
Delirium Rating Scale	94.1	94.1
CIWA (Alcohol Withdrawal Scale)	85.3	79.4
Confusion Assessment Method	91.2	85.3
Beck's Depression Inventory	91.2	88.2
Braden	100	100

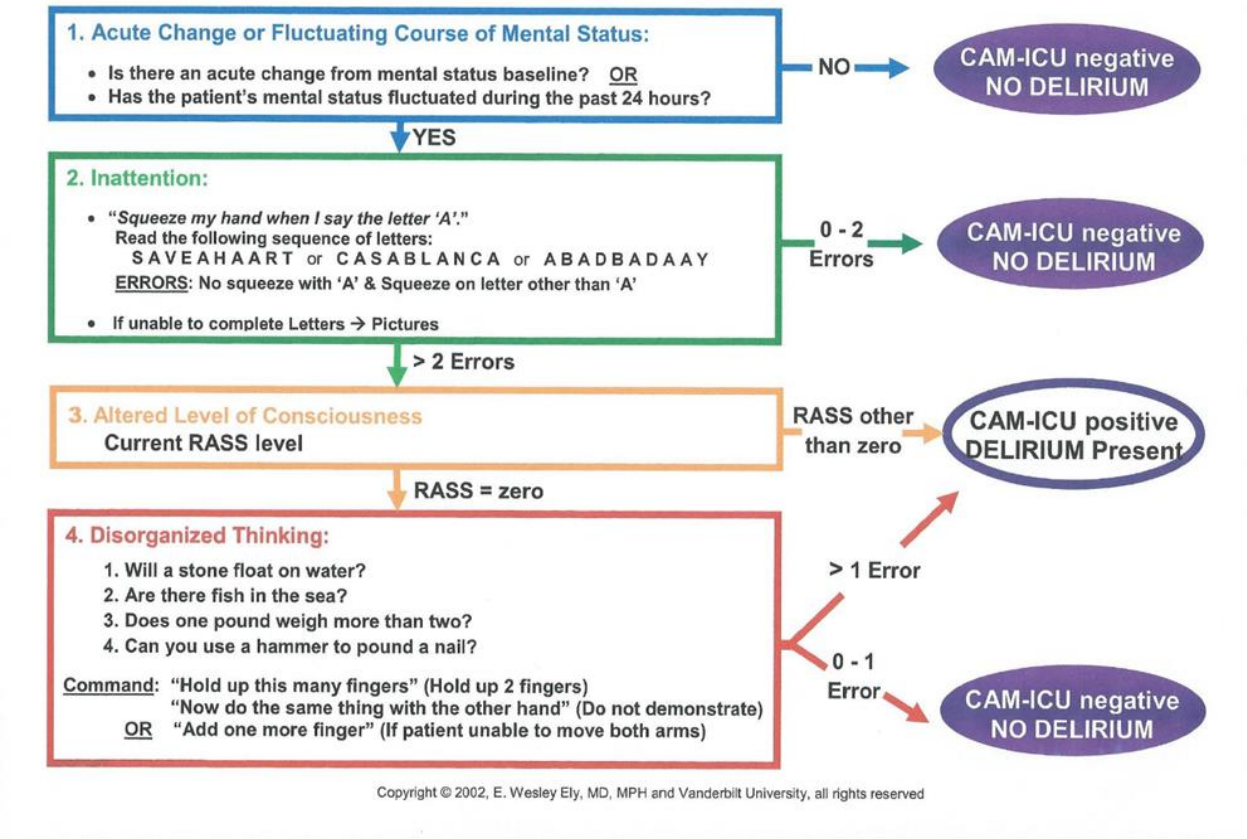


Figure 1. CAM-ICU Algorithm for delirium screening. Used with permission from www.icudelirium.org.

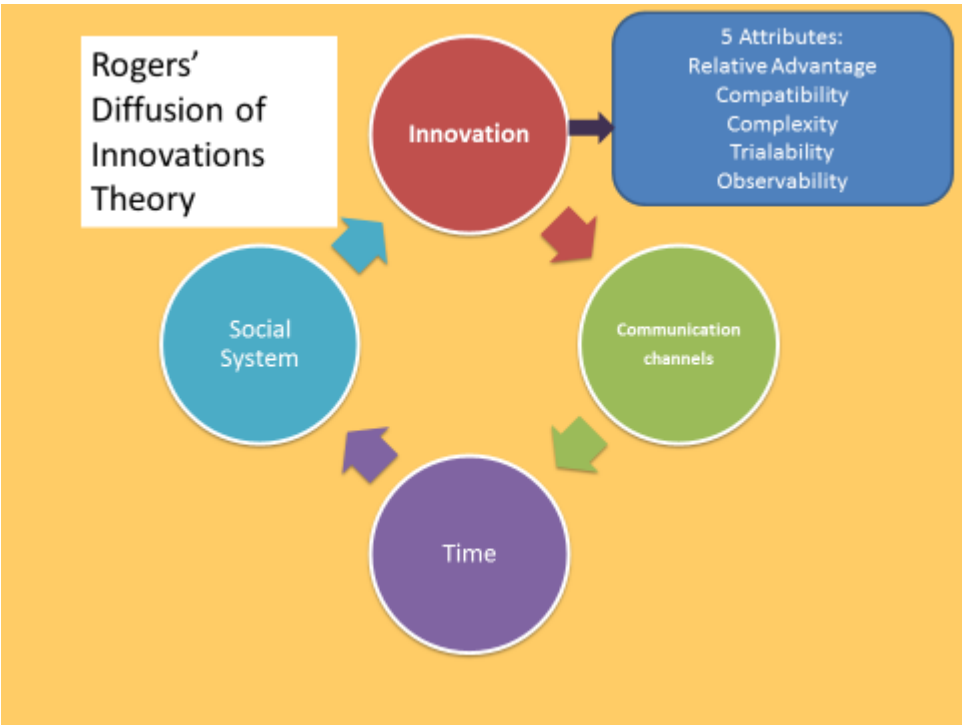


Figure 2. Rogers' Theory of Diffusion of Innovations
Created from: Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.

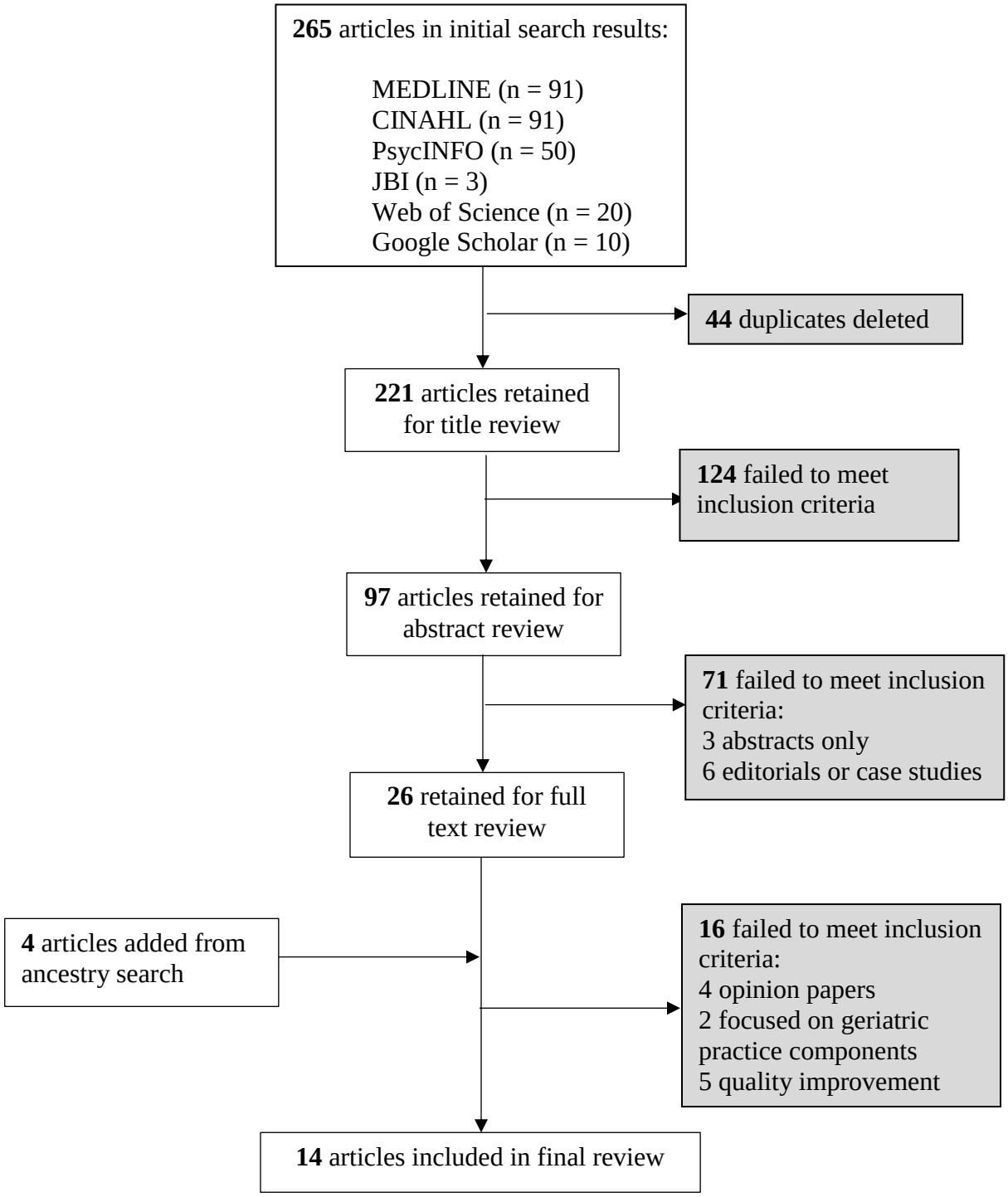


Figure 3. Integrative literature review database search strategy

Nurses' Delirium Knowledge Assessment Survey

IRB #_____ Survey #_____

Training session time and date: _____

The purpose of this questionnaire is to assess your knowledge regarding delirium. Your answers will remain confidential.

Please complete the questionnaire on your own. Please answer all questions.

