2016

Need Assessment for Early Identification of Delirium in Post-Operative Patients in Intensive Care Unit

Raji Rajan
University of Kentucky, raji9389@gmail.com

DNP Final Project Report

Need Assessment for Early Identification of Delirium in Post-Operative Patients in Intensive Care Unit

Raji Rajan

University of Kentucky College of Nursing

Fall 2016

Sheila Melander PhD., APRN, ACNP-BC, FCCM, FAANP– Committee Chair

Melanie Hardin-Pierce PhD, ACNP- Committee Member

Debbie Hampton, PhD, RN, FACHE, NEABC- Committee Member

Moutaz Al-Nabhan, MD, FCCP- Clinical Mentor

Dedication

This manuscript is dedicated to my family for believing in me. They have driven me to work hard, and remain steadfastly committed to achieving my goals.

Acknowledgements

I could not have finished my project without the help of number of people. I owe a deepest gratitude my Committee, Dr. Sheila Melander, Dr. Melanie Hardin Pierce and Dr. Debbie Hardin- Pierce for providing their valuable guidance and expertise opinion. I deeply appreciate Dr. Moutaz Al- Nabhan for mentorship and sharing his knowledge into this project. My deepest thanks to my colleagues at work and fellow DNP Students for their encouragement and support throughout the program. A special thanks to writing specialist Whitney Kurtz-Ogilive and statistician Amanda Wiggings for their invaluable support with manuscript and statistics analysis. My deepest gratitude to my husband and my daughter for their support and encouragement during the long hours of study and work.

Table of Contents

Acknowledgements iii

Abstract 1

Introduction 3

Delirium Risk Factors 6

Impacts of Delirium 7

Strategies for prevention of postoperative delirium 8

Methods 9

Sample selection. 9

Study Design 10

Statistical Analysis 10

Results 11

Discussion 12

Limitations 16

Recommendations for clinical practices 16

Recommendations for future study 17

Conclusion/ Summary 17

Appendices 19

Appendix A 19

Appendix B 20

Appendix C 21

References 22

Abstract

Background: Delirium is an acute dysfunction of cognition, memory, and attention resulting in changes in perception, mood, and activity. Delirium is associated with increased length of hospital stay, prolonged mechanical ventilator days, increased mortality rate, and a higher number of discharge disposals to rehabilitation centers. The purpose of the study is to assess the current practice in delirium assessment and management strategies among postoperative patients in Intensive Care Units.

Methods: A retrospective medical record review was conducted in postoperative patients admitted to Norton Women's and Kosair Children Hospital between January 2015 and December 2015. Postoperative delirium was diagnosed in compliance with CAM- ICU screening. Variables focused on in the study included: length of hospital stay, length of ICU stay, discharge disposition to rehabilitation facilities, number of mechanical ventilator days, use of restraints, and use of pharmacological and non-pharmacological measures.

Results: Of the 115 patients assessed, 65 (56.5%) were screened for delirium. Among the 115 patients, 61.5% were positive for delirium and 38.4% were negative. The median number of mechanical ventilator days and number of restraint days in delirium positive patients was 3.5 and four respectively. The length of ICU stay (p=.000) and the length of hospital stay (p=0.001) were significantly associated with delirium. Sixty percent of patients diagnosed with delirium required rehabilitation placement after the ICU stay. Thirty-seven and half percent of the patients who were positive for delirium received interventions.

Conclusion: The study results demonstrated that there was a significant gap in delirium screening in the ICU. Postoperative delirium was an independent risk factor for increased

number of mechanical ventilator days as well as increased use of restraints. Study results indicate the need for early identification of delirium in postoperative patients in ICU and the development of evidence-based delirium management protocol.

Need Assessment for Early Identification of Delirium in Post-Operative Patients in Intensive Care Unit

Introduction

Delirium is an acute dysfunction of cognition, memory, and attention resulting in changes in perception, mood, and activity. The revised diagnostic criteria for the fifth Diagnostic and Statistical Manual of Mental Disorders (DSM) include disturbances in level of attention, acute onset of symptoms that tend to fluctuate throughout the day, disturbance in cognition, presence of neurocognitive disorder and an evidence of etiological causes (Zaal & Slooter, 2013). Patients in the Intensive Care Unit (ICU) are vulnerable to developing delirium due to the severity of illness, use of sedatives or pain medications, and environmental factors in ICU. Postoperative delirium is associated with increased mortality rate, increased length of hospital stay and high morbidity rates. The study has shown that post-operative patients experiencing delirum have increased risk of prolonged or even permanent cognitive disorders (Abelha et al., 2013).

