

The Long-Term Impact of an Educational Intervention on Nursing Knowledge of
Delirium, Perception of the Intensive Care Delirium Screening Checklist and
Delirium Screening Compliance in the ICU:

A Master's Thesis

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Submitted in Partial Fulfillment
Of the Requirements for the Degree
Master of Nursing
Athabasca University



The future of learning.

Approval of Thesis

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“The Long-Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU.”

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Dedication

This thesis is dedicated to my family. To my parents for supporting me through all my endeavours. To my children Caitlin, Chloe and Benjamin for being patient with the time I spent studying and reminding me that they needed the mom not the student sometimes. To my husband Craig, without your continual love, support, patience, encouragement, and occasional reality check I could not have achieved this goal.

Acknowledgements

I would like to thank the delirium working group and nursing staff at Royal Columbian Hospital Intensive Care Unit who participated in the quality improvement (QI) initiative from which this work was derived.

A special thank-you to Sandra White, my co-lead in the QI initiative, who encouraged, challenged, collaborated, and believed in me throughout the life of the initiative and into my thesis.

I would also like to thank my supervisor Dr. Jennifer Knopp-Sihota, committee member Dr. Shawn Fraser and external examiner, Dr. Louise Rose, for their feedback and support.

Abstract

Delirium, a frequent complication in the intensive care unit, has significant and widespread impacts on patients, families, and the healthcare system. Interdisciplinary delirium prevention and mitigation strategies are necessary to effectively manage this syndrome. Routine screening by nurses using a validated tool is effective in identifying those patients at risk for or experiencing delirium. This practice is not consistent internationally and lack of knowledge of both delirium and the screening tools appears to be a contributing factor. The overall aim of this manuscript based thesis, was aimed at assessing the long-term impact of a multi-faceted educational intervention on delirium management. This thesis consists of two papers, the first a comprehensive review and the second a research based paper. The first manuscript is a comprehensive overview of delirium intended for critical care nurses to address the knowledge-practice gap. The second paper is a quantitative study that examined the long-term effects at 18-months of a multi-faceted educational intervention on nurses' knowledge of delirium and the screening tool, and the frequency of delirium assessment in a single intensive care unit. The findings from the second manuscript demonstrate an initial increase in knowledge that was not retained at the 18-month survey period. Nurses perceived the tool to be useful and over the long-term felt physicians were placing more value on it. They did not, however, feel more knowledgeable or confident using the tool. Delirium screening frequency improved after the educational intervention and was maintained over the long-term. This work reinforced and expanded on the findings of previous studies related to the short-term efficacy of a multi-faceted knowledge translation intervention on nursing knowledge and screening of delirium. It also demonstrated that passive knowledge

transfer is ineffective in maintaining these knowledge gains over the long-term. Future research needs to focus on establishing an optimal frequency for reinforcing delirium and screening knowledge within the context of the busy clinical setting of the intensive care unit.

Preface

This manuscript-based thesis describes the results of original research completed during my graduate studies and partially fulfills the requirements for the Master of Nursing degree at Athabasca University. The thesis is comprised of two manuscripts. The first is titled “Delirium in the Intensive Care Unit – a Nursing Refresher” and consists of a concise overview of delirium, risk factors, current screening, treatment options, and long-term impacts. This paper has been accepted for publication in the *Canadian Journal of Critical Care Nursing*. I am the primary author of this paper; the content of which was the foundation for the educational intervention implemented by the quality improvement initiative.

The second manuscript is titled “Nurses’ Knowledge and Perception of Delirium Screening and Assessment in the Intensive Care Unit: Long-term Effectiveness of an Education-Based Knowledge Translation Intervention” and describes the results of the quantitative study portion of the project. This paper has been accepted for publication in *Intensive and Critical Care Nursing*. As the primary author of this work, I developed the hypothesis and study design, collected raw data, conducted the data analysis, developed the conclusions and wrote the manuscript under the guidance of my thesis advisor, Jennifer Knopp-Sihota. Sandra White collaborated with me in the creation and implementation of the quality improvement initiative, which formed the basis of this study. Her contributions included the co-development and co-implementation of the multi-faceted educational intervention along with the collection of the raw survey data.

White’s inclusion as second author for both these papers is consistent with the guidelines for joint authorship by the Athabasca University Intellectual Property

Guidelines (2016). As my co-lead for the quality improvement (QI) initiative from which this work derived, her contribution was sufficiently significant to merit recognition as an author.

A grant from the Graduate Student Research Fund at Athabasca University helped to financially support this work, which included the purchase of statistical software. I was also very fortunate to be awarded a 2015 Excellence in Research Scholarship from Athabasca University and the 2015 Gussie MacPhail Bursary from the Royal Columbian Hospital Nurses Alumnae Society both of which helped defray the costs of tuition during my studies.

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List of Abbreviations

ICU	Intensive Care Unit
ICDSC	Intensive Care Delirium Screening Checklist
CAM-ICU	Confusion Assessment Method for the Intensive Care Unit
QI	Quality Improvement
RASS	Richmond Agitation Sedation Scale
DSM	Diagnostic and Statistical Manual of Mental Disorders
PAD	Pain, Agitation and Delirium
KTA	Knowledge-to-Action
CRN	Clinical Resource Nurse
CNE	Clinical Resource Nurse
CIHR	Canadian Institutes of Health Research

Chapter I – Integrating Chapter

Motivation for Research

During my 14 years of caring for critically ill patients in the Intensive Care Unit (ICU) I have observed significant shifts in the clinical practices of caring for a patient during critical illness. Specifically, it was the evolution in practice of sedating patients from which my research topic arose. When I entered critical care, best practice was to maintain ventilated patients in a state of moderate to heavy sedation for comfort. Over time, practice changed to one in which sedation is used more sparingly. This lower use of sedation has revealed the presence of a significant medical concern - delirium. Initially patients displaying hypoactive delirium symptoms were often treated for depression despite the uncharacteristic rapid onset of symptoms (e.g., being withdrawn and not interacting appropriately with their environment). While researching a paper for a course that examined the manifestations and current practices of delirium management in the ICU, I was astounded by the number of signs I was seeing suggesting these patients may be suffering from delirium. Following this realization, I partnered with one of the nurse educators in my unit to highlight concerns with patient care and the management of delirium. An interdisciplinary team, of which I was a member, was established to improve delirium screening in our ICU. This work became the basis for my graduate studies and this thesis.

Introduction and Overview

Delirium associated with critical illness is a serious complication in the intensive care unit (ICU) with far-reaching effects on patients, families, the healthcare team, hospitals, and healthcare costs (Gesin, Russell, Lin, Evans, & Devlin, 2012; Olson, 2012; Pun & Ely, 2007). In the last decade, research has advanced the understanding of associated risk factors, symptom manifestation, diagnostic and treatment options, and the overall impact of delirium on patient outcomes. The development and routine use of objective validated screening tools has proven a reliable method for detecting delirium in this population. However, despite these advances, delirium remains a poorly managed phenomenon affecting up to 80% of ventilated patients (Pun & Ely, 2007). A large knowledge practice gap exists within nursing practice with respect to understanding delirium and the resources available to prevent, detect, and mitigate the symptoms.

Delirium Definition

Delirium, a clinical diagnosis, is defined as a syndrome characterised by an acute onset of cerebral dysfunction associated with fluctuating mental status, inattention and either disorganized thinking or an altered level of consciousness (Barr et al., 2013; Devlin, Marquis, et al., 2008). The American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-V) (see Appendix A) has updated its delirium diagnosis criteria to include the requirement that these symptoms be a deviation from baseline, are not associated with another neurocognitive disorder, and are the result of a somatic factor, medication intoxication, or withdrawal (Brummel et al., 2013).

Hallmark characteristics of this syndrome include: 1) a disturbed level of consciousness with a decreased ability to focus, sustain, or shift attention; and 2) either a change in cognition or the manifestation of perceptual disturbances (Barr et al., 2013). Three major subtypes of delirium are: hyperactive (characterised by agitation and restlessness), hypoactive (characterised by lethargy and withdrawal), and a mixed presentation with aspects of both (Olson, 2012). Recently emerging forms of delirium include subsyndromal delirium which manifests with fewer symptoms, and rapidly reversible sedation-related delirium, which clears within two hours of the cessation of sedating drugs (Ouimet, Riker, et al., 2007; Patel, Poston, Pohlman, Hall, & Kress, 2014).

Epidemiology of Delirium in the ICU

Delirium is a frequent and serious event associated with critical illness (Reade, Phil, & Finfer, 2014). Rates of delirium in critically ill patients range from 20-50% in non-ventilated patients and 68-80% in ventilated patients (Pun & Ely, 2007). Baseline cognitive dysfunction appears to be the most robust predictor of delirium with evidence of greater than 60% of patients with underlying impairment developing an acute delirium (Harrington & Vardi, 2014). Delirium is an independent predictor of both prolonged ICU admission and increased length of hospital stay. Every additional day of delirium is associated with a 10% increased risk of death and a 20% increased risk of prolonged hospitalisation (Ely et al., 2004). Patients diagnosed with delirium experience a threefold increase in 6-month mortality compared to those with no delirium (Ouimet, Kavanagh, Gottfried, & Skrobik, 2007). In the US, delirium is associated with significant increases in healthcare costs. Specifically, delirium attributes to 39% higher ICU and 31% higher

overall hospital costs (Olson, 2012). Due to the similarities in delirium treatment, it is reasonable to expect similar cost relationships in Canada.

Risk Factors for Delirium

Risk factors associated with delirium can be classified in three main categories: the nature of the acute illness, predisposing factors related to baseline health status, and precipitating iatrogenic or environmental factors (Faria & Moreno, 2013; Pun & Ely, 2007). These broad categories encompass numerous factors identified as contributing to an increased risk of delirium.

Baseline or predisposing risk factors include advanced age, hypertension, smoking and alcohol dependence, depression, chronic illness, cognitive dysfunction, dementia, and sensory impairment (Arend & Christensen, 2009; Brummel et al., 2013; Olson, 2012). The 2013 PAD Guidelines, identify the four most frequently associated predisposing risk factors for developing delirium as pre-existing dementia, high severity of illness on admission, a history of hypertension, and a history of alcohol dependence (Barr et al., 2013).

Precipitating risk factors are numerous and can be grouped into iatrogenic and environmental (Table 2 – Manuscript #1). Being modifiable, they are the focus of delirium management. Recognizing those patients already at risk due to underlying factors enables clinicians to focus on reducing the effects of these modifiable risk factors.

Management of Delirium

Non-Pharmacological Treatment Options

Delirium management relies on non-pharmacological and pharmacological interventions. The primary treatment of delirium is aimed at correcting underlying illness and minimizing precipitating factors. The ICU is busy, noisy and at times an environment of controlled chaos. Consequently, non-pharmacologic treatments aim to reduce environmental sensory overload in an effort to minimize delirium incidence and severity. A comprehensive approach is the most effective and includes factors such as early mobility, restoring day/night cycles, promoting sleep with reduced noise and interruptions, decreasing sensory overload, and reducing visual and hearing impairment (Choi, 2013; Pun & Ely, 2007; Zaal & Slooter, 2012).

Frequent re-orientation and explanation of activities along with simple memory aids such as whiteboards with basic date/time and location information accompanied by caregivers' names can help reduce confusion (Choi, 2013; Zaal & Slooter, 2012). Effective delirium mitigation must have both multidisciplinary and multimodal approaches to be effective.

Pharmacological Treatment Options

Unfortunately, not all delirium can be treated with non-pharmacological approaches. Treating underlying medical conditions frequently requires medications that may also increase the risk for developing delirium. Although antipsychotic medications are not recommended in the prevention of delirium they are often used in managing and reducing the severity of associated symptoms (Barr et al., 2013). Pharmacological treatment options are limited with typical antipsychotics, atypical antipsychotics, and more recently dexmedetomidine, a selective α_2 -agonist with sedative, analgesic and sympatholytic properties, being the most frequently used (Myatra, 2014; Zaal & Slooter, 2012).

Impacts of Delirium

Increasing evidence is emerging concerning the impact of delirium. These include not only increased healthcare costs but also long-term cognitive impairment with memory, attention and executive functioning challenges, decreased ability to return to work, diminished activities of daily living, and the need for long-term care (Brummel et al., 2013; Devlin, Brummel, & Al-Qadheeb, 2012; Faria & Moreno, 2013). As many as 30-40% of patients suffering delirium in the ICU still experience significant symptoms at hospital discharge necessitating transfer to 'skilled nursing facilities' or nursing homes (Harrington & Vardi, 2014). Limited research is available on the long-term effects of delirium on ICU survivors; however, recent findings have demonstrated delirious patients were much more likely to report no recall of their ICU stay and have significantly less factual recall with a higher occurrence of paranoid delusions (Svenningsen et al., 2013). Cognitive impairment has been found to be similar to patients who have suffered a

moderate traumatic brain injury or mild Alzheimer's disease (Pandharipande et al., 2013). Duration of delirium in the ICU was independently associated with poorer executive functioning and long-term cognitive impairment; age was not a factor (Pandharipande et al., 2013). These findings are concerning from a societal perspective as a significant number of survivors experience long-term negative cognitive effects in their productive earning years.