SECTION 1: Demographic Data

Please circle the correct response

1**.1. Your Age (Years):**

A. 20-30 B. 31-40 C. 41-50 D. 51-60 E. 61+

1.2. Gender

A. Female B. Male

1.3. Clinical Ladder Level

A. Clinician II B. Clinician III C. Clinician IV D. APN-1 E. APN-2

1.4. Years of Nursing experience

A. 1-5 B. 6-10 C. 11-15 D. 16-20 E. 21+

1.5. Years at UVA Health System

A. 1-5 B. 6-10 C. 11-15 D. 16-20 E. 21+

1.6. Years in MICU

A. 1-5 B. 6-10 C. 11-15 D. 16-20 E. 21+

1.7. Educational preparation

A. Diploma B. ADN C. BSN D. MSN E. Doctorate

1.8. Amount of delirium recognition/screening education

A. none B. small amount C. moderate amount D. large amount

SECTION 2: Knowledge of Delirium

Please circle the best response

Definition of delirium

2.1 Which of the following groups of symptoms best describe or define delirium?

A. Amnesic, drowsy, sudden onset of incontinence, uncontrolled salivation, disorganized thinking
B. Acute confusion, fluctuating mental state, disorganized thinking, altered level of consciousness.
C. Anxiety, diaphoresis, trembling, muscle weakness, dysphasia, altered arousal level.
D. Slow onset of confusion, memory loss, disorientation, lack of spontaneity, and change in personality.

Identifying Delirium

The following rating scales/tools are commonly used to detect certain conditions. Match the tool to the most appropriate condition(s). Note that "None of these" may be the best answer. **You may choose more than one condition for each tool.**
Please fill in the circle.

	Delirium	Dementia	Depression	None of these
2.2 Mini Mental State Examination (MMSE)	O	O	O	O
2.3 Glasgow Coma Scale (GCS)	O	O	O	O
2.4 Delirium Rating Scale (DRS)	O	O	O	O
2.5 Alcohol Withdrawal Scale (CIWA)	O	O	O	O
2.6 Confusion Assessment Method (CAM)	O	O	O	O
2.7 Beck's Depression Inventory	O	O	O	O
2.8 Braden Scale	O	O	O	O

Please fill in the circle to indicate the correct answer for each of the following questions.

	Agree	Disagree	Unsure
2.9 Fluctuation between orientation and disorientation is not typical of delirium.	O	O	O
2.10 Symptoms of depression may mimic delirium.	O	O	O
2.11 Treatment for delirium always includes sedation.	O	O	O
2.12 Patients never remember episodes of delirium.	O	O	O

		Agree	Disagree	Unsure
2.13	A Mini Mental Status Examination (MMSE) is the best way to diagnose delirium.	O	O	O
2.14	A patient having a repair of a femur neck fracture has the same risk for delirium as a patient having an elective hip replacement.	O	O	O
2.15	Delirium never lasts for more than a few hours.	O	O	O
2.16	The risk for delirium increases with age.	O	O	O
2.17	A patient with impaired vision is at increased risk of delirium.	O	O	O
2.18	The greater the number of medications a patient is taking, the greater their risk of delirium.	O	O	O
2.19	A urinary catheter in place reduces the risk of delirium.	O	O	O
2.20	Gender has no effect on the development of delirium	O	O	O
2.21	Poor nutrition increases the risk of delirium.	O	O	O
2.22	Dementia is the greatest risk factor for delirium.	O	O	O
2.23	Males are more at risk for delirium than females.	O	O	O
2.24	Diabetes is a high risk factor for delirium.	O	O	O
2.25	Dehydration can be a risk factor for delirium.	O	O	O
2.26	Hearing impairment increases the risk of delirium.	O	O	O
2.27	Obesity is a risk factor for delirium.	O	O	O
2.28	A patient who is lethargic and difficult to arouse does not have a delirium.	O	O	O
2.29	Patients with delirium are always physically and/or verbally aggressive.	O	O	O
2.30	Delirium is generally caused by alcohol withdrawal.	O	O	O
2.31	Patients with delirium have a higher mortality rate.	O	O	O
2.32	A family history of dementia predisposes a patient to delirium.	O	O	O
2.33	Behavioral changes in the course of the day are typical of delirium.	O	O	O
2.34	A patient with delirium is likely to be easily distracted and/or have difficulty following a conversation.	O	O	O
2.35	Patients with delirium will often experience perceptual disturbances.	O	O	O
2.36	Altered sleep/wake cycle may be a symptom of delirium.	O	O	O

Adapted and used by permission from Mr. Malcolm Hare
Fremantle Hospital & Health Service
Curtin University of Technology
Perth WA Australia

Figure 4. Nurses' Delirium Knowledge Assessment Measure

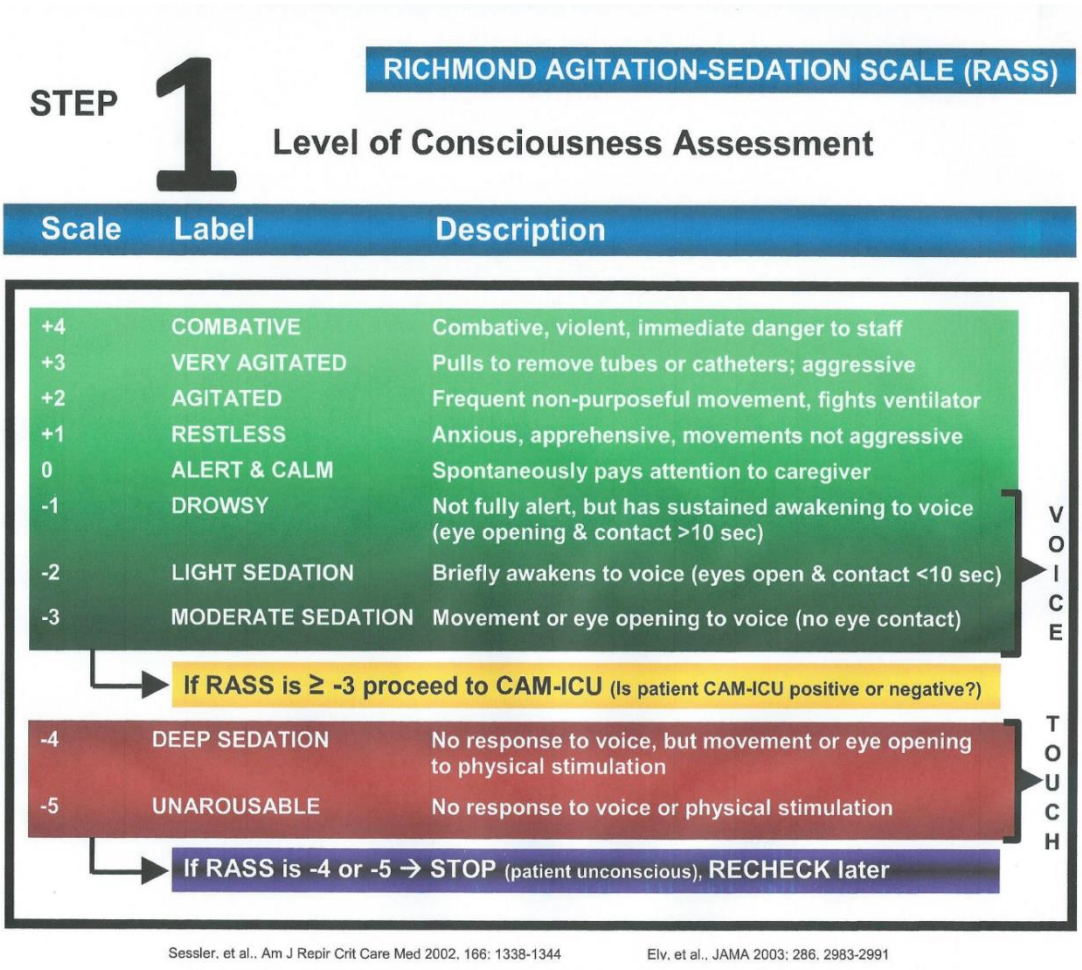


Figure 5. Richmond Agitation Sedation Score chart. Used with permission from www.icudelirium.org.

From: <slm6q@virginia.edu>
Date: June 16, 2016 at 10:01:45 AM EDT
To: <cms5q@hscmail.mcc.virginia.edu>, <rmd3e@virginia.edu>
Cc: <slm6q@virginia.edu>
Subject: Pertaining to SBS Number 2016022800

In reply, please refer to: Project # 2016-0228-00

June 15, 2016

Cheri Blevins
Regina DeGennaro
Nursing Research
PO Box 801456

Dear Cheri Blevins and Regina DeGennaro:

The Institutional Review Board for the Social and Behavioral Sciences has approved your research project entitled "An Educational Intervention to Improve Delirium Recognition by Nurses." You may proceed with this study. The stamped Informed Consent Agreement will be sent to you via Messenger Mail.

This project # 2016-0228-00 has been approved for the period June 14, 2016 to June 13, 2017. If the study continues beyond the approval period, you will need to submit a continuation request to the Review Board. If you make changes in the study, you will need to notify the Board of the changes.

Sincerely,

Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences

Figure 6. IRB approval notification

UNIVERSITY of VIRGINIA HEALTH SYSTEM

The MEDICAL INTENSIVE CARE UNIT

February 29, 2016

Cheri Blevins, MSN, RN, CCRN, CCNS
Medical ICU
UVA Health System

Cheri,

This letter represents permission given to you to conduct your DNP scholarly project on improving delirium recognition by nurses in the Medical ICU. Please let us know how we can be of further assistance.

R. M. Carpenter, MSN, RN
Manager, Medical ICU

Kyle Enfield, MD, MS
Medical Director, MICU

P.O. Box 801456 • Charlottesville, VA 22908-1456
Office: 434-924-2409 • Fax: 434-243-6527

Figure 7. Permission to perform project in Medical ICU

From:	Hare, Malcolm <Malcolm.Hare@health.wa.gov.au>
Sent:	Sunday, February 21, 2016 8:04 PM
To:	Blevins, Cheri S. *HS
Cc:	Wynaden, Dianne
Subject:	RE: Delirium Knowledge questionnaire request

Hi Cheri

Thanks for your enquiry.