Postoperative delirium is one of the complications of extensive surgery. Delirium in critically ill patients usually results from a multitude of pathological and non-pathological factors. Risk factors for delirium in postoperative patients include advanced age, smoking history, alcohol use, electrolyte imbalance, dehydration, pain, hypoxia, sleep deprivation, medications (anticholinergics, central nervous depressants, sedative/analgesic), length of surgery, and hyper/hypoglycemia (Girad, Pandharipande, & Ely, 2008). Delirium onset may be acute or subacute, and it tends to fluctuate during the hospital stay. There are 3 types of delirium based on the charachterstics of the delirium symptoms. They are hyperactive delirium, hypoactive delirium and mixed

delirium. Patient with hyperactive delirium demonstrates restlessness and agitation whereas hypoactive patients exhibit inattention, a decrease in communication, and unresponsiveness. Patients experiencing the mixed type of delirium demonstrate characteristics of both hypo and hyperactive delirium. Hypoactive delirium often goes underdiagnosed and undetected.

The prevalence of delirium in the ICU among mechanically ventilated patients is 60 % to 80% and for non-mechanically ventilated patients is 20% to 50% (ICU Delirium and Cognitive Impairment Study group, 2013). The incidence of delirium is higher among elderly patients and post-operative patients. Delirium can cause short term and long term adverse outcomes among post-operative patients in the ICU. Ely et al. (2001) and Lat et al. (2009) found that ICU delirium had a strong association with increased length of hospital stay and increased number of mechanically ventilated days. Davydow (2009) identified a strong connection between delirium episodes and development of subsequent symptoms of depression and anxiety. Results of a study done by Roberts, Rickard, Rajbhandari, & Reynolds (2006) showed that delirious patients experienced frightening dreams more than nondelirious patients after the hospital discharge. Abelha et al. (2013) reported that postoperative delirium is an independent risk factor for increased mortality, increased dependency in personal activities of daily living (P-ADL) and worsened quality of life. Further, ppatients with postoperative delirium had ten times higher critical care mortality, almost six times greater mortality at hospital discharge and 3.2 times greater mortality rate at six months' follow-up (Abelha et al., 2013).

Delirium assessment in postoperative patients is challenging due to the fluctuating symptoms and use of sedatives/analgesics for pain control. The Society of Critical Care Medicine emphasized the utilization of a valid tool that would help health care providers with early identification of delirium (Society of Critical Care Medicine, 2013). There are several tools available for assessing ICU delirium. The Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Delirium Screening Checklist (ICDSC) are the two most common delirium assessment tools; of these CAM -ICU has high specificity and sensitivity in assessing delirium. The Confusion Assessment Method tool allows nonpsychiatric health care providers to evaluate and diagnose delirium by doing a brief cognitive testing. The Confusion Assessment Method tool assesses the four cardinal features of delirium: acute onset or fluctuation in delirium symptoms, inattention, disorganized thinking and altered level of consciousness. Patients are diagnosed as delirium positive when three out of four features of the CAM tool are positive (Wei, Fearing, Sternberg, & Inouye, 2008).

The purpose of the study was to evaluate the current practice in delirium assessment and intervention measures among postoperative patients admitted to the Norton Women's and Children (NWCH) ICU. The study results will be used to make recommendations for implementation of evidence based intervention measures for delirium prevention and management. Variables analyzed in the study were fall rates, restraints use, number of mechanically ventilated days, length of ICU stay and number of transfers/ discharges to rehabilitation facilities. Information from study the results will be used to develop an evidence-based protocol for general surgical post-operative patients in the ICU.

Literature Review

Postoperative delirium is highly prevalent among the ICU population, characterized by inattention, fluctuating levels of consciousness and disorganized thinking. These symptoms can increase postoperative complications, prolong hospital stays, lead to functional decline, put patient at high risk for falls or device removals, increase discharge disposal to rehabilitation facilities or nursing homes and increase mortality. Postoperative delirium can contribute to higher health care cost.