Delirium Screening Practices

Recommendations from the Society of Critical Care Medicine (SCCM) call for routine delirium assessment with an objective validated screening tool. The Intensive Care Delirium Screening Checklist (ICDSC) (see Appendix B) and the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) (see Appendix C) are clinically validated for use in the ICU setting (Barr et al., 2013; Bergeron, Dubois, Dumont, Dial, & Skrobik, 2001; Ely et al., 2001). There remains, however, a large discrepancy in delirium screening practices internationally with the practice of routine delirium assessments ranging from 7% - 97% (Eastwood, Peck, Bellomo, Baldwin, & Reade, 2012; Elliot, 2014; Pun et al., 2005). Considering the prevalence and significance of ICU delirium, this is clearly insufficient.

Barriers to screening. Research aimed at understanding the barriers associated with routine delirium screening at the bedside has highlighted several important impediments. Consistently identified in the literature, these barriers include: lack of time, lack of knowledge related to delirium, difficulty assessing patients who are intubated and sedated, perceived complexity of screening tools, lack of feedback on performance, and lack of physician support (Barr et al., 2013; Devlin, Fong, et al., 2008; Elliot, 2014; Gesin

et al., 2012; Law et al., 2012; Wells, 2012). Interventions aimed at overcoming these barriers ought to facilitate an improvement in screening practices.

Nursing Knowledge of Delirium

Critical care nurses, as the members of the healthcare team who are most intimately involved with the patient, play a significant role in assessing and recognising delirium (Olson, 2012). Understanding predisposing and precipitating risk factors associated with delirium are essential to prevention, early detection, and ultimately managing the condition (Olson, 2012). Nursing knowledge surveys have highlighted a lack of knowledge related to delirium risk factors, its presentation and prevalence (especially the hypoactive subtype), non-pharmacological interventions, associated increase in mortality, and its fluctuating presentation (Devlin, Fong, et al., 2008; Devlin, Marquis, et al., 2008; Elliot, 2014; Hamdan-Mansour, Farhan, Othman, & Yacoub, 2010; Speed, 2015).

Educational Interventions

Educational interventions aimed at improving nursing knowledge of delirium and training in the use of delirium screening tools are effective at overcoming perceived barriers (Devlin, Marquis, et al., 2008; Gesin et al., 2012; Pun et al., 2005; Scott, McIlveney, & Mallice, 2013; Speed, 2015). A multifaceted approach appears to be the most effective means of improving the understanding of delirium, associated risk factors, preventative measures, and improving rates of routine screening at the bedside (Devlin, Marquis, et al., 2008; Gesin et al., 2012). Interventions should incorporate a combination of traditional didactic teaching, PowerPoint presentation, interactive discussion, case

study, bedside demonstration, and providing reference material at the bedside (Gesin et al., 2012; Scott et al., 2013; Speed, 2015).

Purpose of the Study

This study explored the long-term effects of a multifaceted education program on delirium knowledge and the use of the Intensive Care Delirium Screening Checklist (ICDSC) within a general 18-bed ICU in a large Canadian tertiary centre hospital. As part of an 18-month quality improvement (QI) initiative within the subject ICU, a quasi-experimental quantitative study was designed by myself and carried out with assistance of the clinical nurse educator (CNE) to monitor progress of the project. Data gathered from the QI initiative were employed as a secondary purpose to explore the research hypothesis.

The ICDSC was the approved screening tool in use in the subject ICU, however, no official unit policy stipulated the frequency of use. Screening was not being performed routinely and many nurses were either unaware of the tool or did not know how to use it. The goal of the QI initiative was to increase delirium screening using the ICDSC to once per shift (e.g., once every 12 hours).

Research Question/Hypothesis

For this research, I hypothesized that with an increase in understanding of both delirium and a validated screening tool, critical care nurses would recognise the importance of managing this syndrome. This improved knowledge and perception of the ICDSC would result in critical care nurses incorporating delirium screening into their routine patient assessment.

Definition of Terms

1. *Knowledge*: the information, understanding and skills gained through education or experience ("Knowledge," 2015).

Operational definition: Knowledge was defined as an understanding of delirium and the ICDSC.

2. *Perception*: an idea or belief held as a result of how something is seen or understood ("Perception," 2015).

Operational definition: Perception of the ICDSC was defined as the opinion nurses' hold of the assessment tool.

3. *Compliance*: the process of obeying instructions or requests made by people in authority to meet standards of practice ("Compliance," 2015).

Operational definition: Compliance was defined as the rate of valid ICDSC scores being documented.

One specific question guided my research:

Does a multifaceted education program on delirium and the Intensive Care Delirium Screening Checklist (ICDSC) improve nurses' knowledge and awareness of the syndrome leading to an increase in compliance with delirium assessment in the ICU promoting early symptom recognition and intervention to minimise the occurrence and impact of delirium in the critical care population?

Within this research question the following sub-questions were explored:

1. Does nursing knowledge of delirium and the ICDSC increase after a multifaceted educational program and can this knowledge be sustained over a longer period?
2. Does nursing perception (opinion) of the ICDSC improve after a multifaceted educational program and if so, is it sustained over the longer term?
3. Is there an increase in compliance with delirium assessment in the ICU post intervention and if so, is compliance maintained over 18 months?

In exploring these questions, I made the following assumption: Because critical care nurses incorporate evidence-based knowledge into their practice, an increase in knowledge of delirium and the ICDSC should result in an increased frequency of delirium assessment. In answering these questions, new knowledge will be gained about the long-term effectiveness of delirium education related to the perception of the ICDSC, and whether an increase in understanding leads to greater compliance with routine delirium assessment in the ICU at the unit level.

Theoretical Framework

Knowledge translation (KT) is a process designed to promote the timely evolution of healthcare practice based on emerging research (Canadian Institutes of Health Research, 2014). Knowledge translation (KT) is defined by the Canadian Institutes of Health Research (CIHR) as “a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically sound application of knowledge to improve health, provide more effective health services and products and strengthen the healthcare system” (Straus, Tetroe, & Graham, 2011, p. 6).

Knowledge-to Action Framework. The knowledge-to-action (KTA) framework is a planned-action process developed by Graham et al. to facilitate knowledge translation (Graham et al., 2006). The KTA framework is divided into two components: knowledge creation and the action cycle (disseminating and monitoring knowledge) (See Appendix D). The CIHR supports and promotes the use of this framework as it provides a dynamic, clear, and methodical approach to effective knowledge translation (CIHR, 2014). KTA is one of the few knowledge translation frameworks that has been tested, supporting its credibility and encouraging the involvement of a multidisciplinary team to facilitate change (Bjork et al., 2013; Tetroe, 2007). It is for these reasons that this framework was chosen to guide the process.

Manuscript Overview

This manuscript style thesis consists of two interrelated manuscripts intended for publication. The first manuscript is a broad-based review of the delirium syndrome and implications for nursing. The information contained in the first manuscript was the foundation of the design of the educational intervention in the quantitative study that followed. The second manuscript is a quantitative analysis of the effectiveness of a multifaceted educational intervention in my ICU in promoting improved compliance with delirium screening with a validated tool over the long term.

Manuscript 1: *Delirium in the Intensive Care Unit – a Nursing Refresher*

This manuscript formed the foundation for the educational intervention utilised in the QI initiative and quantitative study. A critical review of the literature on delirium and current management practices highlighted areas consistently identified as barriers to

effective delirium screening. The manuscript, therefore, was written as a delirium summary and refresher for critical care nurses to address the nursing knowledge-practice gap in delirium that continues to exist in the ICU. Content of this manuscript focuses on nursing knowledge of delirium, its impact on the patient, screening tools, mitigation strategies, and pharmacological interventions. Addressing these areas enabled the customisation of a multi-faceted educational intervention to focus on known barriers.

This manuscript has been accepted for publication in *Canadian Journal of Critical Care Nursing* (Hickin, White, & Knopp-Sihota, In Press).

Manuscript 2: *Nurses' Knowledge and Perception of Delirium Screening and Assessment in the Intensive Care Unit: Long-term Effectiveness of an Education-Based Knowledge Translation Intervention*

In this manuscript, I explored the effectiveness of education aimed at increasing the understanding by critical care nurses of delirium and improving delirium screening compliance with a validated tool over time. This manuscript encompasses the main component of the thesis study and describes the process of the educational intervention, the measures taken to assess the impact of the intervention, and the subsequent findings.

A multifaceted educational intervention, designed primarily by myself along with the CNE (S. White) from the ICU in which the study took place, was delivered to critical care nurses during an annual education day. Nursing knowledge of delirium and perception of the ICDSC – the approved validated assessment tool for the ICU in question – was tested prior to the educational intervention, 3-months after completion and again at 18-months (See Appendix E). This timeframe was chosen as a feasible length for

the QI initiative; in addition, data collection methods within the Critical Care Data base changed significantly after the 18-month period limiting further data comparison. This study demonstrated a positive impact of education on delirium knowledge and perception in the short term; however, results were not sustained. Continued use of the ICDSC did improve the perception of the tool over time and screening compliance increased over the long term.

The work undertaken by the QI initiative, including some of the findings of this paper were presented at the BC Patient Safety and Quality Council Quality Forum 2016 and at Dynamics, the Canadian Critical Care Nursing Conference 2016. This manuscript has been published in *Intensive and Critical Care Nursing* (Hickin, White, & Knopp-Sihota, 2017).

When taken together these two manuscripts provide a comprehensive overview of this research initiative.

Significance of Findings

The gap in understanding of delirium by nurses remains a significant barrier to implementing routine delirium screening in the ICU. This research addresses strategies required to reduce the knowledge-practice gap and the method in which to disseminate this knowledge. Critical care nurses require evidence-based research before incorporating practice changes. Understanding the impact of delirium on patient outcomes, risk factors, screening tools, and associated mitigation techniques is an important step towards implementing an effective delirium screening program. Using a multifaceted approach to disseminate current delirium knowledge is an effective method.

The implementation of a multi-faceted education program was effective in increasing nursing knowledge of delirium and the ICDSC in the short term. Cohen's effect size value ($d = 0.89$) indicated a high practical significance. These findings support the results of other similar studies. The long-term retention of knowledge, however, was not maintained and in fact had a moderately negative effect size ($d = -0.56$). This finding indicates that it would be beneficial to have regular educational interventions available to maintain initial gains in knowledge. Passive knowledge transfer, in the form of posters and reminders, was not effective in sustaining the learning. Active knowledge transfer may be more effective in promoting knowledge retention.

The second research question explored nurses' perceptions of the ICDSC tool over four domains: knowledge of delirium and the tool, confidence in its use, its utility in terms of identifying delirium, and physicians' value of the tool. While there was no significant change in nurses' perception of their knowledge of delirium and the ICDSC or confidence in using the tool from the initial assessment, the majority of nurses held positive opinions throughout the study in these domains. As with knowledge about delirium, these results indicate that regular active knowledge transfer may be more effective in increasing confidence with using the tool. Educating a smaller group of nurses to be confident and consistent with their assessments, and having them available to the remainder of the nursing staff as mentors, may be effective in boosting both knowledge acquisition and retention as well as confidence with using the ICDSC.

The perception of the utility of the ICDSC increased after education and remained high at the end of the study with a moderate effect size at both testing points ($d = 0.63$ and $d = 0.67$ respectively). The majority of nurses recognised a benefit of incorporating

the tool as part of their comprehensive patient assessment. Nurses' perception of physicians' value of the tool increased by the end of the study but retained a negative perception overall. While statistically significant, Cohen's $d = 0.23$ indicated only a small effect size. These results may reflect that ICU physicians were not directly involved with the QI initiative and changes in practice were nurse focused and nurse driven. Educational interventions aimed at the physician group may be an effective method of increasing their opinion of this resource.

The third research question examined whether there was an increase in compliance with delirium assessments after the intervention was implemented. Delirium screening rates increased from 38.6% (SD 0.05) to 48.2% (SD 0.03) after education and despite a few periods of lower compliance, thought to be associated with other initiatives being introduced during the study period, achieved an overall positive increase to 66.5% (SD 0.04) at 18 months. The effect size before and after education was large ($d = 0.87$) suggesting a high practical value of education. The final screening rates, however, leave significant room for improvement. While knowledge transfer in the form of reminders appears to be effective in increasing screening rates, incorporating regular periods of active knowledge transfer may improve rates even more. While it is unrealistic to expect 100% compliance, higher rates are achievable and realistic.

These results indicate the beginning of a shift in the culture of this ICU in regards to delirium screening practices. The benefits of a multi-faceted educational intervention were realised as were lessons learned regarding more active knowledge transfer to sustain the knowledge.

Limitations

There are several limitations associated with this study. Firstly, as data were already gathered for the QI initiative used for the secondary purpose of this thesis, there was no opportunity to modify data elements and collection procedures. This limitation is somewhat tempered by the fact that I designed the data collection for the initial QI initiative with the possibility of this thesis as a consideration. Secondly, a separate control group and randomization were not feasible as the QI initiative targeted the entire ICU nursing population. This limits the ability to determine causation for any changes observed as well as the generalizability of the results to other populations. A third limitation is the assumption that participants completed the self-reported survey accurately and thoughtfully, however, there is no way to determine the validity of the assumption. This may impact the accuracy of the results.