I'm very happy for you to use the questionnaire. Please acknowledge myself, Fremantle Hospital and Curtin University of Technology. At the end of your study, I would also like to be advised of how you used the questionnaire and your results please.

I've attached two versions of the questionnaire - one has the correct answers highlighted. The documents are in Word 2003 format. The questionnaire was set up to be optically scanned using Remark Office(tm) but you may reformat to whatever suits your needs. On the first page, the fields for filling in require a font (OMR Bubbles) which I've also attached - the fields will appear as odd graphics without the font installed. You could just place capital O's there in Arial font.

You will need to adjust the demographics page anyway, but I'm happy for you to modify it however you need.

When the completed questionnaires were scanned into Remark Office (and then exported to SPSS), the answers were coded as "correct" or "incorrect" or "unsure" for questions 2.9 on. I didn't use an overall score for the whole questionnaire, but dealt with question 2.1 (definition of delirium), questions 2.2 through 2.8 (tools for identifying delirium) and questions 2.9 on (delirium presentation and risk factors) as separate sections - you may find that another method works better for you. Question 2.8 may need adapting depending on what Pressure Injury Risk Assessment tool(s) is/are used locally - eg replace Braden with Norton.
In that last group of questions (2.9 on) are a mixture of general statements and risk factor statements, and those I added and scored separately. In the Answers version of the document, the general questions are highlighted in yellow, and the risk factor questions are un-highlighted (there are 14 of each).

Bear in mind that the questionnaire was designed for use across multiple wards of differing specialties. You may find that you need to modify it significantly if you are looking exclusively at critical care nurses. The easiest and safest way to do this would be to remove questions that may not be relevant. Changing or adding questions requires careful thought and literature search.

Since publication of the article in Contemporary nurse, most of the users of the questionnaire have been post-graduate nursing and medical students. In some cases they have not yet provided results, and in some instances their reporting has been through their academic work and poster presentations at conferences (and hence unpublished).

The questionnaire is in use in various countries around the world (19 countries at last count, and 27 places in the US, and translated into 11 languages other than English) and I have invited some of the users to consider a validation study, but have not heard yet of progress in that direction except for some work done in Western Australia by Prof Christine Toye. Chris tells me she "used the Kuder-Richardson Formula 20 (KR-20) to determine internal consistency reliability co-efficient for the two main sub-sections (3a and 3b) of the knowledge questionnaire at Time 1 (T1). After combining incorrect and unsure responses so that the two options were correct versus incorrect, the Kuder-Richardson internal consistency reliability coefficient for Section 3a of the questionnaire was 0.66 (n=26) and for Section 3b
it was 0.80 (n=25)" (Personal communication).

If you have any further questions or need for clarification please feel free to email me again. Best wishes for your study!

Kind regards

Malcolm Hare | Coordinator Compliance Monitoring and Clinical Audit Analyst | Service 3 | Royal Perth
Group South Metropolitan Health Service Level G, E Block, 18 - 56 MillS Street, BENTLEY WA 6102
T: (08) 9416 3618
E: Malcolm.Hare@health.wa.gov.au

Figure 8. Permission for use of the Nurses' Delirium Knowledge Assessment survey

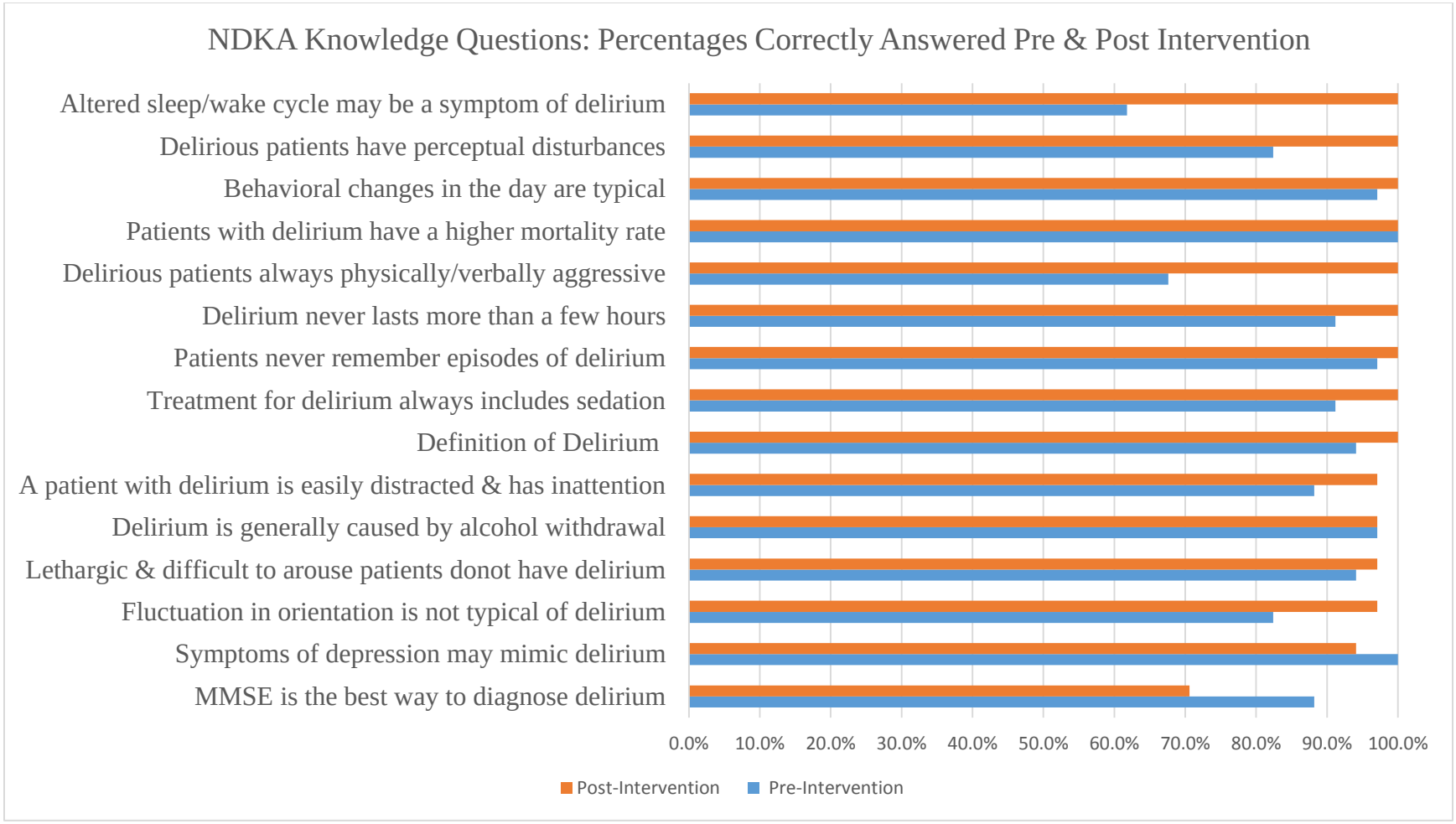


Figure 9. NDKA knowledge questions: percentages correctly answered pre and post intervention

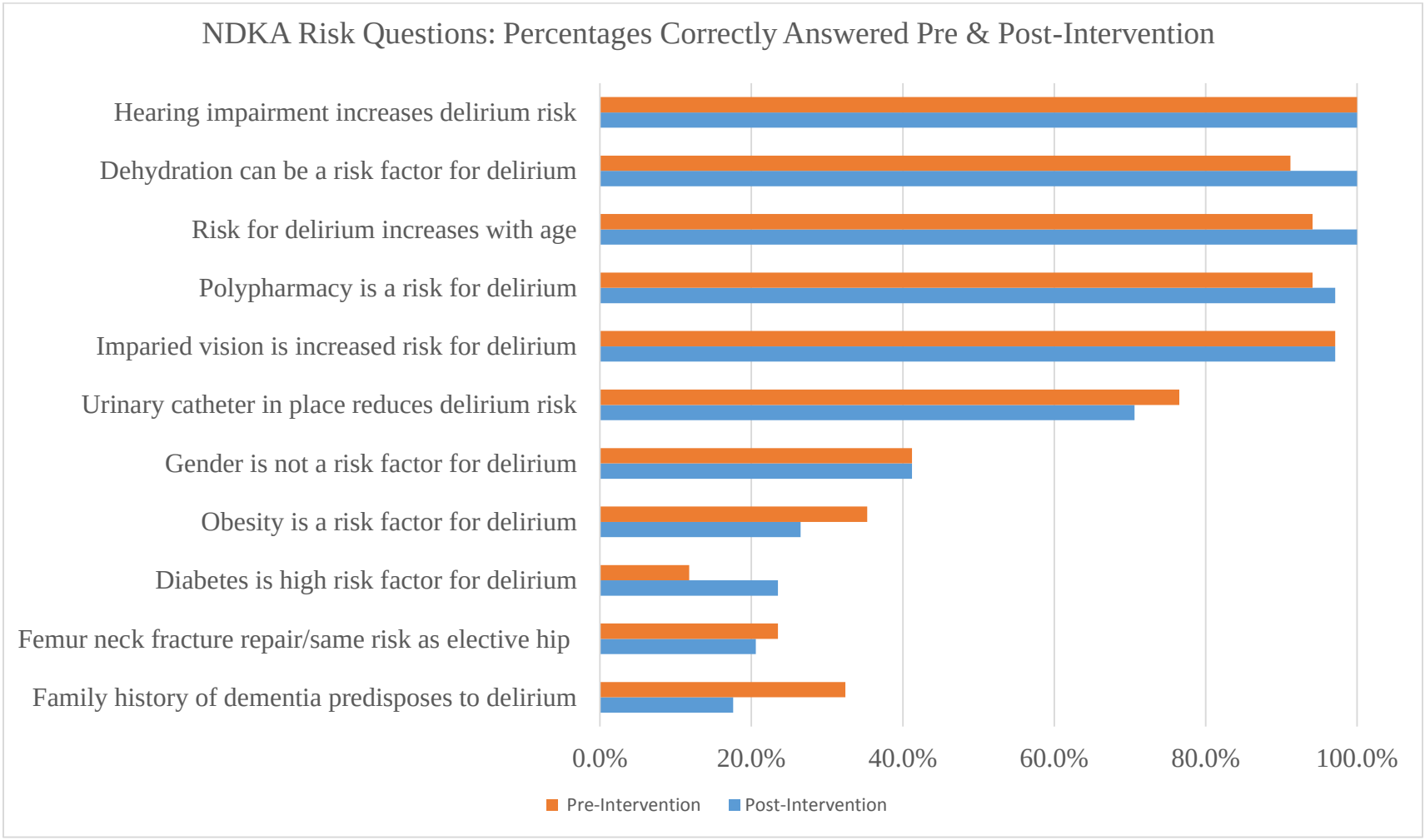


Figure 10. NDKA risk questions: percentages correctly answered pre and post intervention

Appendix A

Proposed IRB Consent Form for Participants in Study

Educational Intervention to Improve Delirium Recognition by Nurses
IRB #_____

Proposed Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study.