The literature review included articles published within the last ten years. Databases used for the literature search were PubMed, Cochrane and CINAHL (the Cumulative Index to Nursing and Allied Health Literature) for articles published within the last ten years. The keywords used for the search were postoperative delirium, delirium risk factors, the impact of delirium on patient outcomes, delirium interventions and delirium mortality in postoperative patients. The selection criteria for the search focused on postoperative delirium, publication in English, and peer reviewed articles. For early identification of delirium among postoperative patients, it is essential to understand the risk factors, prevalence rate, effects of delirium and measures to prevent or treat symptoms.

Delirium Risk Factors

Delirium is multifactorial, and risk factors vary depending on patient population and duration of the postoperative stay in ICU. Several studies have identified possible risk factors for delirium including advanced age, preoperative dementia, and depression. A study conducted on elderly patients after abdominal surgery by Olin, Eriksdotter-Jonhagen, Jansson, Herrington, & Kristainsson (2005) found that bleeding is an important

risk factor for delirium. Another study by Girad, Pandharipande and Ely (2008) demonstrated that delirium is due to predisposing and precipitating risk factors. Predisposing factors are age, preexisting cognitive impairments, depression, visual and hearing impairments. Precipitating factors include increased use of sedatives or analgesic medications, sleep disturbances, electrolyte disturbances, respiratory diseases and severity of illness. Although predisposing factors are difficult to alter, precipitating factors are potentially modifiable and prevent delirium (Girad et al., 2008). Theuerkauf et al. (2012) found more precipitating factors that contribute to the development of delirium in postoperative patients; additional factors include malnutrition, primary cerebral disease conditions (intracranial bleeding, stroke, meningitis, or encephalitis), use of physical restraints, indwelling catheters and admission to ICU.

Impacts of Delirium

Postoperative delirium is one of the frequent complications after a major surgery, and it leads to various adverse effects. Basinski and colleagues (2010) studied whether there is an association of delirium with Health-Related Quality of Life (HRQOL) and Stress after Hematopoietic Cell Transplant (HCT). They found a significant association with delirium and decreased HRQOL and persistent stress after HCT (Basinski, Alfano, Katon, Syrjala, & Fann, 2010). Several studies indicated that delirium positive patients had higher mortality rate compared to non-delirious patients (Leslie et al., 2005), (Lin et al., 2004), (Abelha et al., 2013). Abelha and his colleagues (2013) conducted a study on outcome and quality of life in patients with postoperative delirium and found that delirium patients have ten times higher mortality during hospital stay, six times greater mortality at discharge and 3.2 times higher mortality at six months' follow-up. They also

found an association between delirium and worsening physical function, vitality and social functions that affect the quality of life (Abelha et al., 2013).

Several studies have addressed the association between delirium and dementia. Most of the studies focused on the association between delirium and the risk for developing dementia. Saczynski et al. (2012) found a significant association with delirium and decline in cognitive function during the first year after the surgery. A higher percentage of patients with delirium had not returned to baseline cognitive function compare to non-delirious patients at 6 months after discharge. Delirium also contributes to prolonged mechanical ventilation days and higher risk for extubation failure. Jeon et al. (2016) and Lat et al. (2009) found delirium was independently associated with increased number of mechanically ventilator day, increased the length of hospital stays, and extended length of ICU stay.

Strategies for prevention of postoperative delirium

There are no current Food and Drug Administration (FDA) approved pharmacological measures to treat delirium. However, there are various pharmacological and non-pharmacological measures to prevent or reduce the incidence of delirium (Hipp & Ely, 2012). A randomized controlled study has shown preoperative education on postoperative delirium to be effective in improving patient knowledge and reducing anxiety. The experimental group were more knowledgeable about postoperative care ($P<0.001$) and had fewer days of mechanical ventilator days ($P=0.04$) than the control group. The authors found that hearing impairment was the predictor for postoperative delirium in patients who underwent pulmonary thromboendarterectomy (Chevillon, Hellyar, Madani, Kerr, & Kim, 2015).