The longitudinal nature of this study and the reality of the healthcare system introduce confounders that cannot be controlled for in the study design. These include factors such as other Regional initiatives being introduced during the study period, such as Nursing Standards of Care, that may have positively or negatively influenced attitudes and screening compliance. As well, ongoing changes in unit nursing staff composition may have affected knowledge and attitude scores as newer nurses may have chosen not to review the educational materials prior to completing the knowledge survey.

Finally, nurses were not tested for accuracy with using the ICDSC. Other studies have indicated that education does increase accuracy with the screening tool; however, further research is needed to determine the frequency of education reinforcement required to ensure skill is being maintained.

Conclusion

The research produced as a result of this thesis provides a resource for understanding delirium and facilitating the implementation of effective delirium screening. The first paper provides critical care nurses with a clear and succinct delirium resource to bridge the knowledge-practice gap. The content of this paper formed the foundation for the multi-faceted educational intervention employed in the research study described in the second paper. This paper describes the impact of education on nurses' knowledge and perception of delirium and the ICDSC and identifies gaps in knowledge retention over the long-term.

Contribution

This master's thesis contributes to new knowledge in several ways. This work is a replication and extension of existing knowledge in the area of bridging the delirium nursing knowledge practice gap through multi-faceted education. It expands the previous work undertaken by Gesin et al. (2012) by including all nursing staff of the ICU in the sample. By achieving similar results as Gesin et al. in the short term, the study demonstrated the effectiveness of KT on a larger scale; however, the results from the follow-up reinforces that passive KT is not effective suggesting that active KT is needed to maintain knowledge levels.

This work also extended work undertaken by Law et al. (2013) in examining nurses' perception of the ICDSC. I examined perceptions prior to and after education and again at a longer-term follow-up. These findings demonstrated changes in perception of

the tool over time providing information on barriers to knowledge retention and routine delirium screening.

Finally, by incorporating the trending of delirium screening rates prior to and after education as an indicator of change, I have demonstrated a long-term positive change in routine delirium assessment is possible.

There are several implications to these findings. We know that longer-term change in delirium screening practice is possible with education and that a greater understanding of delirium and the ICDSC may lead nurses to find value in incorporating the ICDSC into routine delirium. At the same time, knowledge gained from an effective multi-faceted educational program cannot be maintained with only passive knowledge transfer. Formal knowledge reviews to facilitate active knowledge transfer are necessary. The lack of change associated with the nurses' perception of their knowledge of delirium and the ICDSC, and confidence in performing assessments with the tool reflects this need.

Increases in compliance rates over the course of the study may reflect the increased positive perception in the utility of the ICDSC. As nurses find the tool useful in assessing and reporting their findings, it may be reported on and reacted to more frequently by the physician group. This may be reflected by the positive change in nurses' view of physician opinion of the tool. With increased long-term compliance potential, this could lead to more patients being recognized as being at risk for delirium and measures taken to prevent or mitigate the syndrome.

Future Research

Opportunities for future research have been identified through the course of this study. Active knowledge transfer is necessary to sustain knowledge gains, but similar to other KT studies, the frequency and form of this education needs to be explored. New staff in the ICU need a full introduction to delirium and the ICDSC, while current staff require education directed at a refresher of the tool and an update of the latest research and resources.

As delirium screening frequency increases, the next step will be to assess whether the implementation of non-pharmacologic interventions can reduce the incidence of delirium diagnosis over time. Identifying patients at risk for or experiencing delirium early enables the team to implement measures to prevent or mitigate symptoms and sequelae.

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Chapter 2: Paper #1**Delirium in the Intensive Care Unit – a Nursing Refresher****Abstract**

Delirium is a frequent yet poorly assessed and managed complication in the intensive care unit (ICU). Morbidity and mortality increase with delirium; and cognitive impairment often persists after hospital discharge affecting quality of life and ability to function independently.

Interdisciplinary delirium prevention and mitigation strategies are necessary to effectively assess and manage this syndrome with critical care nurses playing a key role in the process. Lack of nursing knowledge has been identified as a key barrier to comprehensive delirium assessments.

Understanding delirium, including the identification of key presenting symptoms, and associated risk factors, is essential for bedside nurses to employ effective assessment and management strategies. This article provides nurses with a concise review of delirium from assessment to management for critically ill patients in the adult ICU environment.

Delirium in the Intensive Care Unit – A Nursing Refresher

Delirium is a frequent complication in the intensive care unit (ICU). Previously considered an inevitable and unimportant side effect of critical illness, its incidence is higher than initially realized; it significantly impacts morbidity and mortality, healthcare costs, and other long term effects on the patient and society (Devlin, Brummel, & Al-Qadheeb, 2012). As a result, the Society of Critical Care Medicine (SCCM) released clinical practice guidelines for the management of pain, agitation, and delirium (PAD) recommending an interdisciplinary management approach and the use of validated screening tools (Barr et al., 2013). Despite the explosion of research on the pathophysiology of delirium, its prevention, management, and mitigating long term sequelae, delirium in the ICU remains poorly understood and assessed by many nurses.

Delirium

Delirium is characterized by an acute onset of cerebral dysfunction associated with fluctuating mental status, inattention, and *either* disorganized thinking *or* an altered level of consciousness (Barr et al., 2013). The American Psychiatric Association updated its delirium diagnosis criteria to include the requirement that these symptoms be a deviation from baseline and not associated with another neurocognitive disorder, and are the result of a somatic factor, medication intoxication, or withdrawal (Brummel et al., 2013). Delirium traditionally presents as one of three subtypes: hyperactive, hypoactive, and mixed (Table 1).

Emerging Manifestations of Delirium

In addition to the major subtypes, two newly recognized variants of delirium have been described: subsyndromal delirium and rapidly reversible sedation-related delirium. In

subsyndromal delirium, patients exhibit some of the signs and symptoms associated with delirium but do not progress to full presentation. Patients experience similar complications to those who develop delirium but to a lesser extent; it may be more preventable (Ouimet, Riker et al., 2007). Rapidly reversible, sedation-related delirium is defined as delirium that resolves quickly (within a 2 hour period) when sedation is discontinued (Patel, Poston, Pohlman, Hall, & Kress, 2014). This sub-type demonstrates similar outcomes to patients with no delirium.

Risk Factors for Delirium

In order to mitigate delirium's effects, understanding risk factors associated with the condition is important. Risk factors can be classified in three main categories: the nature of the acute illness, predisposing factors related to baseline health status, and precipitating iatrogenic or environmental factors (Faria & Moreno, 2013; Pun & Ely, 2007). These broad categories encompass numerous factors identified as contributing to an increased risk of delirium.

Baseline or predisposing risk factors include advanced age, hypertension, smoking and alcohol dependence, depression, chronic illness, cognitive dysfunction, dementia, and sensory impairment (Arend & Christensen, 2009; Brummel et al., 2013; Olson, 2012). The 2013 PAD Guidelines, identify the four most frequently associated predisposing risk factors for developing delirium as pre-existing dementia, high severity of illness on admission, a history of hypertension, and a history of alcohol dependence (Barr et al., 2013).

Precipitating risk factors are numerous and can be grouped into iatrogenic and environmental (Table 2). Being modifiable, they are the focus of delirium management. Recognizing those patients already at risk due to underlying factors enables clinicians to focus on reducing the effects of these modifiable risk factors.

Clinical Presentation in the ICU

Delirium in the ICU manifests with multiple signs and symptoms (Table 1). Many signs are subtle and easy to miss, especially as most ICU patients are admitted in a state of decreased consciousness making establishing baseline neurological status challenging. Confusion regarding orientation to place and time or responses unrelated to questions are early indicators of changing mental status (Harrington & Vardi, 2014). Inattention may become apparent as the patient is initially able to focus during an assessment but becomes easily distracted or does not engage with others (Harrington & Vardi, 2014; Svenningsen et al., 2014). Changes occur acutely over hours or days but always within a condensed timeframe and fluctuate, often following a diurnal pattern (Svenningsen et al., 2014).

Agitation and restlessness are easy to identify in patients with hyperactive delirium; however, the motor retardation that accompanies hypoactive delirium may be mistaken for depression or sedation effects (Harrington & Vardi, 2014). Other common psychological symptoms include anxiety, emotional lability, apathy, tearfulness, withdrawal, disinhibition, disordered thinking, visual or audio hallucinations, and delusions (Harrington & Vardi, 2014; Svenningsen et al., 2014). Sleep disturbance is common with many experiencing day/night reversal. Historically, symptoms have been disregarded on the assumption that they reflected a normal response to critical illness. As more is known about delirium, it is apparent that these symptoms are in fact associated with a serious brain dysfunction. Consistent assessment is the key to recognizing delirium early and mitigating potential long term effects.

Delirium Assessment

Critical care nurses, as the members of the healthcare team most intimately involved with the patient, play a significant role in assessing and recognizing delirium (Olson, 2012). Studies have established that validated objective screening tools are essential in monitoring and diagnosing delirium in critically ill patients (Pandharipande et al., 2013). The Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) are the only delirium screening tools clinically validated for use in the ICU (Barr et al., 2013; Bergeron, Dubois, Dumont, Dial, & Skrobik, 2001; Ely et al., 2001). These tools, while effective, are not widely used despite recommendations for routine delirium screening of all critically ill patients (Barr et al., 2013).

Confusion assessment method for ICU. The CAM-ICU assesses four features of delirium: an acute onset of mental status changes or a fluctuating course, inattention, disorganized thinking, and an altered level of consciousness (Ely et al., 2001). The ICU version of the tool was developed from the original CAM for use with intubated patients and provides a snap-shot of a patient's mental state at the time of assessment (Devlin et al., 2012). To be identified as delirious, patients need to have a positive screen for both an acute onset of mental status changes or a fluctuating course and inattention along with either disorganized thinking or an altered level of consciousness (Ely et al., 2001). This tool is available at www.icudelirium.org.

Intensive care delirium screening checklist. The ICDSC a straightforward eight-point screening tool for use with intubated patients based on the DSM-IV delirium diagnosis criteria. Specifically, it evaluates altered level of consciousness, inattention, disorientation, hallucination or delusion, psychomotor agitation or retardation, inappropriate mood or speech, sleep/wake

cycle disturbance, and system fluctuation (Bergeron et al., 2001). The ICDSC takes into account symptom fluctuation over the course of a 24-hour period (Devlin et al., 2012). The first four screening questions refer to the first two elements of the DSM-IV criteria for a diagnosis of delirium (Bergeron et al., 2001). A patient is identified as delirious if they have at least four features present. A benefit of using the ICDSC to assess delirium is the ability to detect (score 1-3) and manage subsyndromal delirium (Devlin et al., 2012; Ouimet, Riker et al., 2007). This tool is available at <http://www.iculiberation.org/Bundles/Pages/Delirium.aspx>

When used consistently by appropriately trained practitioners, both tools are found to be reliable methods of establishing the presence of delirium in the ICU setting. These tools are, however, not appropriate as a single means of determining a diagnosis of delirium in sedated patients.

Delirium Screening and Sedation

The CAM-ICU and the ICDSC are endorsed for responsive patients and designed for use in conjunction with a sedation scale to assess level of patient arousal. The Sedation-Agitation Scale (SAS: 1 to 7) and the Richmond Agitation and Sedation Scale (RASS: -5 to +4) are clinically validated for use with the ICU population (Barr et al., 2013; Khan et al., 2012; Riker, Picard, & Fraser, 1999; Sessler et al., 2002). Both scales rate level of patient arousal ranging from comatose to highly agitated and have been compared in multiple studies demonstrating a high level of agreement (Khan et al., 2012; Sessler et al., 2002).

There is disagreement related to the minimum/maximum level of arousal/sedation that can be reliably screened using these tools. In some studies, a score of SAS ≥ 3 or RASS ≥ -3 (moderately sedated) has been found to be the cut-off while other studies have determined SAS

>3 or RASS > 3 (lightly sedated) is the boundary (Gesin, Russell, Lin, Evans, & Devlin, 2012; Khan et al., 2012). The impact of sedation on the ability to respond may lead to false positive screening results. Due to this reason, the practice of screening at a level of light sedation is becoming more common in ICU bedside practice (Gusmao-Flores, Martins, Amorin, & Quarantini, 2014).

Management of Delirium

Non-Pharmacologic Treatment

The primary treatment of delirium is aimed at correcting underlying illness and minimizing precipitating factors. The ICU is busy, noisy and at times an environment of controlled chaos. Consequently, non-pharmacologic treatments aim to reduce environmental sensory overload in an effort to minimize delirium incidence and severity. A comprehensive approach is the most effective and includes factors such as early mobility, restoring day/night cycles, promoting sleep with reduced noise and interruptions, decreasing sensory overload, and reducing visual and hearing impairment (Choi, 2013; Pun & Ely, 2007; Zaal & Slooter, 2012). Modifications such as these were implemented in a study of medical geriatric patients outside of the ICU, and demonstrated a 40% reduction in episodes of delirium; these results have been the basis of non-pharmacological approaches in the ICU (Pun & Ely, 2007).