Purpose of the research study: The purpose of the project is to evaluate the effectiveness of an educational intervention for medical ICU nurses to improve their knowledge and skills regarding delirium and delirium recognition. The educational intervention will be a multimodal approach to include didactic method, case-study analyses, and bedside instruction and observation.

What you will do in the study: You will be asked to complete 2 knowledge assessment surveys one immediately before and one immediately after attending a one hour educational program on delirium and delirium recognition. You will be asked to perform a bedside delirium screening with the APN investigator observing during the bedside instruction portion of the program.

Time required: The study will require about 1 1/2 hours of your time.

Risks: There are no anticipated risks in this study.

Benefits: There are no direct benefits to you for participating in this research study. The study may help us understand the effectiveness of a multi-modal educational program to improve knowledge of delirium and delirium recognition and improve skill in accurately performing delirium screenings.

Confidentiality: The information that you give in the study will be handled confidentially. Your data will be anonymous which means that your name will not be collected or linked to the data. If it is possible for you (the researcher) to deduce the participant's identity, state the following: Because of the nature of the data, it may be possible to deduce your identity; however, there will be no attempt to do so and your data will be reported in a way that will not identify you.

Voluntary participation: Your participation in the study is completely voluntary.

Right to withdraw from the study: You have the right to withdraw from the study at any time without penalty.

How to withdraw from the study: In order to withdraw you can discard the surveys without returning or elect to not attend the educational intervention. Please note that once the survey has been returned it will be impossible to withdraw due to the survey being anonymous.).

Payment: You will receive no payment for participating in the study.

If you have questions about the study, contact:
Cheri S. Blevins MSN RN CCRN CCNS
MICU
PO Box 801456
University of Virginia, Charlottesville, VA 22903.
Telephone: (434)760-4046
cms5q@virginia.edu

Faculty Advisor: Gina DeGennaro DNP RN CNS OACN CNL
Associate ProfessorAssistant Department Chair, Acute and Specialty Care
University of Virginia School of Nursing
Claude Moore Nursing Educational Building
225 JeannetteLancaster Way, Box 800826
Charlottesville, VA 22908-0826
Ph: 434.924. 0116
rmd3e@virginia.edu

If you have questions about your rights in the study, contact:
Tonya R. Moon, Ph.D.
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr. Suite 500
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vpr/irb/sbs

Agreement:
I agree to participate in the research study described above.

Signature: _____ Date: _____

You will receive a copy of this form for your records.

IRB-SBS Office Use Only		
Protocol #		
Approved	from:	to:
SBS Staff		

Appendix B

Delirium Refresh Education Training Outline

I. Delirium Survivor Video (10 minutes)

II. Didactic (30 minutes)

- a. Objectives
- b. Delirium definition
- c. Delirium facts and figures
- d. Outcomes
- e. Signs and symptoms
- f. Motoric sub-types
- g. Risk Factors
  - i. Delirium superimposed on Dementia
- h. Delirium detection: CAM-ICU
  - i. Description
  - ii. Performance
- i. Delirium documentation in EMR

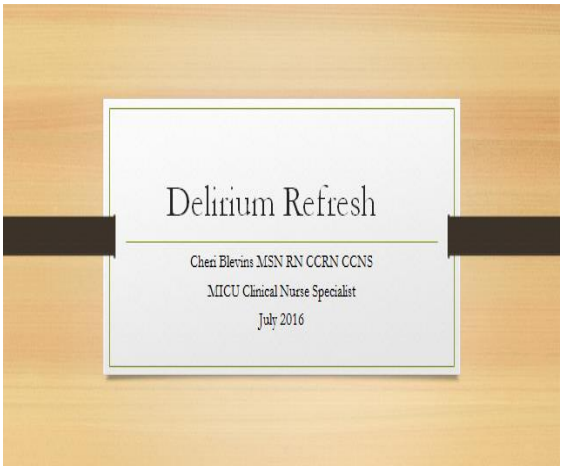
III. Case Studies (20 minutes)

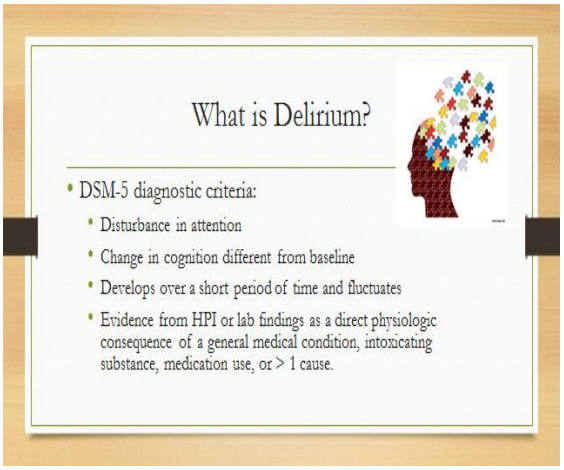
- a. Mechanically ventilated patient scenario
- b. Hepatic encephalopathy scenario

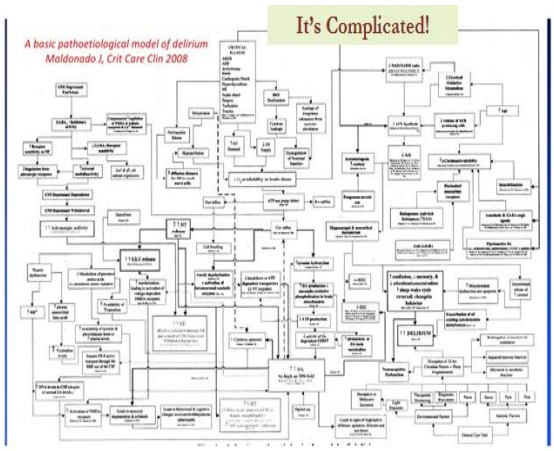
IV. Bedside assessments of MICU patients (15 minutes)

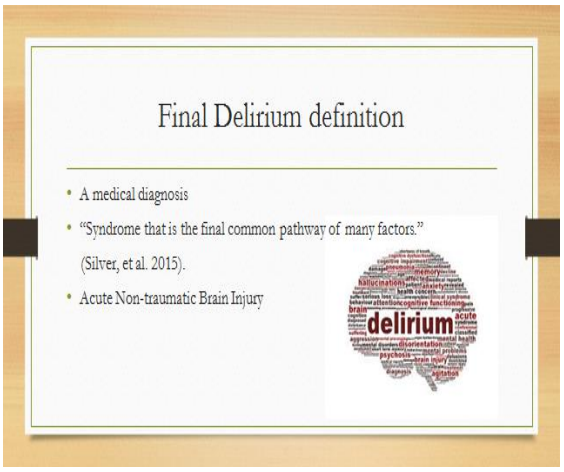
Appendix C

Delirium Refresh Educational Program









Delirium Facts and Figures

- 7 million hospitalized Americans experience delirium every year
- >60% of patients with delirium **ARE NOT** recognized by healthcare professionals/systems
- Reported rates of delirium incidence in adults range from 14-80%
- Rates of delirium for end-of-life patients: up to 88%
- Comparison between non-delirious and delirious patients (adjusting for age, gender, race, & co-morbidities):
  - Higher mortality at 1 month(5% vs 14%), 6 months (11% vs. 22%), & 23 months (28% vs. 38%)
  - Higher probability of developing dementia at 48 months (8% vs. 63%)

Data from www.americandeliriumsociety.org

Outcomes: Short Term

- Days of mechanical ventilation increased
- Increased accidental tube/catheter removals
- Increased days for central lines, indwelling catheters = increased infection rates
- ↑ LOS-ICU, ↑LOS-hospital, ↑ Mortality Rate

Table 3
Differences between non-delirium and delirium patients on short-term consequences.

	Non-delirium patients (N=1202)		Delirium patients (N=411)		P-value*
Days of mechanical ventilation	0.3	[0.2-0.6]	4.6	[0.9-10.9]	<0.0001
Re-intubation (N)	6	(0.5)	41	(10%)	<0.0001
Accidental removal of tubes, catheters (N)	7	(0.6)	49	(11.9%)	<0.0001
Total number of removals (N, frequency/patient)	8	(1.1)	95	(1.9)	0.35
LOS-ICU (days)	1	[1-2]	6	[2-13]	<0.0001
LOS-Hospital (days)	7	[5-14]	20	[10-20]	<0.0001
Mortality rate (N)	40	(3%)	73	(18%)	<0.0001

LOS, length of stay. Data are expressed as medians [IQRs] or numbers of patients and percentages.
* Adjusted for APACHE-II score using analysis of covariance.

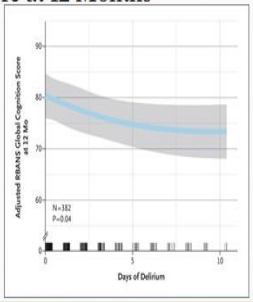
Copied from van den Boogaard, M., Schoonhoven, L., van der Hoeven, J., van Achterber, T., & Pickkers, P. (2012). Incidence and short-term consequences of delirium in critically ill patients: A Prospective observational cohort study *International Journal of Nursing Studies 49*(7), 775-783.