Another study on a preoperative nurse-led intervention program showed beneficial effects on postoperative delirium. Intervention measures included in the study were educating nursing staff, systemic cognitive caring, improving sleep quality, maintaining a safe environment and providing social support. The severity of delirium was significantly low ($p<0.01$) in the intervention group within 24 hours compared to non-interventional group (Guo & Fan, 2016). Hipp and Ely (2012) suggest the use of a bundled intervention such as the ABCDE (Spontaneous Awakening and Breathing trials, Daily Delirium Monitoring and Early mobilization) in delirium prevention. Growing evidence supports the use of a standard multicomponent approach in mitigating delirium in ICU. The ABCDE bundle empowers the interdisciplinary team to utilize the best available interventions regarding mechanical ventilation, sedation and delirium in a safe, effective patient-centered manner (Balas, Buckingham, Braley, Saldi, & Vasilevskis, 2013)

Methods

Sample selection.

The study was carried out at the Norton Women's and Children Hospital (NWCH) in Louisville, Kentucky. The study was approved by the University of Kentucky Research Board and the Norton Women's and Children Hospital Research Review Committee. Medical records of all postoperative patients admitted to the Intensive Care Unit from January 2015 to December 2015 were reviewed for this study. The inclusion criteria were age older than 18, patients who stayed longer than 24 hours in the ICU, non-neurosurgical cases, and post-operative patients who required a mechanical ventilator for greater than twenty-four hours. Also, patients admitted with medical conditions, but

requiring surgical interventions during the stay were included in the study. The exclusion criteria for this study were patients admitted with severe neurological trauma that would have affected the delirium evaluation, patients admitted for medical treatment, and moribund patients who received comfort/ palliative care. The study was conducted at the 16 bed Intensive Care Unit at NWCH. The Intensive Care Unit is staffed with 44 nursing staff and two physicians who specialize in care of critically ill patients (intensivists). The ICU is managed by a multidisciplinary team who provides care for all general medical disease conditions and for all general, vascular, urology, thoracic and obstetrics-gynecology surgery patients.

Study Design

A descriptive analysis was done to assess the current delirium assessment process and intervention strategies for post-operative patients in the ICU. A retrospective medical record review was conducted on all postoperative patients admitted to the ICU from January 2015 to December 2015 on those who met the study inclusion and exclusion criteria. The following data were extracted from medical records; age, sex , number of delirium cases ,patients' length of ICU days, ventilator days, use of CAM tool at least once during their stay, use of sitters, use of pharmacological measures (use of antipsychotic medications- Seroquel, Haldol, Risperidone), number of restraint days, and number of device removals. Also, data were collected on how many patients expired during their stay and, discharge dispositions to rehabilitation facilities or home.

Statistical Analysis

Descriptive statistics were used to summarize study variables. Frequency distributions were used for categorical variables due to non- normality of distributions. For continuous

variables, data on delirious and non-delirious patients were compared using Mann-Whitney U test and Pearson's χ^2 test for categorical variables. All analyses were conducted using SPSS version 22 (IBM SPSS Statistics for Windows, version 22.0). The statistical level of 5% ($p < 0.05$) was considered as significant.

Results

During the study period, there were 136 postoperative patients admitted to ICU. Of the 136 post-operative patients, 115 patients met the inclusion criteria. Sixty five of the 115 patients (56.5%) were screened for delirium using the CAM- ICU tool. Patients who were positive on CAM -ICU tool were considered as delirium cases (n= 40), and patients who were CAM- ICU negative were considered as negative delirium cases (n=25). There were 50 patients (43.5%) with missed screenings during their ICU stay.

The study population was predominantly more female than male. In the study group, 62.5 percent were female and 38 percent were male. The mean age for females was 57.5 years and males mean age was 73 years. There was a significant difference (p= 0.03) in the means age between men and females. The patient population is divided into groups of delirium positive and delirium negative to compare the outcomes variables.

The prevalence of delirium in the postoperative patients was 61.5%. There were no International Classification of Disease (ICD) codes used in coding of positive delirium cases. Patients with delirium had a significantly higher number of mechanical ventilator days (median - 3.5 days) compared to non-delirious patients. The study showed statistical significance (p=.010) in use of antipsychotics like Risperidone, Seroquel, and Haldol in postoperative patients with and without delirium. There was no difference in the use of non -pharmacological measures in postoperative patients with and without delirium.

The study assessed device removal by the patient and the number of falls in the group. Although there were no falls during the study period, one device removal occurred in delirium positive group. There was no statistical significance between delirium and device removal.