Early mobility is the only evidence-based non-pharmacologic intervention clearly demonstrated to reduce the risk of delirium in the critical care population (Schweickert et al., 2009). Two multicentre randomized controlled trial studies on mobilization saw a significant reduction in delirium, depth of sedation, ventilator days, and both ICU and hospital length of stay

leading the PAD guidelines to recommend early mobility as a key component in reducing and preventing delirium (Barr et al., 2013; Schweickert et al., 2009).

Sleep deprivation not only impairs healing, but also considerably enhances delirium. Sleep promotion through the implementation of noise and light control, clustering activities, and decreasing stimulus at night is recommended (Barr et al., 2013). One ICU limited nursing activity during the night (between 2300-0400 hrs) resulting in a significant decrease in noise and unnecessary night time visits (Brand, 2014). These efforts demonstrate simple and positive steps towards the reduction of delirium through sleep promotion.

Some interventions are not evidence-based but rather underwritten by common sense and critical thinking. Many ICU rooms do not have natural light and the day/night cycle must be mimicked with artificial lighting. Sensory overload from frequent alarms, loud bedside discussions, and hallway noise can be reduced by tailoring alarms and closing doors (Pun & Ely, 2007). Visual, hearing, and speech impairment can be reduced by ensuring patients have their glasses, hearing aids, and dentures in situ (Choi, 2013). Frequent re-orientation and explanation of activities along with simple memory aids such as whiteboards with basic date/time and location information accompanied by caregivers' names can help reduce confusion (Choi, 2013; Pun & Ely, 2007). Effective delirium mitigation must have both multidisciplinary and multimodal approaches to be effective.

Pharmacological Treatment Options

Unfortunately, not all delirium can be treated with non-pharmacological approaches. Treating underlying medical conditions frequently requires medications that may also increase the risk for developing delirium. Although antipsychotic medications are not recommended in

the prevention of delirium they are often used in managing and reducing the severity of associated symptoms (Barr et al., 2013). Pharmacological treatment options are limited with typical antipsychotics, atypical antipsychotics, and more recently dexmedetomidine most frequently used (Zaal & Slooter, 2012).

Typical or first generation antipsychotics, namely haloperidol, are the mainstay for treating hyperactive delirium symptoms in the ICU. There is no evidence, however, that haloperidol decreases the duration of delirium (Barr et al., 2013). It blocks dopaminergic receptors, disinhibits acetylcholine and has anti-inflammatory properties (Kalabalik, Brunetti, & El-Srougy, 2014). It reduces agitation while improving mental cognition and can be administered intravenously making it an ideal drug in the critical care setting (Zaal & Slooter, 2012). Significant side effects, especially when given in higher doses, include extrapyramidal symptoms, neuroleptic malignant syndrome, tardive dyskinesia, QT prolongation, hyper/hypotension, tachycardia, and torsade de pointes (Kalabalik et al., 2014; Zaal & Slooter, 2012). Frequent cardiac monitoring is required as a prolonged QT interval necessitates terminating the medication immediately.

Atypical or second generation antipsychotics are used to treat delirium in ICU patients although less often. This group of drugs has a reduced affinity for dopamine receptors when compared to typical antipsychotics (Kalabalik et al., 2014). This class of drugs has similar side effects to typical antipsychotics but at a lower frequency (Zaal & Slooter, 2012). Many of these medications are only available in oral form making drug uptake less reliable and not practical with highly agitated patients (Zaal & Slooter, 2012).

Dexmedetomidine, a relatively new drug on the market, is a highly selective α_2 -agonist with sedative, analgesic and sympatholytic properties (Myatra, 2014). Initially it was developed

as short-term sedation for weaning post-op patients from the ventilator; however, it has proven to be an effective tool in liberating delirious patients from the ventilator (Zaal & Slooter, 2012).

This allows the symptom management of a patient with hyperactive or mixed delirium without the respiratory depression associated with benzodiazapines. Side effects include both transient and/or prolonged hypotension, bradycardia, and an exaggerated startle response (Myatra, 2014).

With emerging evidence of the deliriogenic effects of benzodiazapines and the positive results achieved with dexmedetomidine, this medication may not only be effective for managing delirium but may be a good primary sedative choice for reducing or preventing delirium.

Impact of Delirium: Nursing Implications

Patients who develop delirium during their ICU admission require greater nursing care both within the ICU and on the general wards. ICU admissions prolonged by delirium, not only impact the resources available to other patients, but also negatively affect patient outcomes.

Patients with hypoactive delirium are at increased risk of prolonged ventilation time, re-intubation, aspiration, and ventilator-acquired pneumonia (Faria & Moreno, 2013; Kalabalik et al., 2014). Hypoactive delirium occurs more frequently in older patients and has the poorest prognosis; it is also the most frequently missed and, therefore, may remain untreated leading to further complications (Faria & Moreno, 2013).

Manifestations of hyperactive or mixed delirium increase the risk for self-extubation, re-intubation, removal of intravenous and monitoring lines thus causing self-harm, as well as the potential harm to staff. Once sedated to control hyperactive symptoms, patients are at risk for the same complications as those with hypoactive delirium (Faria & Moreno, 2013; Olson, 2012).

Physiologically, hyperactive delirium may have negative sequelae including ventilator

dyssynchrony and increased myocardial stress; in the context of an acute critical illness, this may become life-threatening (Kalabalik et al., 2014).

Increasing evidence is emerging regarding the long-term effects of delirium. Those associated with long-term cognitive impairments include memory, attention and executive functioning challenges, decreased ability to return to work, diminished activities of daily living, the need for long-term care, and increased healthcare costs (Brummel et al., 2013; Devlin et al., 2012; Faria & Moreno, 2013). As many as 30-40% of ICU patients with delirium experience significant impairment at hospital discharge necessitating transfer to skilled nursing facilities or nursing homes (Harrington & Vardi, 2014). Svenningsen et al. (2014) examined the memory of delirious and non-delirious ICU survivors and found delirious patients much more likely to report no recall of their ICU stay and have significantly less factual recall with a higher occurrence of paranoid delusions.

A multi-centre study published by Pandharipande et al. (2013) demonstrated 40% of patients (at 3-months) and 24% of patients (at 6 months) had cognitive scores similar to those who have suffered a moderate traumatic brain injury. A further 26% and 24%, respectively, scored similarly to patients with mild Alzheimer's disease (Pandharipande et al., 2013). Delirium duration was independently associated with long-term cognitive dysfunction and worse executive function; age was not a factor (Pandharipande et al., 2013). These findings are concerning from a societal perspective as a significant number of survivors experience long-term negative cognitive effects in their productive earning years.

Conclusion

Delirium in the ICU continues to be a challenging syndrome with far-reaching effects on patients, families, the healthcare team, hospitals, and healthcare costs. Emerging research into the long-term delirium sequelae highlights the need for nurses to understand, assess, prevent, identify, and resolve delirium early. Greater knowledge of delirium supports a proactive approach to screening patients, implementing non-pharmacologic interventions and providing treatment to mitigate symptoms. An increased understanding can reduce the impact of delirium for both patients and nursing staff. While strategies to prevent or minimize delirium should be implemented for all patients, it is essential that those who do develop delirium be identified and treated early to improve both short and long-term outcomes.

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Table 1. Characteristics of Delirium Subtypes

Hyperactive	Hypoactive	Mixed
Inattentive, distractible	Inattentive	Inattentive, distractible
Confused to date, time, and/or place	Confused to date, time, and/or place	Confused to date, time, and/or place
Restless, agitated, emotional instability	Withdrawn, flat affect, does not interact	Fluctuating pattern
Pulling at tubes and lines/ increased risk for own and caregiver safety	Motor retardation, little/no spontaneous movement	Fluctuating pattern
May experience hallucinations or delusions	May experience hallucinations or delusions	May experience hallucinations or delusions
Sleep disturbance; day/night reversal	Sleep disturbance; day/night reversal	Sleep disturbance; day/night reversal
1.6% occurrence	43.5% occurrence	54.9% occurrence
Patients almost exclusively under 65	Most frequently missed	At risk for complications associated with both subtypes
Associated with drug intoxication or acute withdrawal	Poorest outcome	

Table 2. Precipitating Delirium Risk Factors**Iatrogenic**

- | | |
|--|--|
| <ul style="list-style-type: none"> • hypoxia • acute infection • intracranial events • electrolyte imbalance • seizures • benzodiazapine infusions | <ul style="list-style-type: none"> • metabolic disturbance • uncontrolled pain • medication • withdrawal states • dehydration |
|--|--|

Environmental

- | | |
|--|---|
| <ul style="list-style-type: none"> • sleep deprivation • immobilisation • sensory overload – alarms • elevated noise levels • unfamiliar surroundings | <ul style="list-style-type: none"> • visual/hearing impairment • lack of windows • lack of exposure to daylight • disorientation • isolation from family |
|--|---|

Chapter 3: Paper #2

Nurses' Knowledge and Perception of Delirium Screening and Assessment in the Intensive Care Unit: Long-term Effectiveness of an Education-Based Knowledge Translation Intervention

Abstract

Objectives: To determine the impact of education on nurses' knowledge of delirium, knowledge and perception of a validated screening tool, and delirium screening in the ICU.

Methods: A quasi-experimental single group pretest-post-test design.

Setting: A 16 bed ICU in a Canadian urban tertiary care center.

Main Outcome Measures: Nursing knowledge and perception were measured at baseline, 3-month and 18-month periods. Delirium screening was then assessed over 24-months.

Results: During the study period, 197 surveys were returned; 84 at baseline, 53 at 3-months post education, and 60 at the final assessment period 18-months post intervention. The significant improvements in mean knowledge scores at 3-months post intervention (7.2, SD 1.3) were not maintained at 18-months (5.3, SD 1.1). Screening tool perception scores remained unchanged. Improvements in the perception of utility were significant at both time periods ($p = 0.03$, 0.02 respectively). Physician value significantly improved at 18-months ($p = 0.01$). Delirium screening frequency improved after education ($p < 0.001$) demonstrating a positive correlation over time ($p < 0.01$).

Conclusion: Multifaceted education is effective in improving delirium knowledge and screening; however, without sustained effort, progress is transient. Education improved perceived tool utility and over time utility perception and physician value improved.

Keywords:

Delirium, Screening, ICDSC, Critical care, Nursing knowledge, Multifaceted education

Implications for Clinical Practice

- *Multifaceted education is effective in improving nursing knowledge of delirium and the Intensive Care Delirium Screening Checklist (ICDSC)*
- *The long-term gains in knowledge are not maintained with passive education; research is needed into the optimum frequency of active education*
- *Improved perception and acceptance of the ICDSC is realised over time*
- *Delirium screening rates improved after education and were sustained over the longer period*

Introduction

Delirium associated with critical illness is a serious problem affecting up to 80% of ventilated patients in intensive care units (ICU) (Ely et al., 2001). In the last decade, the understanding of associated risk factors, symptom manifestation, diagnostic and treatment options, and the overall impact of delirium has advanced. Despite improvements, delirium remains poorly managed (Devlin et al., 2008a). Short-term educational interventions have demonstrated a positive correlation between delirium knowledge, screening practices and effectiveness of delirium management; however, without ongoing educational interventions, long-term delirium management advances will not occur (Devlin et al., 2008b; Gesin et al., 2012; Speed, 2015). This research assesses the impact of nursing delirium and screening education on long-term compliance with performing routine delirium assessment in the ICU. We hypothesize that an increased understanding of delirium and screening tools will result in an increase in routine delirium assessment by critical care nurses.

Background

Delirium

Delirium is an acute syndrome characterised by: 1) a disturbed level of consciousness with a decreased ability to focus, sustain, or shift attention; and 2) either a change in cognition or the manifestation of perceptual disturbances (Barr et al., 2013). Symptoms are a deviation from baseline, not associated with another neurocognitive disorder, and the result of a somatic factor, medication intoxication, or withdrawal (American Psychiatric Association, 2013). Rates of delirium in ICU patients range from 20-50% in non-ventilated patients and 68-80% in ventilated patients (Pun & Ely, 2007). Delirium significantly increases morbidity and mortality, prolongs

ICU and overall hospital length of stay increasing health care costs (Ely et al., 2004; Olson, 2012; Ouimet, Kavanagh et al., 2007; Pandharipande et al., 2013; Reade et al., 2014). Despite recommendations for increased delirium screening frequency, rates remain low overall (Devlin et al., 2008a; Eastwood et al., 2012; Elliot, 2014; Pun et al., 2005). Barriers to routine delirium screening include time pressures, difficulty assessing intubated and sedated patients, perceived complexity of assessment tools, lack of physician support, and lack of general delirium knowledge (Devlin et al., 2008a; Elliot, 2014; Gesin et al., 2012; Law et al., 2012; Wells, 2012).