Outcomes: Long Term

- Cognitive dysfunction
- Anxiety/depression
- PTSD
- ↑ admission to Long-term care & skilled nursing facilities

Duration of Delirium and Global Cognition Score at 12 Months

Figure 2. Duration of Delirium and Global Cognition Score at 12 Months. Longer durations of delirium were independently associated with worse RBANS global cognition scores at 12 months. Point estimates and the 95% confidence interval for these relationships are shown by the blue line and the gray band, respectively. RBANS global cognition scores have age-adjusted population norms, with a mean (±SD) score of 100±15. Rug plots show the distribution of the durations of delirium. Although delirium could be assessed for up to 30 days in the study, the x axis is truncated at 10 days because 95% of the patients had delirium for 10 days or less; all available data were used in the multivariable modeling. As one example, in a comparison of patients with no delirium and those with 3 days of delirium (the 25th and 75th percentile values of delirium duration in our cohort), with all other covariates held constant (at the median or mode of the covariate), patients with 3 days of delirium had RBANS global cognition scores at 12 months that were an average of 3.6 points lower than the scores for patients with no delirium.



Pandharipande P et al. N Engl J Med 2013;369:1306-1316. The NEW ENGLAND JOURNAL of MEDICINE

Delirium Signs and Symptoms

Cognitive
- Disorientation
- Inattention
- Impaired short-term memory
- Reduced LOC
- Impaired visuospatial ability
- Perseveration
- Depressed affect

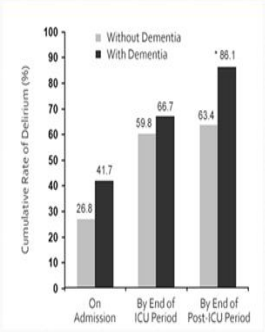
Behavioral
- Sleep-wake cycle disturbance
- Irritability
- Hallucinations
- Delusions
- Decreased interaction/responsiveness

Motoric Sub-types of Delirium

- Hyperactive (actually occurs the least!)
  - agitation, restlessness, hypervigilance, irritability, lack of concentration, emotional lability, hitting/biting
- Hypoactive
  - Decreased responsiveness, no or slowed speech, lethargy, decreased movement, withdrawal, flat affect
- Mixed-obviously a combination a both

Delirium Risk Factors

- Dementia
- Mechanical Ventilation
- Critical illness & severity of illness
- Polypharmacy (pre and during hospital stay)
- Elderly
- Infection
- Previously experienced delirium
- Hypertension
- Dehydration
- Sleep deprivation/disturbance
- Sensory deprivation/overload
- Pain
- Immobilization
- Surgery
- Benzodiazepine administration
- History of alcoholism



From: McNicoll, L., Pisani, M., Zhang, Y., Ely E., Siegel, M., Inouye, S. (2003). Delirium in the intensive care unit: occurrence and clinical course in older patients. *Journal of the American Geriatric Society* 51(5):591-598.

Delirium superimposed on Dementia (DSD)

- Accelerates cognitive & functional decline
- Often results in patients requiring SNF placement
- Systematic Review in 2012 by Morandi, et al. demonstrated that the original CAM by Inouye and CAM-ICU were deemed to have the highest specificity for detecting DSD.

What's the difference?

Delirium	Dementia
Acute onset (hours to days)	Insidious onset (months to years)
Fluctuating course	Progressively worsening course
Lasts hours to weeks	Lasts months to years
Altered LOC	Usually clear LOC
Impaired attention	Normal attention except if progresses to severe
Psychomotor changes	Irreversible
Usually reversible (may have longer term consequences)	

Mnemonics

http://www.icudelirium.org/terminology.html

Delirium Detection

- CAM-ICU (Confusion Assessment Method-ICU)
- CAM (long and short)
- NuDESC (Nursing Delirium Screening Checklist)
- DTS (Delirium Triage Screen-ED),
- bCAM (Brief CAM)
- ICDSC (Intensive Care Delirium Screening Checklist)
- DRS (Delirium Rating Scale) & DRS-R98 (Delirium Rating Scale Revised-1998)
- Other cognitive assessment tools:
  - Mini Mental Status Exam (MMSE)
  - Abbreviated Mental Test (AMT)

How accurate are the adult screening tools? Systematic Review by De and Wand 2015

Delirium Screening Tool	Performed By	Time to perform (minutes)	Sensitivity	Specificity
CAM (and various iterations)*	Any trained clinician	5-7	46-100% (dependent on operator experience)	63-100% (dependent on operator experience)
DRS & DRS-R 98 (Delirium rating score)	Psychiatry clinician	20-30	91-100% (depends on cut-off scores)	84-92% (depends on cut-off scores)
MDAS	Physician	10-15	64.1%	100%
Nu-DESC	Nursing	1-3	85.7%	86.8%
4AT	Anyone	2-3	89.7%	84.1%

*most widely studied. In above systematic review 13/31 studies examined.

How do I perform the CAM-ICU?

- Determine RASS score (CAM ICU is UTA for patients with RASS -4/-5 because patients are comatose.
- Determine if patient has had a fluctuating mental status for the past 24 or an acute change from baseline.
- Measure inattention by performing the SAVEAHAART hand squeezing test, if patient unable to squeeze related to paralysis, hemiplegia, or myopathy, try to test with eye squeezes.
- If RASS is 0 would continue with disorganized thinking questions and following bilateral commands.

STEP 1 — RICHMOND AGITATION-SEDATION SCALE (RASS)

Level of Consciousness Assessment

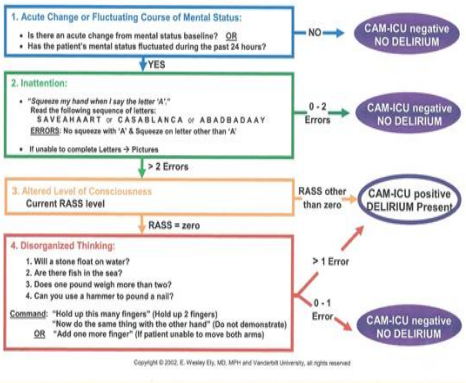
Scale	Label	Description	
+4	COMBATIVE	Combative, violent, immediate danger to staff	VOICE
+3	VERY AGITATED	Pulls to remove tubes or catheters; aggressive	
+2	AGITATED	Frequent non-purposeful movement, fights ventilator	
+1	RESTLESS	Anxious, apprehensive, movements not aggressive	
0	ALERT & CALM	Spontaneously pays attention to caregiver	
-1	DROWSY	Not fully alert, but has sustained awakening to voice (eye opening & contact >10 sec)	
-2	LIGHT SEDATION	Briefly awakens to voice (eyes open & contact <10 sec)	
-3	MODERATE SEDATION	Movement or eye opening to voice (no eye contact)	

If RASS is ≥ -3 proceed to CAM-ICU (is patient CAM-ICU positive or negative?)

-4	DEEP SEDATION	No response to voice, but movement or eye opening to physical stimulation	TOUCH
-5	UNAROUSABLE	No response to voice or physical stimulation	

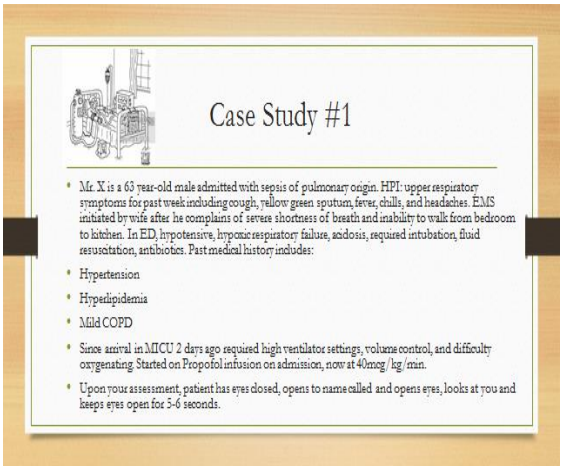
If RASS is -4 or -5 → STOP (patient unconscious), RECHECK later

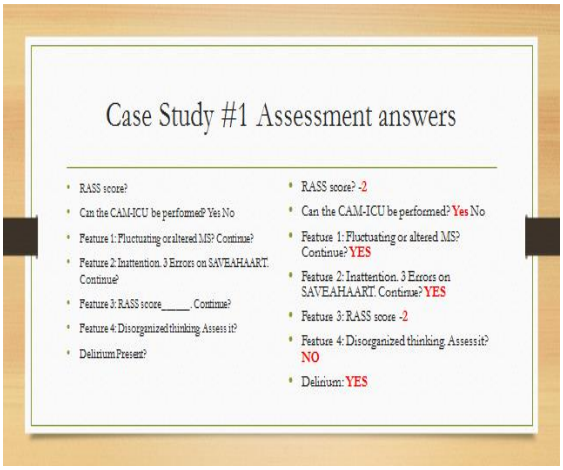
Sessler, et al., Am J Respir Crit Care Med 2002; 166: 1338-1344 Ely, et al., JAMA 2003; 286: 2703-2991