Delirium positive patients had longer length of ICU stay (p= .00), and longer hospital stay (p= 0.001) when compared to delirium negative patients. There was a significant association between delirium and discharge disposition. The discharge dispositions in delirium positive patients were 60% to rehabilitation facilities, 25% to home, and 15% expired during hospitalization. In patients who tested negative for delirium, the percentages were 36% to rehabilitation facilities, 60% to home and 4% expired during hospitalization (Please refer to Appendix A)

Discussion

This study results demonstrated that there is an inconsistency in assessing delirium among post-operative patients in the critical care setting. Out of the total study population, 61.5 % of post-operative patients developed delirium during their stay. Despite the high prevalence of delirium in postoperative patients in the ICU, delirium assessment was missed in many of the study group. About 43.5% of post-operative patients have missed screening during their stay. Delirium developed in post-operative patients mostly on the third or fourth postoperative day. Delirium often goes under-recognized in ICU due to the severity of illness, use of sedatives or analgesics, lack of knowledge about delirium and lack of communication. Abelha et al (2013) reported that under- recognition or delay in delirium identification may leads to increased length of hospital days, increased mechanical ventilator days and increased health care cost. Using

a valid diagnostic tool such as CAM- ICU would help non-psychiatric physicians or other health care providers to meticulously diagnose delirium even on mechanical ventilator patients. Moreover, the American Geriatrics Society Expert Panel (2015) recommends that the formal and informal educational sessions to targeted health care professionals would improve delirium recognition and prevent delay in implementing treatment measures (The American Geriatrics Society Expert Panel [AGS], 2015).

This study results did not indicate any use of standard treatment measures or bundled intervention measures for delirium management. There was an inconsistency in the use of pharmacological and non-pharmacological measures in delirium management. Over 22 percent of delirious patient had pharmacological interventions and 15 percent of delirious patients had non- pharmacological interventions. Early recognition and implementation of proper treatment are crucial in reducing delirium in ICU. Lat et al (2009) found an association between analgesics and delirium. The occurrence of delirium in their study was due to the over administration of analgesics. Conversely, under treatment of pain can also increase the risk for delirium in postoperative patients. This study results demonstrated that 94.8 percent of postoperative patients were on pain medications. However, there is no association found between delirium and pain medication in this study. Kam, Dibartolo, Hinderer and Jones (2015) recommendations for management of delirium include the use of pharmacological and non-pharmacological measures. Although there is no Federal Drug Agency (FDA) approved pharmacological agent to treat delirium, the current management is focused on reducing the duration and severity of delirium. The pharmacological measures include preemptive management of pain, use of mild sedatives for patients' comfort while on a mechanical ventilator and use

of first or second generation antipsychotics to treat delirium symptoms. There are several multicomponent non-pharmacological measures to reduce or prevent delirium in the ICU. Some of the non-pharmacological measures are reorienting to the surroundings, encouraging patient- family interactions, promoting sleep along with vision/ hearing optimization, and implementing early mobilization activities. Moreover, recognizing and addressing the delirium risk factors will reduce the incidence of delirium.

The study results demonstrated an association between the number of physical restraints days and delirium. The median number of physical restraint days in delirious patient was four days compared to 0 days in non-delirious patients. Also, there was a significant association between physical restraints and number of mechanical ventilator days. Physical restraints are common in critical care settings. Mion, C Lorraine (2008) found that 74 percent of physical restraints were used to prevent device disruptions. In ICU, physical restraints are primarily used to maintain devices such as endotracheal tubes, tracheostomies, arterial lines, central lines, chest tubes. In this study, the association between delirium and accidental device removal was analyzed. Study results did not demonstrates a significant association found between delirium and accidental device removal. Move over there is no evidence to support that the need for of physical restraints to manage delirium. Physical restraints can increase agitation and can worsen the delirious situation. Implementing effective alternative measures such as providing a quiet environment, monitoring patients close to nurses' station, reorienting patient more frequently, increasing patient- family interactions and discontinuing unnecessary monitoring devices or Intravenous Catheters (IVs) could possible limit the agitation due to physical restraints.