Delirium Screening Tools

Critical care nurses play a significant role in assessing and recognising delirium (Olson, 2012). Employing a validated objective delirium screening tool is essential as subjective delirium assessments greatly underestimate ICU-related delirium prevalence (Guenther et al., 2012). The Intensive Care Delirium Screening Checklist (ICDSC) is an 8-point tool based on the DSM-IV criteria to diagnose delirium (Barr et al., 2013; Bergeron et al., 2001; Ely et al., 2001). Specifically, it evaluates altered levels of consciousness, inattention, disorientation, hallucination or delusion, psychomotor agitation or retardation, inappropriate mood or speech, sleep/wake cycle disturbance, and system fluctuation (Bergeron et al., 2001). One point is awarded for the presence of each symptom.

Design & Methods

We used a quasi-experimental single group pretest-post-test design to determine if a focused educational intervention for critical care nurses is effective in increasing long-term delirium knowledge and improving perception and rates of routine delirium screening in the ICU. This study was part of a larger quality improvement initiative to improve ICU delirium

management in a 16-bed unit of a tertiary hospital in a large urban centre in Vancouver, Canada. We used the knowledge-to-action (KTA) framework to guide our educational intervention. The KTA framework is a planned action process to facilitate knowledge translation. Firstly, theoretical knowledge is distilled into a useable form for the target audience and then activities are identified for knowledge application (Straus et al., 2011). Although all ICU team members were involved in the larger project, this study focused on critical care nurses. The study timeline is presented in Figure 1.

Ethics Approval

The hospital Research Ethics Board (REB) was contacted to confirm that the QI initiative did not require ethics approval prior to administering surveys. Permission was obtained from both Athabasca University (22012) and the hospital (FHREB 2015-119) REBs for use of all data for the secondary purpose of this study.

Permissions were received from the corresponding authors for use of the surveys employed in this study. Participant consent was implied by survey completion.

Sample

All permanent certified critical-care nursing staff employed in the ICU between October 4, 2013 and March 31, 2015 were eligible for the study. At the initial and post-intervention data-collection points, approximately 130 nurses met the inclusion criteria and were eligible for the study. This number decreased to 125 by the final data collection period. Non-nursing staff, nurses not permanently employed in the unit (e.g., float nurses) and nurses completing critical care clinical placements were excluded. Non-random convenience sampling techniques were used to obtain the sample.

Educational Intervention

A multifaceted educational knowledge translation (KT) intervention was presented to participants during an annual ICU educational refresher. This consisted of PowerPoint presentations incorporating information on delirium, patient testimonial, the ICDSC, and procedures for using the screening tool. Similar information was also emailed to participants and posted on a SharePoint site. To reinforce the teachings, unit level and individualized bedside follow up was provided. The formal educational intervention phase lasted approximately one month. Subsequent informal education included screening reminders from Clinical Resource Nurses (CRN), email reminders, and the display of delirium and the ICDSC “Fast-Fact” posters were ongoing throughout the following year.

Data Collection Procedures

There were three separate survey collection periods: at baseline prior to the intervention, and then again 3-months and 18-months post educational intervention. See study timeline in Figure 1.

The Survey

A knowledge and perception assessment survey was created by combining two existing tools (Supplemental File A) (Gesinde et al., 2012; Law et al., 2012). To obtain baseline data, the first survey was administered (using paper and pen) prior to the initial educational intervention. Those not attending the formal education session, but had reviewed the session materials, were invited to complete a paper or electronic version of the survey; this survey period was open for approximately one month.

The second and third surveys were made available electronically with the link emailed to all ICU nursing staff and as a paper copy placed in individual mail slots (See timeline in Figure 1). Nurses then choose their preferred method to complete the survey. The survey period for each subsequent survey was approximately three weeks.

Measurement

Knowledge. Delirium and ICDSC-specific knowledge were measured using a 10-question multiple-choice quiz with knowledge questions validated for use in the previous study (Gesin et al., 2012). Three equivalent versions of the questionnaire were administered at the 3 separate testing points.

Perception. Perception of the ICDSC was measured using a 12-question, 5-point Likert scale survey with responses ranging from 1=strongly disagree to 5=strongly agree (Law et al., 2012). This scale has been validated in several previous studies and has a high internal reliability ($\alpha = 0.89$). After permissions were received, survey wording was adapted for the ICU context. Nurses' perceptions of the ICDSC were assessed over four domains: knowledge of delirium and the tool, confidence in using it, its utility, and physicians perceived value of the tool.

Delirium screening rates

The local health region tracks ICDSC scores in the Critical Care Database monthly. These data were used to determine delirium screening rates. We grouped ICDSC scores into three categories: documented, not documented, and unable to assess. Patients with scores in the "unable to assess" category were removed from the total number and the ratio of documented scores was calculated for each time period. Data were collected monthly for 6 months prior to

the education initiative to establish a baseline and then monthly for 24 months of ICDSC scoring frequency data (Figure 2).

Data Analysis

We calculated means and standard deviations for interval data, and frequency counts and proportions for categorical data. Knowledge scores at baseline, 3-months, and 18-months were compared using one-way ANOVA. Perception scores were grouped into the four domains (knowledge, confidence, utility, and physician value) and statistical analysis was performed. Kruskal-Wallis test was used to compare mean scores and pairwise comparison employed when significant findings were indicated. ICDSC scores were converted to frequency rates and were compared before and after the completion of the educational intervention using a Mann-Whitney analysis. Correlation analysis of assessment rates over time were performed using Spearman's Rho. All data were analysed using IBM SPSS Statistics, Version 23 (IBM Corp. IBM SPSS Statistics for Windows, Armonk, NY).

Results

During the study period, 197 surveys were returned; 84 at baseline, 53 at 3-months post education, and 60 at the final assessment period 18-months post intervention. No significant differences in age, years of experience as a RN, or years of experience working in the ICU were found across the 3 testing periods (Table 1).

Nursing Knowledge.

Mean knowledge scores (maximum score of 10 on the survey) were 6.0 (SD 1.4; Range 2-9) at baseline, 7.2 (SD 1.3; Range 4-10) 3-months, and 5.3 (SD 1.1; Range 3-8) at 18-months post intervention. There were significant improvements in knowledge scores at 3-months post

intervention ($p < 0.001$). Scores at the 18-month follow-up were significantly lower than the 3-month period but not statistically different from those at baseline ($p = 0.72$). There were no significant differences in knowledge scores related to age, nursing experience or ICU experience ($p > 0.05$).

Nursing Perception.

Mean nursing perception scores (maximum score of 5 on the survey) for the four domains over the three testing periods are shown in Table 2. The mean scores for the nursing knowledge and confidence domains remained unchanged over the three testing periods: $p = 0.43$ and $p = 0.11$, respectively. Statistically significant changes were seen within the utility domain: $p = 0.008$ at both 3-months ($\chi^2 (2, n=189) = 24.76; p = 0.03$) and 18-months ($\chi^2 (2, n=189) = 25.07; p = 0.02$). Physician value also presented a significant positive change: $p = 0.01$ which was accounted for by differences between baseline and 18-months scores ($\chi^2 (2, n=189) = 25.53; p = 0.01$).

Screening Rates.

Screening rates were significantly different in mean rank ($p < 0.001$) before 4.14 ($n=7$) and after 15.94 ($n=17$) education. Using Spearman's rho, a positive correlation of scoring frequency over time was demonstrated: $\rho (24) = 0.73; p < 0.01$. $\rho^2 = 0.53$, indicating a large effect.

Discussion

This study explores the impact of a multi-faceted KT intervention within a QI initiative on three aspects of delirium screening in the ICU: nurses' knowledge of delirium and the ICDSC, nurses' perception of the ICDSC, and delirium assessment frequency. Previous studies

have examined the impact of education on parts or combinations of the above aspects of delirium with a small number of participants over a relatively short period of time. This study examines knowledge over a longer time frame thus providing an important contribution to the KT literature.

Impact on Knowledge

The findings demonstrate an increase in nursing knowledge of delirium and the ICDSC after the educational intervention consistent with previous studies that also used multifaceted education programs (Devlin et al., 2008b; Gesin et al., 2012; Scott et al., 2013; Speed, 2015). In comparison with the multifaceted education study by Gesin et al. (2013), utilizing a similar intervention and outcome measurement survey, initial knowledge scores were similar; however, mean scores were lower in our study. Our sample included all nurses in the ICU versus a select intervention group in the Gesin study which likely contributed to our lower overall scores. While short-term impacts of education are positive, we demonstrated that unit-level knowledge retention is not maintained long-term. The reasons for this are unclear as less research has been done to examine the long-term sustainability of KT interventions (Tricco et al., 2016). It may reflect change in nursing staff over the study period as staff hired into the unit after the educational piece would not have received the formal education intervention. While the study design could have controlled for this occurrence, nurses were included in the study to account for the reality of changing staff within any ICU. The demonstrated overall decline in nursing knowledge to baseline levels during the study period highlights the need for regular formal staff education for delirium and the use of the ICDSC.

Impact on Perception

Nurses' perceptions of the ICDSC were assessed over four domains: knowledge of delirium and the tool, confidence in using it, its utility, and physicians' value of the tool. Education appears to affect some aspects of nurses' perception of delirium and the ICDSC, while time has a greater impact in other areas.

Study results were compared with similar studies evaluating nurses' perceptions of the ICDSC and the CAM-ICU for context (Table 3). Law et al. (2012) evaluated perceptions of the ICDSC while Scott et al. (2013), Soja et al. (2008), and Pun et al. (2005) evaluated the CAM-ICU. Survey questions were the same for all studies, however, the timing of the surveys varied. At baseline, our results were compared with Law et al. (2013) as a snapshot of the nurses' perceptions without intervention. Our 3-month post-education survey results were compared with Scott et al. (2013), Soja et al. (2008), and Pun et al. (2005) as short-term follow-up. Because our study used a longer time frame, there were no directly comparable data for our 18-month survey results.

The proportion of nurses surveyed initially had similar perceptions of their knowledge of delirium to those in the Law et al. (2012) study. At the final survey period, only half of the nurses reported that the ICDSC impacted their knowledge of delirium, significantly lower ($p < 0.05$) than the proportion of nurses agreeing after the educational intervention. The proportion of nurses initially perceiving they have received adequate training in the use of the screening tool is significantly lower than that reported in the Law et al. (2012), but after education, our results are similar to those in other comparable studies (Pun et al., 2005; Scott et al., 2013; Soja et al., 2008).

The anticipated improvement in nurses' confidence in using the ICDSC is not supported by our data. While scores were higher after the educational intervention and at the end of the study, they were not statistically significant. This is surprising as an increase in competency with the tool would be anticipated with prolonged use. Exploration into the reasons for lack of confidence may help tailor further education.

Although the majority of nurses felt confident in using the tool, a significantly lower proportion of nurses reported favourably than in the Law et al. study (2012). In the 3-month follow up survey, the findings are more aligned with other studies initially introducing the CAM-ICU screening tool (Pun et al., 2005; Scott et al., 2013; Soja et al., 2008). Although the ICDSC was in use in the subject ICU for several years prior to the study, it was used sporadically and without formal teaching, perhaps accounting for the disparate findings. The majority of nurses surveyed felt the screening tool was easy to use, however this opinion varied widely in the other studies (Law et al., 2012; Pun et al., 2005; Scott et al., 2013; Soja et al., 2008). It is unclear as to what would account for the variability between ours and previous similar studies; different patient population may be a possible factor.

A positive increase in the perception of the utility of the tool was realised at both the 3- and 18-month periods, an anticipated outcome based on findings of previous studies. The proportion of nurses' perceiving the tool to be useful prior to the education initiative was similar to those in Law et. al. (2012). While education appears to have a positive impact on the perception of this domain, time also may be a factor. Recognising the positive impact on patient care is a significant factor in nurses adopting a tool for further use.

Nurses' perception of the value physicians placed on the tool did not improve significantly until the final survey. This is not unexpected as change in practice is a slow process.

Physicians in the study ICU were not involved directly in the QI initiative; their participation was guided by nurses' promoting the use of the tool and discussing delirium during patient care rounds. Physicians placing more value on assessment findings based on objective data that can direct treatment options may influence this shift in perception. Despite this shift, low perception of physicians' value of either the ICDSC or the CAM-ICU is evident throughout ours and similar studies describing barriers to delirium assessment (Devlin et al., 2008a; Gesin et al., 2012; Law et al., 2012; Pun et al., 2005; Scott et al., 2013; Soja et al., 2008). Lack of physician engagement has been described as one of the most significant barriers to delirium screening in the ICU (Barr et al., 2013; Devlin et al., 2008a; Gesin et al., 2012).

Impact on Screening Compliance

There were positive changes in the frequency of delirium screening after the educational initiative, perhaps reflecting an improved understanding of the ICDSC and perception of its utility. Nevertheless, much higher compliance rates are reported elsewhere (Pun et al., 2005; Scott et al., 2013; Soja et al., 2008). This difference may be due to the different intensity in focus between the implementation of a new tool (i.e., the comparison studies) versus re-establishing an existing one (i.e., the subject study). While the ICDSC has been in place in the subject ICU for a number of years, it was not being fully utilised. We believe it is more challenging to motivate change in this situation versus one in which the introduced tool is novel. Leadership is a key factor for successful change; implementing a new tool frequently involves a stronger leadership drive than when simply revitalising an existing one (Brummel et al., 2013).