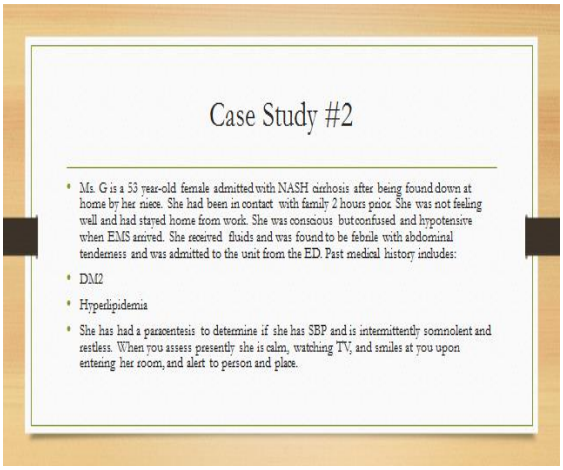


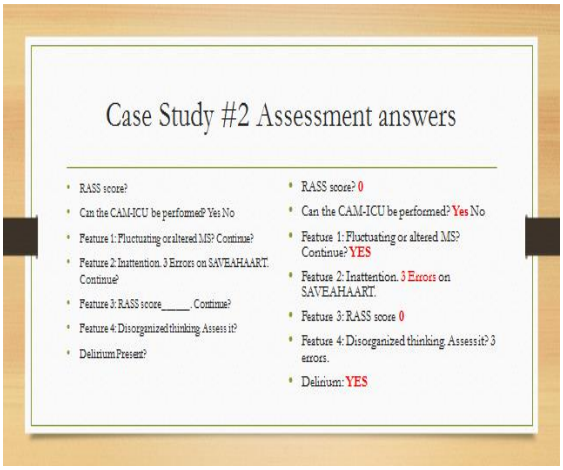
EMR (EPIC) documentation

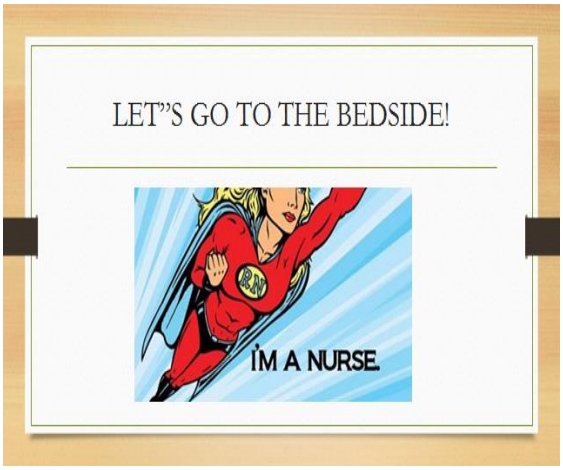
- CAM-ICU done every shift with assessment & with acute changes in MS
- EPIC DEMO


Case Study #1
Mr. X is a 63 year-old male admitted with sepsis of pulmonary origin. HPI: upper respiratory symptoms for past week including cough, yellow green sputum, fever, chills, and headaches. EMS initiated by wife after he complains of severe shortness of breath and inability to walk from bedroom to kitchen. In ED, hypotensive, hypoxic respiratory failure, acidosis, required intubation, fluid resuscitation, antibiotics. Past medical history includes:
Hypertension
Hyperlipidemia
Mild COPD
Since arrival in MICU 2 days ago required high ventilator settings, volume control, and difficulty oxygenating. Started on Propofol infusion on admission, now at 40mcg/kg/min.
Upon your assessment, patient has eyes closed, opens to name called and opens eyes, looks at you and keeps eyes open for 5-6 seconds.


Case Study #1 Assessment answers
RASS score?
Can the CAM-ICU be performed? Yes No
Feature 1: Fluctuating or altered MS? Continue?
Feature 2: Inattention. 3 Errors on SAVEAHAART. Continue?
Feature 3: RASS score_____. Continue?
Feature 4: Disorganized thinking. Assess it?
Delirium Present?
RASS score? -2
Can the CAM-ICU be performed? Yes No
Feature 1: Fluctuating or altered MS? Continue? YES
Feature 2: Inattention. 3 Errors on SAVEAHAART. Continue? YES
Feature 3: RASS score -2
Feature 4: Disorganized thinking. Assess it? NO
Delirium: YES


Case Study #2
Ms. G is a 53 year-old female admitted with NASH cirrhosis after being found down at home by her niece. She had been in contact with family 2 hours prior. She was not feeling well and had stayed home from work. She was conscious but confused and hypotensive when EMS arrived. She received fluids and was found to be febrile with abdominal tenderness and was admitted to the unit from the ED. Past medical history includes:
DM2
Hyperlipidemia
She has had a paracentesis to determine if she has SBP and is intermittently somnolent and restless. When you assess presently she is calm, watching TV, and smiles at you upon entering her room, and alert to person and place.


Case Study #2 Assessment answers
RASS score?
Can the CAM-ICU be performed? Yes No
Feature 1: Fluctuating or altered MS? Continue?
Feature 2: Inattention. 3 Errors on SAVEAHAART. Continue?
Feature 3: RASS score_____. Continue?
Feature 4: Disorganized thinking. Assess it?
Delirium Present?
RASS score? 0
Can the CAM-ICU be performed? Yes No
Feature 1: Fluctuating or altered MS? Continue? YES
Feature 2: Inattention. 3 Errors on SAVEAHAART.
Feature 3: RASS score 0
Feature 4: Disorganized thinking. Assess it? 3 errors.
Delirium: YES


LET"S GO TO THE BEDSIDE!
I'M A NURSE.

Appendix D

American Journal of Critical Care Journal Author Guidelines

AJCC American Journal of Critical Care

AUTHOR GUIDELINES

The editors of the *American Journal of Critical Care (AJCC)* invite authors to submit original manuscripts describing investigations, advances, or observations from all specialties related to the care of critically and acutely ill patients. Papers promoting collaborative practice and research are encouraged. Manuscripts will be considered on the understanding that they have not been published elsewhere and have been submitted solely to *AJCC*. (This restriction does not apply to abstracts.)

Manuscripts must be submitted online via the *AJCC* online manuscript submission and review system at www.editorialmanager.com/ajcc. At the time of submission, complete contact information (postal address, e-mail address, telephone and fax numbers) for the corresponding author is required. First and last names, e-mail addresses, and institutional affiliations of all coauthors also are required. (Print copies of the journal will be sent only to those coauthors who provide their postal address.) Manuscripts must be submitted in Microsoft Word, or a compatible format.

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Educational Intervention to Improve Delirium Recognition by Nurses

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ABSTRACT

Background: Delirium poses significantly increased morbidity and mortality for the hospitalized patient. Under-recognition by healthcare providers, especially nurses, contributes to poor patient outcomes. A lack of literature regarding educational methodology on the use of the confusion assessment method for the intensive care unit (CAM-ICU) delirium screening was noted.

Objective: The purpose was to evaluate the effectiveness of a multimodal educational intervention for medical ICU nurses to improve their knowledge and skills regarding delirium and delirium recognition.

Methods: An educational intervention was conducted in the MICU of an academic medical center. Effectiveness was evaluated in a quasi-experimental design using a pre and post assessments. Procedural correctness of performing the CAM-ICU delirium screening was also measured.

Results: Nurses participated in one small group session ($n = 34$). Fifteen sessions were conducted from June to September 2016 and completed pre and post assessments. The sample consisted of predominantly BSN-prepared nurses (55.9%) with one to five years of experience (58.8%). Statistical significance ($p < .001$) was noted in the overall and knowledge sub-scale mean score differences. There was no correlation between demographic groups and score differences. Performance of the CAM-ICU was demonstrated as procedurally correct by 79% of participants after the intervention.

Conclusions: The educational intervention conducted for MICU nurses provided additional validation to the literature regarding benefits of an educational program about delirium knowledge. The content of the educational intervention should be targeted for the setting, patient population-specific risk factors, and the specific delirium screening tool used in practice.

Delirium is defined as an acute confusional state characterized by fluctuating mental status and inattention and is acute organ failure of the brain.[1] Delirium prevalence rates vary from 20-27% in acute care and up to 87% in intensive care unit (ICU) patients.[2] Adverse outcomes for the critically ill patient experiencing delirium are widely published and include prolonged mechanical ventilation, lengths of stay, persistent cognitive impairment, and increased mortality.[3-6] Statistically significant increases in ventilator days, re-intubation rates, and accidental removal of tubes are also described.[7] Further validation of negative outcomes for the critically ill delirious patient was published and revealed increased negative clinical sequelae such as increased use of vasopressors or inotropes, increased antipsychotic administration, and increased use of physical restraints.[8] Under-recognition of delirium is an extensive problem and delirium is estimated to be overlooked in 30% to 75% of cases.[9]

BACKGROUND

The inadequate knowledge of nurses regarding delirium manifestation and risk factors is complicated by the fluctuating and varied presentation of symptoms.[10] The enhancement of nurses' knowledge and skill regarding delirium and delirium recognition is of significant importance in improving delirium screening performance. The use of validated assessment tools to screen for delirium and sedation are fundamental elements of delirium recognition and require a variety of educational strategies for nurses to incorporate into daily practice.[11] In addition to didactic training, nurses benefit from a continual learning process involving daily rounding, immediate feedback on assessment accuracy, and refresher training.[12]

A review of literature revealed a lack of detailed evidence about the performance of CAM-ICU screenings by nurses and improvement in nurses' knowledge through clearly defined educational interventions. [13-26] A common finding was that the knowledge level of nurses was

determined to be average when examined for delirium and risk factors and complications from delirium[14, 18-20, 23] Another study described that although the nurses deemed delirium a significant issue, delirium screening was not deemed as necessary prior to the educational intervention.[21] The implementation of a phased educational interventions demonstrated statistically significant improvement when using a multimodal educational intervention.[18, 26] Improved nursing knowledge and delirium screening were noted in quality improvement initiatives.[24-25] Confidence in knowledge and skills were also identified as an important part of practice for healthcare provider, especially nurses.[13, 17, 20] Patients' outcomes were not well characterized by the studies in the review,

Confounding factors noted in the literature review were the wide variety of educational interventions and the number of author-created measures used for evaluation. The lack of clarity of the detailed components of the educational intervention also proved problematic. Thus the aim of the project was to implement and evaluate the effectiveness of a multimodal educational intervention for nurses to determine if their knowledge of delirium and skills of delirium recognition were improved. The theoretical framework of Rogers' Diffusion of Innovations was used as the construct for knowledge translation of evidence-based practice for delirium recognition.[27]

METHODS

Design

A quasi-experimental pre and post assessment design was used to determine if changes occurred in nurses' knowledge and skills regarding delirium and delirium recognition after participation in the educational intervention.

Setting and Sample

A convenience sampling method of medical ICU nurses in a 28-bed unit at an academic medical center on the east coast of the United States was used. Bedside and advanced practice nurses working in the MICU were eligible to participate if they were permanent MICU staff with greater than one year of nursing experience. Permission to conduct the project was obtained from the unit manager and medical director.

Procedures

Institutional social and behavioral sciences review board approval for the project was obtained. Recruitment was conducted via email invitation, flyers, and verbal announcements during shared governance meetings for one month prior to the start of the intervention. Small groups of two to three participants were scheduled. Consents were obtained for each participant prior to the educational session.

The educational session, *Delirium Refresh*, consisted of a ten-minute delirium survivor video[28], 30-minutes of didactic content, 20-minute case study analyses, and 15-minute bedside instruction and return demonstration of performance of the CAM-ICU delirium screening.