The current study showed a strong association between delirium and longer mechanical ventilator days in delirium positive patients. The median number of mechanical ventilator days in delirious positive patients was three times more than delirium negative group (Please refer to Appendix B). Weaning from the mechanical ventilator is an emergent concern in ICU. Problems associated with ventilator weaning could be from overuse of sedation medications or from the overuse of opioids while on mechanical ventilator. Delirium positive patients will have weaning difficulties from the ventilator and increased the risk for reintubations. Study results illustrated an inconsistency in assessing weaning readiness from a mechanical ventilator. Failed weaning can lead to prolonged mechanical ventilation; and it may increase the risk for tracheostomies, lower respiratory tract infections, and respiratory failures. A daily assessment for weaning readiness using a standardized spontaneous breathing trial (SBT) and optimal pain control throughout the duration of mechanical ventilation could minimize the risk of delirium in postoperative patients.

This study results demonstrated that delirium positive patients had three times longer length of ICU stay and prolonged hospitalization (two times higher) compare to non-delirious group (please refer to Appendix B). Prolonged hospitalization can increase mortality rate, high health care cost and increase need for rehabilitation services. The study results further confirmed that delirium is a risk factor for post-discharge rehabilitation services. Sixty percent of delirious patients in the study group went to rehabilitation/skilled nursing facilities, which was twice higher than delirium negative group. The mortality rate was also high among delirious patients. Fifteen percent of

delirious patient expired during their stay which is three times more than the nondelirious patient (please refer to Appendix C).

Limitations

One of the major limitations was the study design. This is a descriptive study to assess the current strategies in delirium assessment and the use of treatment measures. A high percentage (43.5%) of delirium assessment was missed in this study. Missing delirium assessment in a large group and non-standardized use of CAM- tool screening may have influenced the number of delirium cases identified. Secondly, this study did not preclude patients with preexisting risk factors or cognitive impairments. The third limitation was that the study did not compare the cost analysis of delirium positive and delirium negative patients. However, in this study we can find that delirium negative patient group had shorter length of ICU stay, shorter hospital stay and shorter duration of mechanical ventilator days. Another limitation was that the study did not assess the nurse's knowledge about delirium, its risk factors, CAM tool and treatment measures because of the study method.

Recommendations for clinical practices

The implementation of multicomponent evidence based bundle such as the Awakening and Breathing Coordination, Delirium Monitoring and Management, and Early Mobility (ABCDE) bundle provides a standardized care approach in patient care. The important components of ABCDE bundle are assessing and managing pain, both spontaneous awakening trials and breathing trials, choice of analgesics and sedation, delirium assessment and management, encourage exercise and early mobility and the final component is empowering family (ICU delirium and Cognitive Impairment study group, 2013). Balas et al. (2012)

conducted a safety and efficiency of ABCDE bundle in critically ill patients receiving mechanical ventilator patients. Their study findings demonstrated that patients those who treated with ABCDE bundle had more ventilator free days and shorter duration of delirium. Balas et al. (2012) recommend the adoption of interdisciplinary multicomponent approach into everyday clinical care. Further, the bundled approach in patient care can improve communication between health care providers and can reduce practice variance in patient care. In addition, creating an alert system for delirium high risk group could prompt health care providers to initiate delirium preventive measures and monitor closely.

Recommendations for future study

Further study should be done in multiple units, with a larger sample, so that the results can be generalized to all postoperative patient population. The study should be repeated after the implementation of a standardized, evidence-based protocol to assess the effects of intervention measures. Another study recommendation would be follow up cognitive evaluation of delirium positive group after discharge to evaluate the significance of delirium and cognitive impairments. Evaluate outcomes of postoperative patients who were admitted to medical surgical floors to assess the incidence of delirium and its impact on patient outcomes.

Conclusion/ Summary

This descriptive study demonstrates that a higher percentage of general post-operative patients experienced delirium. The study results indicated that there was a significant gap in delirium screening among postoperative patients in the ICU. Postoperative delirium was an independent risk factor for increased number of mechanical ventilator days as well as increased use of restraints. There was a significant association with delirium and length of hospital stay, length of ICU stay, and discharge disposition to rehabilitation facilities. This study highlights the

need for implementation of an evidence-based delirium protocol. Delirium can be prevented by identifying high-risk patients early and implementing a standardized delirium protocol. Delirium prevention measures would highly reduce the adverse outcomes associated with delirium. Moreover, performing a preoperative risk assessment on all surgical patients is helpful in identifying high-risk patients and in implementing preventive measures that reduce the risk of post-operative delirium. Providing continuous education to nurses regarding delirium, its risk factors, use of the valid tool, and implementation of intervention measures will help to identify delirium early and improve the compliance in delirium assessment.