Limitations

There are several limitations associated with this study. Firstly, because data were collected as part of a larger organization-based QI initiative, there was no opportunity to modify data parameters and collection methods. Secondly, the incorporation of a control group was not feasible as the QI initiative was mandated to target the entire ICU nursing population. Finally, the day-to-day operation of a health care system presents factors that cannot be controlled for in a longitudinal study such as this. This includes elements such as the introduction of other initiatives (e.g., hand hygiene) and changes in nursing staff composition during the study period. New initiatives may positively or negatively influence attitudes and screening compliance. Staff composition changes may have affected knowledge and attitude scores as newer nurses may not have reviewed the PowerPoint presentation prior to completing a survey.

Conclusion

Delirium is a significant concern in the ICU patient population. As an integral component of a comprehensive delirium management plan, understanding of delirium and routine screening with an objective screening tool, such as the ICDSC, is essential in identifying patients with, or at risk for developing delirium. This study has provided valuable insights into the impact of education on nurses' knowledge of delirium and the ICDSC in relation to delirium screening frequency in the ICU. A multi-faceted KT intervention is an effective method for improving ICU nurses' understanding of delirium and perception of the screening tools resulting in the incorporation of more regular delirium screening into their assessments. A positive shift in the perception of the utility of the screening tool may be a key factor in the improved screening frequency. The implication of these findings in practice is the potential increase in the number of patients diagnosed with delirium leading to earlier symptom mitigation. More importantly it

showed that, without regular formal reinforcement over the long term, the observed improvements in knowledge are not maintained. Nursing educators need to incorporate continuing education within the ICU. Future studies should examine the most effective “dose” of delirium-based education in the ICU in order to effect more sustainable long-term change.

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Table 1. Description of intensive care unit nurses: demographics and experience

Variables	Baseline (n=84)	3-Months (n=53)	18-Months (n=60)	<i>p</i>
Demographic characteristics				
Age (n, [%])				
<25 years	2 (2.4)	0 (0.0)	0 (0.0)	0.84
26–34 years	24 (28.9)	17 (32.1)	18 (30)	
35–44 years	29 (34.9)	23 (43.4)	26 (43.3)	
45–54 years	13 (15.7)	8 (15.1)	11 (18.3)	
>55 years	8 (9.6)	3 (5.7)	5 (8.3)	
Missing	7 (8.4)	2 (3.8)	0 (0.0)	
Years as an RN (n, [%])				
1-5 years	19 (22.9)	11 (20.8)	7 (11.7)	0.77
6-10 years	18 (21.7)	14 (26.4)	18 (30.0)	
11-15 years	11 (13.3)	11 (20.8)	12 (20.0)	
16-20 years	9 (10.8)	6 (11.3)	8 (13.3)	
>20 years	20 (24.1)	10 (18.9)	14 (23.3)	
Missing	6 (7.2)	1 (1.9)	1 (1.7)	
Years as an ICU RN (n, [%])				
<1 year	12 (14.5)	5 (9.4)	5 (8.3)	0.51
1-5 years	25 (30.1)	17 (32.1)	16 (26.7)	
6-10 years	11 (13.3)	14 (26.4)	19 (31.7)	
11-15 years	12 (14.5)	6 (11.3)	8 (13.3)	
16-20 years	4 (4.8)	4 (7.5)	5 (8.3)	
>20 years	12 (14.5)	5 (9.4)	7 (11.7)	
Missing	7 (8.4)	2 (3.8)	0 (0.0)	

ICU=Intensive care unit, RN= Registered Nurse

Table 2. Perception scores of Intensive Care Delirium Screening Checklist by domain

Domain	Baseline (n=)	3-Month (n=)	18-Month (n=)
Knowledge (mean [SD])	3.4 (0.7) n=74	3.5 (0.8) n=51	3.5 (0.8) n=60
Confidence (mean [SD])	3.3 (0.8) n=77	3.6 (0.8) n=51	3.6 (0.8) n=59
Utility (mean [SD])	3.1 (0.8) n=72	3.6 (0.8)* n=51	3.6 (0.7)* n=60
Physician Value (mean [SD])	2.8 (0.9) n=78	2.9 (0.9) n=51	3.2 (0.8)* n=60

*Statistical significance compared with baseline; $p < 0.05$

Table 3. Comparison of nurses responding strongly agree/agree to perception survey of delirium screening tools

	Current Study			Law et al. (2012)	Scott et al. (2013)	Soja et al. (2008)	Pun et al. (2005)
	Baseline No Int n=78	3-mth Post-Int n=51	18-mth Post-Int n=60	Snapshot No Int n=84	3-mth* Post-Int	4-mth* Post-Int n=42	6-mth* Post-Int n=55
I understand what delirium is and the types of delirium	78%	65%	77%	76%	n=22 47% what 92% type	67%	95%
If asked on the spot, I can give a definition of delirium	59%	63%	73%	54%	n=59 68%	N/A	48%
My knowledge about delirium has increased since using the ICDSC/CAM-ICU	67%	71%	50%	72%	n=43 92%	N/A	80%
I received adequate education on the ICDSC/CAM-ICU and delirium assessments	37%	59%	52%	69%	n=26 55%	62%	N/A
I feel confident in completing the ICDSC/CAM-ICU	57%	67%	62%	83%	n=35 74%	60%	71%
My delirium assessments are accurate	56%	67%	64%	71%	N/A	64%	N/A
The ICDSC/CAM-ICU is easy to complete	50%	67%	65%	88%	n=40 85%	43%	67%
The ICDSC/CAM-ICU is a useful tool.	63%	77%	73%	76%	N/A	N/A	71%
Patient care is enhanced by the ICDSC/CAM-ICU	60%	74%	70%	65%	N/A	17%	N/A
Monitoring for delirium has helped me perform a more comprehensive patient assessment	75%	71%	82%	75%	n=39 83%	N/A	65%
The ICDSC is being completed twice a day for the time the patient is in the ICU	32%	47%	50%	86%	N/A	N/A	N/A
The physicians value the ICDSC/CAM-ICU assessment data	19%	22%	32%	24%	n=22 32%	17%	32%

* Tool newly introduced in clinical setting

ICDSC = Intensive Care Delirium Screening Checklist, CAM-ICU = Confusion Assessment Method for the Intensive Care Unit, Int = Educational intervention

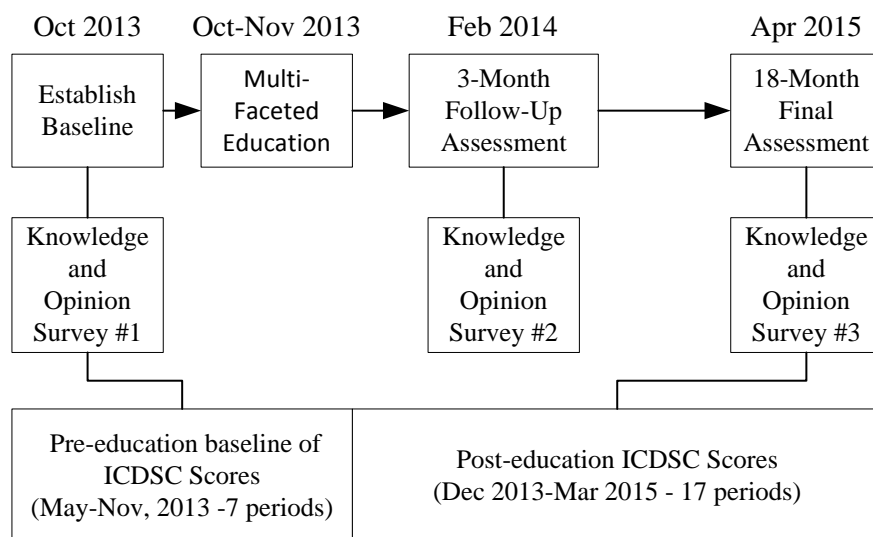


Figure 1. Timeline of quality improvement initiative and data collection.
ICDSC – Intensive Care Delirium Screening Checklist

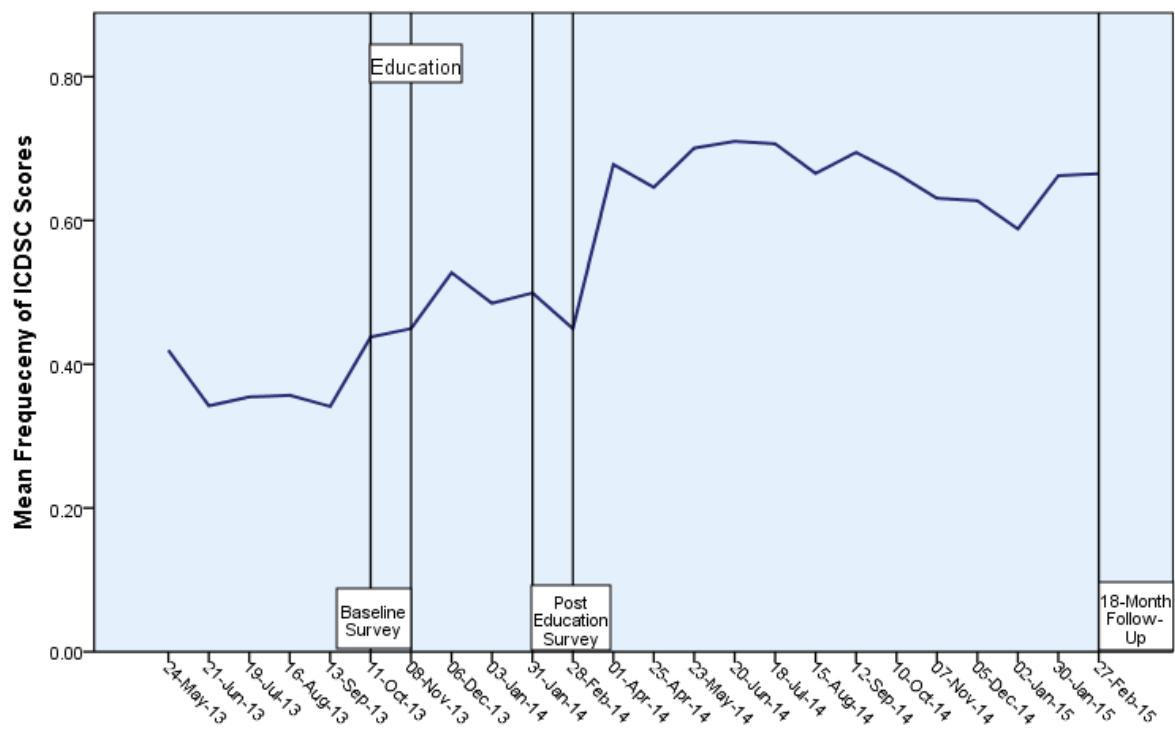


Figure 2. Frequency of delirium screening before and after education. ICDSC = Intensive Care Delirium Screening Checklist

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Appendix A

DSM-V Diagnostic Criteria for Delirium

- A. A disturbance in attention (i.e., reduced ability to detect, focus, sustain, and shift attention) and awareness (reduced orientation to the environment).
- B. The disturbance develops over a short period of time (usually hours to a few days), represents a change from baseline attention and awareness, and tends to fluctuate in severity during the course of a day.
- C. An additional disturbance in cognition (e.g., memory deficit, disorientation, language, visuospatial ability, or perception)
- D. The disturbances in Criteria A and C are not better explained by another preexisting, established, or evolving neurocognitive disorder and do not occur in the context of a severely reduced level of arousal, such as coma.
- E. There is evidence from the history, physical examination, or laboratory findings that the disturbance is a direct physiological consequence of another medical condition, substance intoxication or withdrawal (i.e., due to a drug of abuse or to a medication), or exposure to a toxin, or is due to multiple etiologies.