Measures

The pre and post intervention assessment tool was an adapted version of the Nurses' Delirium Knowledge Assessment (NDKA).[29] Demographics of the survey were modified to reflect the setting and US nursing educational preparation. The origin of the survey is Australian and the survey was revised to reflect American English, however intent of each question on the survey was preserved.

The NDKA measure is a 36-item assessment evaluating specific delirium knowledge components. The measure is a combination of general delirium knowledge, knowledge of screening tools and scales, and knowledge of delirium risk factors. The assessment includes a

multiple-choice question, a section involving matching scales/tools to the appropriate condition, and a scale of agree, disagree, and unsure responses for the remainder of the questions. Sub-scales of knowledge, knowledge of assessment screening tools and scales, and delirium risk are scored independently and a total score is computed overall.[30]

The CAM-ICU is used as the delirium recognition tool in the intensive care units at the facility. The CAM-ICU was initially evaluated and validated for use in the mechanically ventilated patient.[31] The CAM-ICU has high interrater reliability ($\kappa = .96$; 95% CI [0.92-0.99]) between study nurses and 96.5% sensitivity and 99% specificity.[31] In 2011, Vasilevskis et al., reported on a prospective cohort trial of 510 patients and 627 nurses; reliability between bedside RNs and study RNs was found to be $\kappa = .67$(95% CI [0.66, 0.70]) and stable over three years of data collection with sensitivity and specificity of .81.[32]

Data Analysis

The statistical analysis of the data was conducted via the statistical software package of SPSS® 24. Descriptive statistics were performed on all of the NDKA data of demographics and assessment responses. Frequencies and valid percentages were computed for all nominal and ordinal level data. Means, mean differences, and standard deviations were computed for normally distributed continuous data.

The paired *t*-test was used to detect significant differences in normally distributed continuous data between pre and post assessment overall scores and the three sub-scales. Comparative statistics were computed to identify if significant differences were found between the demographic groups. Statistical significance (α) of .05 or less was used.

RESULTS

Thirty-four nurses representing 32% of the group eligible participated in the 15

educational sessions which were provided over nine weeks from July to September 2016. Mean group size was two and all thirty-four participants completed pre and post assessments. Demographic data for the sample are illustrated in Table 1.

Demographics

Demographic information was collected in ranges of age, years of nursing experience, educational preparation, clinical ladder level, and years working in the MICU and institution. Self-reported amount of delirium education received (none, small, moderate, or large) was also collected pre and post. There were no missing demographic values for the participants.

Age ranges and gender. The age range of 20-30 years represented 55.9% of the participants (*n* = 19), 31-40 range was 17.6% (*n* = 6), and the remainder of the ages of 41-61+ comprised 26.5% (*n* = 9). The sample consisted of 94.1% female participants (*n* = 32).

Years in nursing practice. Participants reporting one to five years of nursing experience was 58.8% (*n* = 20). Six to 15 years of experience was reported by 20.6% (*n* = 7) and sixteen years and greater by 20.5% (*n*= 7).

Years in the MICU and institution. The predominant range of years at the institution was one to five representing 70.6% (*n*= 24). The group with twenty plus years at the institution was 17.6% (*n*= 6). The group with one to five years in the MICU also represented 76.5% (*n* = 26) of the sample.

Educational preparation. The categories of diploma, associate degree of nursing (ADN), BSN, and MSN were offered. The BSN-prepared group comprised the majority of the participants with 55.9% (*n* = 19). MSN-prepared nurses represented 35.3% (*n* = 12) of the participants.

Self-reported delirium education levels. The majority of participants reported a

moderate level of education prior to the intervention at 55.9% (n = 19). Those reporting a small amount of education were 41.2% (n = 14). Post assessments revealed self-reported moderate level of delirium education at 61.8% (n = 21) and those reporting a large amount of delirium education increased from 2.9% (n = 1) pre assessment to 17.6% (n = 6) post assessment.

Nurses' Delirium Knowledge Assessment

For the 36-item measure, the overall mean score of correctly answered questions was 75.7% for the pre assessment and 80.3% for the post assessment. The sub-scale mean scores were as follows: knowledge questions 88.8% pre and 96.9% post, knowledge of assessment tools and scales 80.7% pre and 81.1% post, and risk questions 59% pre and 62.2% post (see Table 2). The mean differences (post minus pre) in the overall score, and the three subscales: knowledge questions, knowledge of assessment tools and scales, and risk questions, were also computed and are summarized in Table 2. Paired t-tests were computed and were statistically significant for the overall mean score difference ($p < .001$) and for the knowledge questions sub-scale mean difference ($p < .001$). There was some evidence of improvement in the risk sub-scale mean ($p = .100$), but no evidence of improvement in the knowledge of assessments tools and scales mean ($p = .872$) (see Table 2).

The effects of different levels of two demographic variables on the pre-post differences in the overall scale and the 3 subscales were also investigated (see Table 3). In order to have categories of sufficient size for analysis for years of nursing experience, the five categories were collapsed to three (one to five years, six to 15 years, and ≥ 16 years). The Kruskal-Wallis H-test found no statistically significant differences between the distributions of the pre-post differences in the four scales, over the three categories of years of nursing experience: overall scale score pre-post difference ($p = .534$), knowledge subscale score pre-post difference ($p = .284$),

knowledge of tools and scales subscale score pre-post difference (p = .889), and risk subscale score pre-post difference (p = .699). The four levels of educational preparation were collapsed into three categories: Diploma/ADN, BSN, and MSN/Doctorate. The number of Diploma/ADN prepared nurses was low (n = 3) and those three nurses were not included in the analysis. Independent t-tests were computed comparing the mean pre-post score differences for the BSN and MSN/Doctorate groups. No significant differences between the two education groups were found in the mean overall score differences, t (29) = 0.38, p = .708, or in the knowledge of tools and scales, t (29), = 0.13, p = .987, or risk, t (20) = 0.05, p = .964, sub-scales. The knowledge sub-scale score difference data were skewed and analyzed using the Mann-Whitney U-test with no statistical significance (p = .484) found (see Table 3).

Knowledge questions. Participants demonstrated a substantial baseline knowledge of delirium with a mean of 88.8% on the pre assessment. One-hundred percent of participants correctly answered the knowledge questions regarding delirium treatment and sedation and alcohol withdrawal as the typical cause of delirium on the pre assessment. The questions with the lowest percentage of participants answering correctly on the pre assessment were on the Mini Mental Status Exam (MMSE) as the best tool for assessing delirium at 61.8% and the difficulty to arouse and lethargic patients as having delirium at 67.6%. Eight of the 15 knowledge questions demonstrated improvement to 100% of participants answering correctly after the educational intervention (see Figure 1).

Knowledge of tools and scales. The sub-scale on the knowledge of tools and scales assessed participant knowledge of MMSE, delirium rating scale (DRS), clinical institute of withdrawal of alcohol (CIWA), Glasgow Coma Scale (GCS), confusion assessment method (CAM), and Beck's Depression Inventory to detect delirium, dementia, or depression. The

question with the lowest number of correct answers at baseline was the MMSE at 8.8% of participants and the highest baseline score (100%) was identifying the Braden score as a scale not associated with delirium, dementia, or depression. The MMSE correct responses improved to 32.4% of participants on the post assessment.

Risk Questions. The baseline sub-scale mean scores on risk were very low. The questions with the lowest percentage correctly answered were regarding diabetes and male gender as risk factors at 11.8% and hip fracture repair risk at 23.5%. The other questions with lower numbers of participants answering correctly were on dementia (32.4%), obesity (35.3%), and family history of dementia (32.4%). The risk of dementia question improved to 82.4% of the participants answering correctly on the post assessment and the diabetes question improved to 23.5%. Figure two displays the pre and post intervention percentages of correctly answered risk sub-scales questions.

Procedural Correctness of CAM-ICU Performance

Procedural correctness was determined via return demonstration of performing the CAM-ICU at patients' bedsides during the educational intervention after bedside instruction. Seventy-nine percent of the participants correctly performed the delirium screening during the observation. The most common error (85%) observed in the return demonstration for procedural correctness was continuing with the screening although technically completed based on the progression of assessment algorithm.

DISCUSSION

The analyses of the data demonstrated statistically significant improvement in the overall and knowledge sub-scale scores using the NDKA. Certifying knowledge of delirium is a cornerstone to nursing practice.[33] No participant scored 100% on the overall or any sub-scale of

the assessments, however, the improvement to 100% of the participants answering correctly on some key characteristics of delirium such as the length of delirium, perceptual disturbances experienced by patients, and the increased mortality associated with delirium, may contribute to improved recognition of delirium.

The knowledge of tools and scales sub-scale also indicated the limited awareness of how to correctly identify delirium and which tools are appropriate. There was a profound lack of knowledge of the MMSE as a tool to identify delirium and depression noted on the pre assessment. There was an improvement in knowledge by 24% of participants for the MMSE on the post assessment. A literature review highlighted that the deficiencies in knowledge and use of valid and reliable delirium recognition tools by nurses is an area of needed research.[34]

The low scores on the risk sub-scale demonstrated a significant lack of awareness for those patients prone to delirium. Steis and Fick explained that in order for nurses to appropriately care for delirious patients they must be educated about the variable and discreet manifestations associated with delirium.[35] The mitigation of contributing risk factors is a key contributor to prevention and improved patient outcomes and is primarily a nursing concern.[36] Commonly known risk factors such as advanced age, impaired vision, and impaired hearing were identified correctly by 91.2%, 97.1%, and 100% participants, respectively, and remained unchanged from pre to post assessment. Co-morbidities not considered to contribute to delirium such as obesity and diabetes were incorrectly identified by participants as risks by 64.7% and 88.2% pre assessment and 73.5% and 76.5% post assessment.

Performing the CAM-ICU at the patients' bedside after coaching was anecdotally considered beneficial by participants. The lack of observational data of participants prior to the educational intervention prohibited any conclusions regarding the effectiveness of the

educational intervention on the skills of nurses to perform the screening correctly. Gordon et al.,[24] described that bedside coaching in combination with other educational methods may increase nursing practice for delirium recognition.