(American Psychiatric Association, 2013)

Appendix B

Intensive Care Delirium Screening Checklist

Patient evaluation	Day 1	Day 2	Day 3	Day 4	Day 5
Altered level of consciousness* (A-E)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>If A or B do not complete patient evaluation for the period</i>					
Inattention	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disorientation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hallucination-delusion-psychosis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Psychomotor agitation or retardation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inappropriate speech or mood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sleep/wake cycle disturbance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Symptom fluctuation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total score (0-8)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* Level of consciousness:

A: No response, score: None

B: Response to intense and repeated stimulation (loud voice and pain), score: None

C: Response to mild or moderate stimulation, score: 1

D: Normal wakefulness, score: 0

E: Exaggerated response to normal stimulation, score: 1

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Appendix C

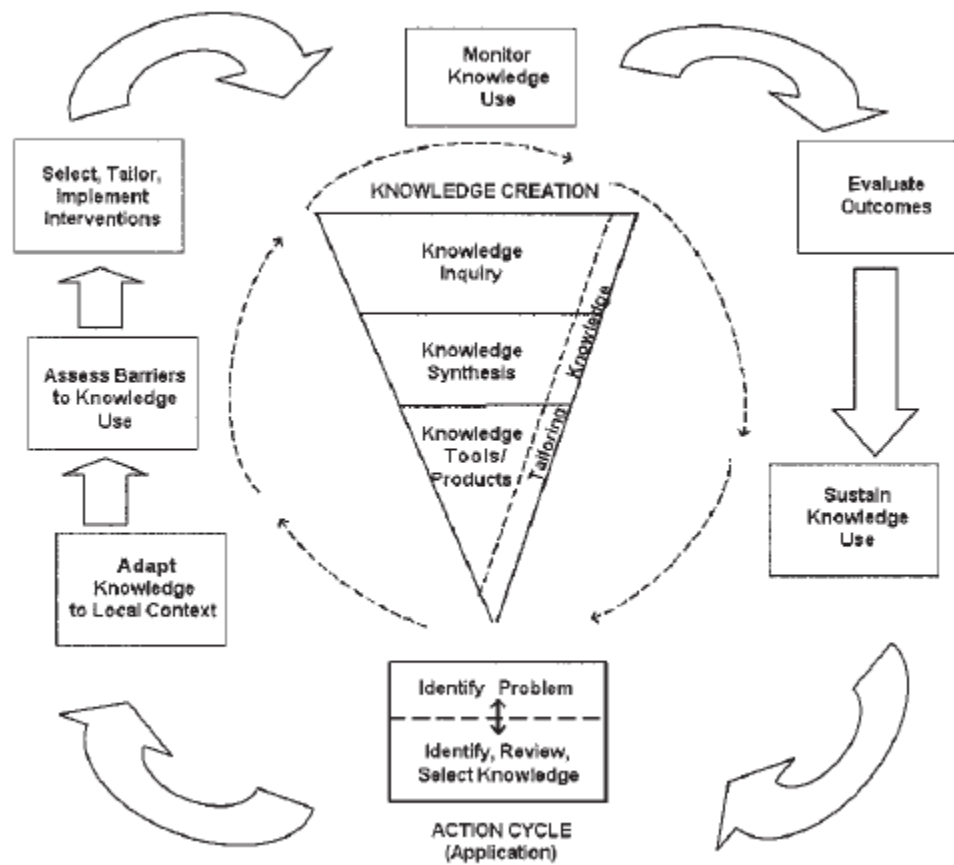
Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)

<i>Delirium is diagnosed when both Features 1 and 2 are positive, along with either Feature 3 or Feature 4.</i>	
Feature 1. Acute Onset of Mental Status Changes or Fluctuating Course	<ul style="list-style-type: none"> ■ Is there evidence of an acute change in mental status from the baseline? ■ Did the (abnormal) behavior fluctuate during the past 24 hrs, that is, tend to come and go or increase and decrease in severity? <p><i>Sources of information:</i> Serial Glasgow Coma Scale or sedation score ratings over 24 hrs as well as readily available input from the patient's bedside critical care nurse or family.</p>
Feature 2. Inattention	<ul style="list-style-type: none"> ■ Did the patient have difficulty focusing attention? ■ Is there a reduced ability to maintain and shift attention? <p><i>Sources of information:</i> Attention screening examinations by using either picture recognition or Vigilance A random letter test (see Methods and Appendix 2 for description of Attention Screening Examinations). Neither of these tests requires verbal response, and thus they are ideally suited for mechanically ventilated patients.</p>
Feature 3. Disorganized Thinking	<ul style="list-style-type: none"> ■ Was the patient's thinking disorganized or incoherent, such as rambling or irrelevant conversation, unclear or illogical flow of ideas, or unpredictable switching from subject to subject? ■ Was the patient able to follow questions and commands throughout the assessment? <ol style="list-style-type: none"> 1. "Are you having any unclear thinking?" 2. "Hold up this many fingers." (examiner holds two fingers in front of the patient) 3. "Now, do the same thing with the other hand." (not repeating the number of fingers)
Feature 4. Altered Level of Consciousness	<ul style="list-style-type: none"> ■ Any level of consciousness other than "alert." ■ Alert—normal, spontaneously fully aware of environment and interacts appropriately ■ Vigilant—hyperalert ■ Lethargic—drowsy but easily aroused, unaware of some elements in the environment, or not spontaneously interacting appropriately with the interviewer; becomes fully aware and appropriately interactive when prodded minimally ■ Stupor—difficult to arouse, unaware of some or all elements in the environment, or not spontaneously interacting with the interviewer; becomes incompletely aware and inappropriately interactive when prodded strongly ■ Coma—unarousable, unaware of all elements in the environment, with no spontaneous interaction or awareness of the interviewer, so that the interview is difficult or impossible even with maximal prodding

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Appendix D

Knowledge-to-Action Framework



Knowledge to Action Process. Reproduced with permission from Wolters Kluwer Health, Inc.

Appendix E

(*Also appears as Supplementary File A online for Manuscript #2. See Appendices M and N for modification and usage permissions)

Initial ICU Delirium Knowledge and ICDSC Perception Survey

RCH ICU Delirium Survey

October 2013

1. Hyperactive delirium is characterized by:
 - a. Apathy
 - b. Attempts to remove catheters
 - c. Emotional lability
 - d. Lethargy
 - e. B and C
2. Hypoactive delirium is characterized by:
 - a. Withdrawal
 - b. Restlessness
 - c. Flat affect
 - d. Apathy
 - e. A, C and D
3. Ordering the subtypes of delirium from least commonly to most common observed:
 - a. Hyperactive, hypoactive, mixed
 - b. Hypoactive, hyperactive, mixed
 - c. Hypoactive, mixed, hyperactive
 - d. All are equally common
4. During the ICU/hospital stay, delirium is associated with all of the following except:
 - a. Increased mortality
 - b. Development of multi-organ dysfunction
 - c. Increased length of stay
 - d. 3x greater re-intubation rate
 - e. Higher costs of care
5. After hospital discharge delirium is associated with:
 - a. Requirement for care in chronic care facility
 - b. Decreased functional status at 6 months
 - c. No long-term sequelae
 - d. A and B
6. All of the following have been shown in clinical trials to be risk factors for the development of delirium except:
 - a. Increased age
 - b. Disruptive family/visitors
 - c. Use of physical restraints
 - d. Use of tubes and catheters
7. When unsure about whether a specific item on the ICDSC it is best to:
 - a. Count the symptom as present and score 1 for that item
 - b. Count the symptom as absent and score 0 for that item
 - c. Mark uncertain for that symptom
 - d. Skip that item
8. All of the following would result in the patient being deemed to have inattention by the ICDSC criteria except:
 - a. The inability to follow a command (i.e. wiggle your toes)
 - b. Being easily distracted by external stimuli
 - c. Being easily distracted by internal stimuli
 - d. Having difficulty in shifting focus (Cannot follow you with their eyes when you move to the opposite side of the bed)

Appendix E continued

9. The difference between hallucinations and delusions is that:
- Hallucinations are the perception of something that is not there with no stimulus and delusions are false beliefs that are fixed/unchanging
 - Delusions are the perception of something that is not there with no stimulus and hallucinations are false beliefs that are fixed/unchanging
 - The terms are interchangeable
 - Hallucinations are the perception of something that is not there with a known stimulus and delusions are false beliefs that are fixed/unchanging
10. A patient would be deemed to have inappropriate speech or mood by the ICDSC in all of the following situations except:
- The patient is apathetic when hearing they likely only have days to weeks left to live
 - The patient is sexually inappropriate toward staff and visitors
 - The patient is inconsolable when hearing they likely only have days to weeks left to live
 - The patient demands a new meal tray four times, asks for the room to be cleaned and re-cleaned repeatedly, and asks to be discharged immediately from the ICU
 - B and C

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. I understand what delirium is and the types of delirium					
2. If asked on the spot, I can give a definition for delirium					
3. My knowledge about delirium has increased since using the ICDSC					
4. I received adequate education on the ICDSC and delirium assessments					
5. I feel confident in completing the ICDSC					
6. My delirium assessments are accurate					
7. The ICDSC is easy to complete					
8. The ICDSC is a useful tool.					
9. Patient care is enhanced by the ICDSC					
10. Monitoring for delirium has helped me perform a more comprehensive patient assessment					
11. The ICDSC is being completed twice a day for the time the patient is in the ICU					
12. The physicians value the ICDSC assessment data					

Years as RN	1-5	6-10	11-15	16-20	20+	
Years as ICU RN	<1	1-5	6-10	11-15	16-20	20+
Age	<25	25-34	35-44	45-54	55+	

Appendix F



AU REB Approval

November 27, 2015

Mrs. Sharon Hickin
Faculty of Health Disciplines\Centre for Nursing & Health Studies
Athabasca University

File No: 22012

Ethics Expiry Date: November 26, 2016

Dear Sharon Hickin,

Thank you for your recent resubmission to the Faculty of Health Disciplines Departmental Ethics Review Committee, providing the ethical approval from Fraser Health as requested for your research entitled, 'The Long Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU'.

Your application has been **Approved** and this memorandum constitutes a ***Certification of Ethics Approval***. You may begin the proposed research.

This REB approval, dated November 25, 2015, is valid for one year less a day.

Throughout the duration of this REB approval, all requests for modifications, ethics approval renewals and serious adverse event reports must be submitted via the Research Portal.

To continue your proposed research beyond, you must apply for renewal by completing and submitting an Ethics Renewal Request form. Failure to apply for **annual renewal** before the expiry date of the current certification of ethics approval may result in the discontinuation of the ethics approval and formal closure of the REB ethics file. Reactivation of the project will normally require a new Application for Ethical Approval and internal and external funding administrators in the Office of Research Services will be advised that ethical approval has expired and the REB file closed.

When your research is concluded, you must submit a Project Completion (Final) Report to close out REB approval monitoring efforts. Failure to submit the required final report may mean that a future application for ethical approval will not be reviewed by the Research Ethics Board until such time as the outstanding reporting has been submitted.

At any time, you can login to the Research Portal to monitor the workflow status of your application.

If you encounter any issues when working in the Research Portal, please contact the system administrator at research_portal@athabascau.ca.

Sincerely,

Sherri Melrose

Chair, Faculty of Health Disciplines Departmental Ethics Review Committee
Athabasca University Research Ethics Board

Appendix G

AU REB Renewal Approval



October 26, 2016

Mrs. Sharon Hickin
Faculty of Health Disciplines\Centre for Nursing & Health Studies
Athabasca University

File No: 22012

Certification of Ethics Approval Date: November 27, 2015

New Renewal Date: October 25, 2017

Dear Sharon Hickin,

Your Renewal Form has been received by the AU REB Office.

Athabasca University's Research Ethics Board (REB) has **approved** your request to renew the *certification of ethics approval* for a further year for your project entitled "The Long Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU".

As you progress with the research, all requests for changes or modifications, ethics approval renewals and serious adverse event reports must be reported to the Athabasca University Research Ethics Board via the Research Portal.

To continue your proposed research beyond October 25, 2017, you must apply for renewal by completing and submitting an Ethics Renewal Request form before expiry. Failure to apply for **annual renewal** before the expiry date of the current certification of ethics approval may result in the discontinuation of the ethics approval and formal closure of the REB ethics file.

Reactivation of the project will normally require a new Application for Ethical Approval and internal and external funding administrators in the Office of Research Services will be advised that ethical approval has expired and the REB file closed.

When your research is concluded, you must submit a Project Completion (Final) Report to close out REB approval monitoring efforts. Failure to submit the required final report may mean that a future application for ethical approval will not be reviewed by the Research Ethics Board until such time as the outstanding reporting has been submitted.

If you encounter any issue with the Research Portal's online submission process, please contact the system administrator via research_portal@athabascau.ca.

If you have any questions about the REB review & approval process, please contact the AUREB Office at (780) 675-6718 or rebsec@athabascau.ca.