Delirium Refresh was designed to determine if a multimodal approach would improve knowledge and skill of nurses regarding delirium recognition. The inclusion of a delirium survivor video highlighted the long-term impact of delirium. Pollard, Fitzgerald, and Ford described that in order to enhance nurses' abilities to provide holistic evidence-based nursing care that insight into the patients' experience of delirium is necessary.[37] The content of the intervention specifically focused on the CAM-ICU delirium screening tool due to its established use in the setting. There was marginal reference to the numerous risk factors identified on the NDKA during the educational intervention; instead focusing on the most obvious risk factors associated with usual MICU patients. The case study analyses portion of the intervention also used specific examples common in the MICU setting; patients with liver disease and respiratory failure. These detailed aspects of the educational intervention may have impacted the statistical significance of the results.

Limitations

The project was limited by the restriction to one medical intensive care nursing unit, a low participation rate of 32% in volunteering participants, the quasi-experimental design, and time constraints which prohibited the collection of baseline data for procedural correctness of the performance of the CAM-ICU. The restriction to one medical nursing unit limits the generalizability of the effectiveness of the content of the *Delirium Refresh* program especially regarding the case study analyses and bedside instruction/return demonstration of delirium screening. The voluntary sample could indicate participation only by those motivated to learn.

The demographics analyses indicated that the predominant volunteers were those with one to five years nursing experience and thus nursing units with more experienced nursing staff may not benefit from the educational design of the intervention. The lack of pre intervention data for the procedural correctness of screenings performed prohibited any analyses that the educational intervention demonstrated impact on the skill of performing the CAM-ICU by the nurse participants.

CONCLUSION

This project provided additional validation that a multimodal educational intervention improved nurses' knowledge regarding delirium. On-going effective education on delirium assessment is necessary to sustain accurate delirium identification.[38] Neither the knowledge of screening tools and neither scales nor the risks of delirium were impacted by the educational intervention as designed. Skills of performing delirium screening using the CAM-ICU may be improved by bedside instruction and return demonstration. Further research on pedagogical methods is needed to determine the most effective strategies to improve RN knowledge of tools and scales to measure delirium, dementia, and depression and delirium risk factors. An improved methodology to reinforce the recognition of delirium and delirium risk factors is vital to patients' health care outcomes. The burden of negative long-term outcomes for patients mandates continued efforts to improve the knowledge and skills of nurses' about delirium and delirium recognition.

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Table 1

Demographics of Nurses Participating in Delirium Refresh Educational Intervention

Characteristic	*n* = 34	%
Age Range		
20-30	19	55.9
31-40	6	17.6
41-50	4	11.8
51-60	4	11.8
61+	1	2.9
Gender		
Female	32	94.1
Male	2	5.9
Clinical Ladder Level		
Clinician 2	24	70.6
Clinician 3	2	5.9
Clinician 4	5	14.7
APN 2	3	8.8
Years of Nursing Experience		
1-5	20	58.8
6-10	4	11.8
11-15	3	8.8
16-20	1	2.9
21+	6	17.6
Years at Health System		
1-5	24	70.6
6-10	2	5.9
16-20	2	5.9
21+	6	17.6
Years in MICU		
1-5	26	76.5
6-10	4	11.8
11-15	1	2.9
16-20	1	2.9
21+	2	5.9
Educational Preparation		
Diploma	1	2.9
Associate Degree	2	5.9
BSN	19	55.9
MSN	12	35.3

Note. BSN = Bachelor of Science in Nursing; MSN = Masters of Science in Nursing

Table 2

Paired t-test Results of Pre and Post Assessment Scores on the Nurses' Delirium Knowledge Assessment (n = 34)

Nurses Delirium Knowledge Assessment Scores	*M (SD)* Pre	*M (SD)* Post	Score Ranges Pre	Score Ranges Post	*M difference (SD)*	*p value*	CI (95%)
Overall	.76 (*.07*)	.80 (*.07*)	.58-.86	.67-.94	.047 (*.09*)	< .001	0.02-0.07
Knowledge sub-scale	.89 (*.09*)	.97 (*.05*)	.67-1.0	.80-1.0	.080 (*.09*)	< .001	0.05-0.11
Knowledge of tools and scales sub-scale score	.81 (*.10*)	.81 (*.14*)	.57-1.0	.43-1.0	.004 (*.15*)	.872	-0.05-0.06
Risk sub-scale score	.59 (*.13*)	.62 (.11)	.36-.86	.43-.86	.032 (*.11*)	.100	-0.01-0.07

Table 3

Comparison of Demographic Variables of Years of Nursing Experience and Educational Preparation to Pre and Post Assessment Scores on the Nurses' Delirium Knowledge Assessment

	Nurses' Delirium Knowledge Assessment Scores (n=34)															
	Overall				Knowledge sub-scale				Knowledge of tools/scales sub-scale				Risk sub-scale			
Demographic	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*	*M (SD)*		*M diff*	*p*
	Pre	Post			Pre	Post			Pre	Post			Pre	Post		
Yrs. of experience																
1-5 (*n* = 20)	.765	.811	.046		.893	.973	.080		.836	.836	.000		.593	.625	.032	
6-15 (*n = 7*)	.78	.80	.020	.534 *	.924	.962	.038	.284 *	.755	.755	.000	.889 *	.633	.643	.010	.699 *
≥ 16 (*n = 7*)	.710	.786	.075		.838	.962	.124		.776	.796	.020		.541	.592	.051	
Educational Preparation																
Diploma/AD N (*n = 3)*	Excluded from analysis															
BSN (*n* = 19)	.753 (.075)	.807 (.060)	.054	.708 **	.888 (.094)	.979 (.039)	.091	.484 +	.797 (.099)	.805 (.152)	.008	.897 **	.586 (.155)	.624 (.101)	.038	.964 **
MSN (*n* = 12)	.771 (.061)	.815 (.078)	.044		.894 (.104)	.967 (.045)	.072		.833 (.082)	.833 (.134)	.000		.607 (.089)	.643 (.122)	.036	

Note: *Kruskal-Wallis *H*-statistic. **Independent *t*-statistic. +Mann-Whitney *U*-statistic

Figure 1: NDKA Knowledge Questions Percentages Correctly Answered Pre & Post Interventions

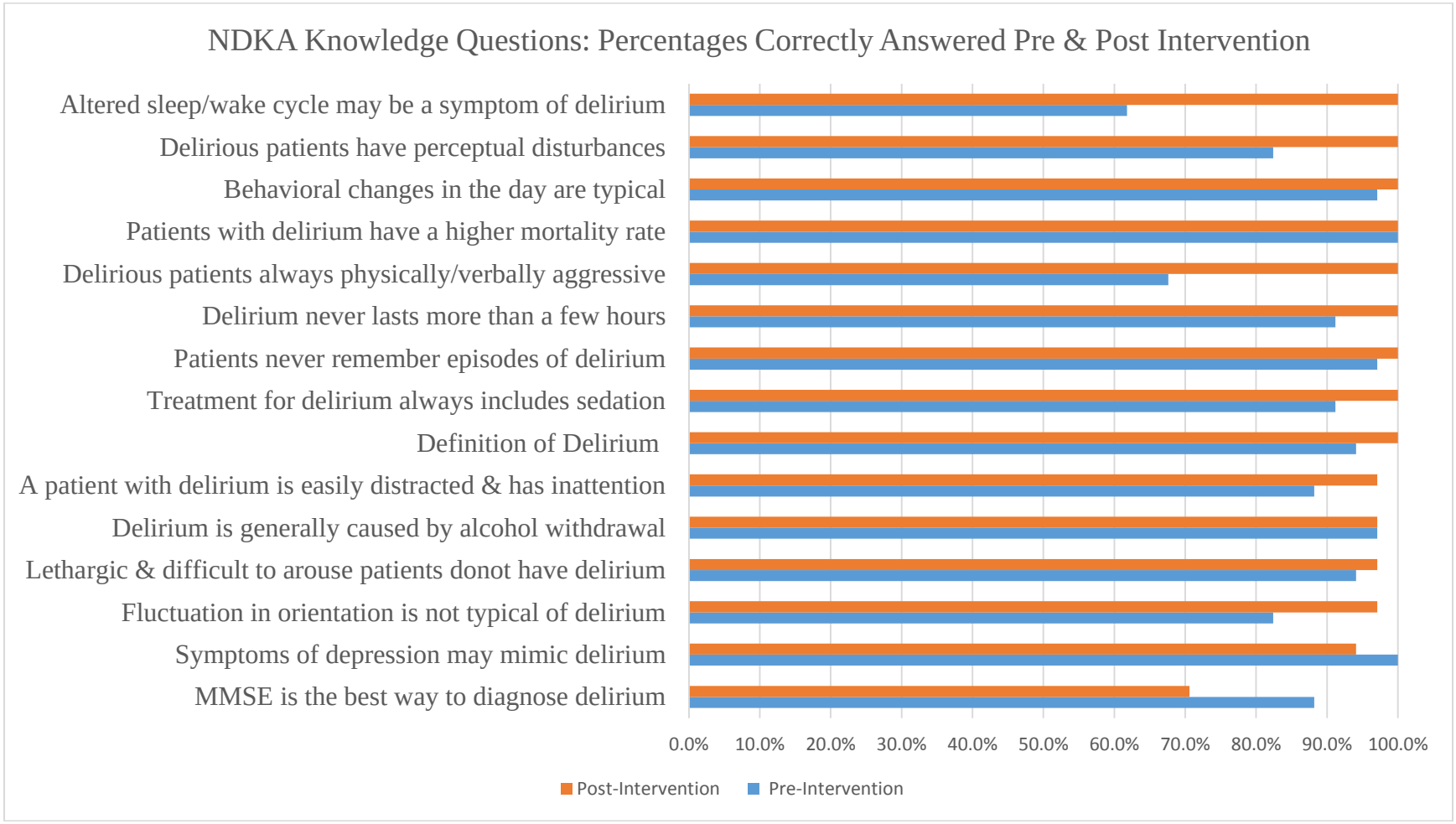

Figure 2: NDKA Risk Questions: Percentages Correctly Answered Pre & Post Intervention