Sincerely,

Office of Research Ethics

Appendix H

Fraser Health Research Authorization

**LETTER OF AUTHORIZATION TO CONDUCT RESEARCH**

Date: 2015 November 26		PI Name: HICKIN, Sharon	
Address: 633 First St, New Westminster, BC			
FHREB File #: 2015-119		Study Protocol #: 2015 September 29	
Study Title: The Long Term Impact Of An Educational Intervention On Nursing Knowledge Of Delirium, Perception Of The Intensive Care Delirium Screening Checklist And Delirium Screening Compliance In The ICU			
The following required applicable approvals have been received and are in order:			
<input checked="" type="checkbox"/> FH REB Certificate of Initial Approval Dated: 2015 November 26 <input checked="" type="checkbox"/> Consent not required Reason: Secondary Data <input type="checkbox"/> Consent Waived Reason:		<input type="checkbox"/> Consent Required and approved: <i>The signed <u>signature page</u> of the consent form for a specific study must be submitted to Health Records/Health and Business Analytics for the release of any of that participant's personal information.</i>	
<input type="checkbox"/> Department Agreement for Providing Research-related Services Authorization Services (DAR Form) <input checked="" type="checkbox"/> Not Applicable			
<input type="checkbox"/> Privacy Impact Assessment (PIA) <input checked="" type="checkbox"/> Not Applicable		<input checked="" type="checkbox"/> N2 Privacy and Confidentiality SOP template attached. Please ensure this SOP is used to maintain confidentiality of data.	
<input type="checkbox"/> Health Canada Letter of No Objection <input checked="" type="checkbox"/> Not Applicable		TRAINING: <input type="checkbox"/> TCPS Certificate Note: N2 CITI courses available at www.citiprogram.org for all FH researchers. Indicate affiliation as Fraser Health.	
<input type="checkbox"/> Clinical Trial Registration No. <input checked="" type="checkbox"/> Not Applicable		Registered at: <input type="checkbox"/> www.ClinicalTrials.gov <input type="checkbox"/> www.Controlled-trials.com Type of Research: Health Services	
Funding: Cost-Centre Not Required <input checked="" type="checkbox"/> Unfunded <input type="checkbox"/> Industry: <input type="checkbox"/> REB fee received <input type="checkbox"/> Grant-in-aid <input type="checkbox"/> Grant awarded to non-Fraser Health Institution		Cost-Centre Required: Budget: Funder: <input type="checkbox"/> Grant/grant-in aid award to Fraser Health <input type="checkbox"/> Grant awarded by Fraser Health (Seed grant by Rehabilitation program) <input type="checkbox"/> Grant funds transferred to Fraser Health by academic sponsor <input type="checkbox"/> External grant fund reimburses Fraser Health <input type="checkbox"/> Industry <i>Please note that FH Research Policy prohibits over-spending on research grants by the principal investigator.</i>	
Agreements:			
<input type="checkbox"/> Executed Clinical Trial Agreement for Industry Sponsored Trials <input type="checkbox"/> Affiliated Researchers: Executed "Research Collaboration Agreement" dated:			
<input type="checkbox"/> Research Grant Contribution Agreement dated:		Name of Granting Agency:	
<i>This letter authorizes the principal investigator to begin research-related procedures in compliance with all FH research-related and privacy policies.</i> http://fhpulse/policies_guidelines/org_policies/pages/default.aspx .			
Please note that the ethical approval for this study must be renewed <u>before the one year expiry date</u> of the certificate of initial approval if the study will be ongoing at that time.			
Authorized by: Susan Chunick Director, FH Department of Evaluation and Research Services			

Fraser Health Authority Medicine Evaluation and Research Services http://research.fraserhealth.ca/	400 – 13450 102nd Avenue Surrey, BC V3T 0H1	Tel (604) 587-4436 Fax (604) 930-5425
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Appendix I

Fraser Health REB Certificate of Approval

Page 1/1



Fraser Health Research Ethics Board
 FHA, Evaluation and Research Services
 #400, 13450 102nd Avenue, Surrey, BC V3T 0H1
 Phone: 604.587.4436 Fax: 604.930.5425

CERTIFICATE OF FHREB APPROVALS

CERTIFICATE OF FHREB APPROVALS				
Official Notification - FHREB Number (to be used on all future correspondence): 2015-119				
Principal Investigator: HICKIN, Sharon		Hospital/Facility & Department: RCH/ICU		
Institution(s) or Geographical Areas where research will be carried out: RCH				
Co-Investigator(s): Jennifer Knopp-Sihota				
Funding Agencies and/or Corporate Sponsor: Unfunded				
Title: The Long Term Impact Of An Educational Intervention On Nursing Knowledge Of Delirium, Perception Of The Intensive Care Delirium Screening Checklist And Delirium Screening Compliance In The ICU				
Documents Included in this Approval	Date of Approval	Date of Expiry	Type of Approval	Approval of the FHREB
<ul style="list-style-type: none">• Application for Initial Ethical Review• Protocol, 2015 September 29 <i>(*The FHREB has determined that the collection of the data elements as described in the protocol/data collection form are justified and required in order to conduct the research)</i>	2015 November 26	2016 November 26	Initial Approval; Delegated Review	

CERTIFICATION:**With respect to clinical trials:**

1. The membership of the Fraser Health Research Ethics Board complies with the membership requirements for research ethics boards as defined in Part C Division 5 of the Food and Drug Regulations and the Tri-Council Policy Statement.
2. The Fraser Health Research Ethics Board carries out its functions in a manner consistent with Good Clinical Practices.
3. The Fraser Health Research Ethics Board has reviewed and approved the clinical trial protocol and the informed consent form for the trial which is to be conducted by a qualified investigator named at the specified clinical trial site. This approval of the documentation listed above and the views of the Fraser Health Research Ethics Board have been documented in writing.

With respect to delegated review:

A co-chair or delegated member of the FHREB has reviewed and approved the documentation listed above for the forenamed research study in accordance with the FHREB Policy on "Ethical Conduct of Research and Other Studies Involving Human Subjects", the Tri-council Policy Statement: Ethical Conduct for Research Involving Humans", and the "International Conference on Harmonisation Guidance E6: Good Clinical Practice E6: Consolidated Guidelines".

With respect to full board review:

Full FHREB review and approval of the documentation listed above was completed for non-expedited review in accordance with the FHREB Policy on "Ethical Conduct of Research and Other Studies Involving Human Subjects", the Tri-council Policy Statement: Ethical Conduct for Research Involving Humans" and the "International Conference on Harmonisation Guidance E6: Good Clinical Practice E6: Consolidated Guidelines".

The FHREB approval for this study expires ONE year from the approval date of this certificate. Researchers must submit a Request for Annual Renewal for ongoing research studies prior to the expiry date in order to receive annual re-approval.

Appendix J

Copyright Permission for CAM-ICU

WOLTERS KLUWER HEALTH, INC. LICENSE
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License Number	3990280050572
License date	Nov 15, 2016
Licensed Content Publisher	Wolters Kluwer Health, Inc.
Licensed Content Publication	Critical Care Medicine
Licensed Content Title	Evaluation of delirium in critically ill patients: Validation of the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)
Licensed Content Author	E. Ely, Richard Margolin, Joseph Francis, et al
Licensed Content Date	Jul 1, 2001
Licensed Content Volume Number	29
Licensed Content Issue Number	7
Type of Use	Dissertation/Thesis
Requestor type	Individual
Portion	Figures/table/illustration
Number of figures/tables/illustrations	1
Figures/tables/illustrations used	Appendix 1. The Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)
Author of this Wolters Kluwer article	No
Title of your thesis / dissertation	The Long-Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU
Expected completion date	Jan 2017
Estimated size(pages)	80
Requestor Location	Sharon L Hickin 633 First St

Appendix K

Copyright Permission for ICDSC

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License Number	3990450374669
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Licensed Content Publisher	Springer
Licensed Content Publication	Intensive Care Medicine
Licensed Content Title	Intensive Care Delirium Screening Checklist: evaluation of a new screening tool
Licensed Content Author	N. Bergeron
Licensed Content Date	Jan 1, 2001
Licensed Content Volume Number	27
Licensed Content Issue Number	5
Type of Use	Thesis/Dissertation
Portion	Figures/tables/illustrations
Number of figures/tables/illustrations	1
Author of this Springer article	No
Order reference number	
Original figure numbers	Table 2. The Intensive Care Delirium Screening Checklist
Title of your thesis / dissertation	The Long-Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU
Expected completion date	Jan 2017
Estimated size(pages)	80
Requestor Location	Sharon L Hickin 633 First St.

Appendix L

Copyright Permission for KTA Framework

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License Number	3990020099219
License date	Nov 15, 2016
Licensed Content Publisher	Wolters Kluwer Health, Inc.
Licensed Content Publication	Journal of Continuing Education in the Health Professions
Licensed Content Title	Lost in knowledge translation: Time for a map?.
Licensed Content Author	Ian Graham, Jo Logan, Margaret Harrison, et al
Licensed Content Date	Jan 1, 2006
Licensed Content Volume Number	26
Licensed Content Issue Number	1
Type of Use	Dissertation/Thesis
Requestor type	Individual
Portion	Figures/table/illustration
Number of figures/tables/illustrations	1
Figures/tables/illustrations used	Figure 1. Knowledge to Action Process
Author of this Wolters Kluwer article	No
Title of your thesis / dissertation	The Long-Term Impact of an Educational Intervention on Nursing Knowledge of Delirium, Perception of the Intensive Care Delirium Screening Checklist and Delirium Screening Compliance in the ICU
Expected completion date	Jan 2017
Estimated size(pages)	80
Requestor Location	Sharon L Hickin 633 First St.

Appendix M

Permission for Use of Knowledge Quiz and Teaching Material

From: Gesin, Gail [Gail.Gesin@carolinashealthcare.org]

Sent: September 30, 2013 11:24 AM

To: Hickin, Sharon

Subject: RE: Delirium

Sharon,

The questions and answer keys are attached.

Regards,

Gail

-----Original Message-----

From: Hickin, Sharon [<mailto:Sharon.Hickin@fraserhealth.ca>]

Sent: Thursday, September 26, 2013 3:27 PM

To: Gesin, Gail

Cc: sharonhickin@shaw.ca

Subject: RE: Delirium

Hi Gail,

It's been a long time in coming (administrative changes at work set us back) but we are soon to get our delirium education program underway shortly. The power point presentation is very informative – again thank-you.

I am now furthering our activities by basing my Master's thesis around this project and am using your study to hopefully expand the findings to our ICU nursing population as a whole. My advisor has suggested that I contact you for access to and for permission to use the multiple choice questions related to delirium knowledge used in your study as these have already been validated and would strengthen the construct validity of the study. Would it be possible to obtain these?

Sincerely,

Sharon

From: Gesin, Gail [<mailto:Gail.Gesin@carolinashealthcare.org>]

Sent: Wednesday, June 06, 2012 6:18 AM

To: Hickin, Sharon

Cc: White, Sandra; Hudniuk, Heather

Appendix M continued.

Subject: RE: Delirium

Hi Sharon,

Attached is a PowerPoint version of the nursing education program we used in the study, and for subsequent education of all ICU nurses. I hope this helps!

Take care,
Gail

-----Original Message-----

From: Hickin, Sharon [mailto:Sharon.Hickin@fraserhealth.ca]

Sent: Monday, June 04, 2012 1:09 PM

To: Gesin, Gail

Cc: White, Sandra; Hudniuk, Heather

Subject: Delirium

Dear Gail,

I am part of a multidisciplinary delirium work group in the ICU at Royal Columbian Hospital in New Westminster, BC. I came across your article Impact of a Delirium Screening Tool and Multifaceted Education on Nurses' Knowledge of Delirium and Ability to Evaluate it Correctly while working on a paper and found it very insightful. We have been using the ICDSC at our site for a couple years now, but have found very low compliance with its use. The purpose of our work group is to improve nurses' understanding and use of the screening tool. I was wondering if it were possible to gain access to the web-based education tool your group created for the study. The demographics of the ICU in the study and ours is similar and this may help our healthcare team better understand that effectiveness of the tool.

Thank you for any assistance you can give us in this matter,

Sincerely,
Sharon Hickin, BSc, RN, CNCC(C)

Appendix N

Permission for Use and Modification of ICDSC Perception Survey

Hi Sharon cc Tyler Law, MD

Yes, you have permission from Dr. Law and me to adapt it – I don't need to see it – pls just clearly indicate that your survey was an adaptation of ours in your written methods section

dale

Dale M. Needham, FCPA, MD, PhD
Professor,
Outcomes After Critical Illness & Surgery (OACIS) Group
Division of Pulmonary & Critical Care Medicine
Department of Physical Medicine & Rehabilitation
Medical Director, Critical Care Physical Medicine & Rehabilitation Program
Johns Hopkins University
dale.needham@jhmi.edu

SAVE DATE: 4th Annual Hopkins ICU Rehab Conference: Nov 12 - 14, 2015 - details at:
www.hopkinsmedicine.org/OACIS/ICUrehab

Learn how we are improving ICU patients' outcomes at our websites:
www.hopkinsmedicine.org/OACIS www.mobilization-network.org
www.improveLTO.com

Follow on Twitter: @icurehab @DrDaleNeedham
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From: Sharon Hickin [<mailto:sharonhickin@shaw.ca>]

Sent: Monday, June 01, 2015 12:56 PM

To: Dale Needham

Subject: Request for Permission to use Perception Questionnaire

Hello Dr. Needham,

Appendix N continued

I am a Master's student in the Nursing Program at Athabasca University. I am working on my thesis and am currently in the proposal stage. My research question is "Does an increase in understanding of delirium and the Intensive Care Delirium Screening Checklist improve nurses' perception of the tool and increase compliance with delirium assessment in the ICU promoting early symptom recognition and intervention to minimise the occurrence and impact of delirium in the critical care population?"

This work is partially based on an interdisciplinary quality improvement initiative undertaken by an interdisciplinary team in the ICU in which I work. Through my initial literature search, I reviewed the paper: *A Survey of Nurses' Perceptions of the Intensive Care Delirium Screening Checklist* and shared it with the team. We utilised the survey, with minor adaptation of wording for the general ICU vs oncology and full source disclosure, among the staff for our internal QI purposes. However, as I would now like to use this data for my thesis, I would like to request permission to use the survey questionnaire as part of my research tools for this purpose.

I can send the adapted version upon request. Also, if you have any questions or concerns you can also contact my supervisor via the information provided below. I look forward to hearing from you in the near future. Thank you.

Sharon Hickin, BSc, RN, CNCC(c)
604-525-8754

Jennifer Knopp-Sihota
Assistant Professor
Centre for Nursing & Health Studies
Athabasca University
jknopp@athabascau.ca
Toll free: 1-866-901-2831

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Version: 2015.0.5941 / Virus Database: 4354/9917 - Release Date: 06/01/15