Appendices

Appendix A

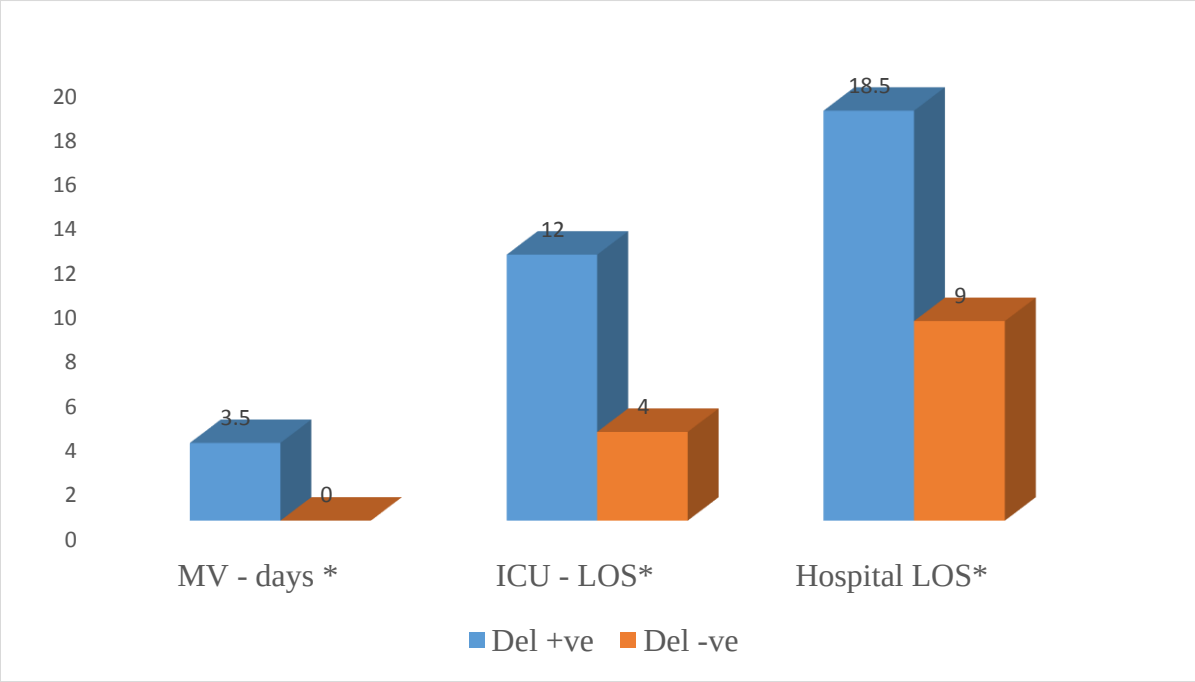
Post-operative patient characteristics and outcomes of delirium screened patients (N=65)

	Delirium (n=40)	No delirium (n=25)	P value
Demographic Variables			
Age (median)	59	57.5	0.740
Sex - Male	5 (20%)	15 (38%)	
Sex - Female	20 (80%)	25 (62%)	
Intervention measures			
Use of pharmacological measures	9 (22.5%)	0 (0%)	0.010
Use of non-pharmacological measures	6 (15%)	2 (8%)	0.047
Number of restraint day (median)	4	0	0.000
Use of sitters	4 (10%)	0	0.106
Patient outcomes			
Device removal by patient	1 (2.5%)	0	1.000
Number of mechanical ventilator days (median)	3.5	0	0.000
Length of hospital stay in days (median)	18.5	9	0.001
ICU length of stay in days (median)	12	4	0.000
Discharge disposition - Home	10 (25%)	15 (60%)	
Discharge disposition - Rehab facilities	24 (60%)	9 (36%)	0.005
Discharge disposition - Expired	6 (15%)	1 (4%)	

Mann- Whitney U test, Pearson Chi square; ICU, Intensive Care Unit; $P \leq 0.05$ is considered significant.

Appendix B

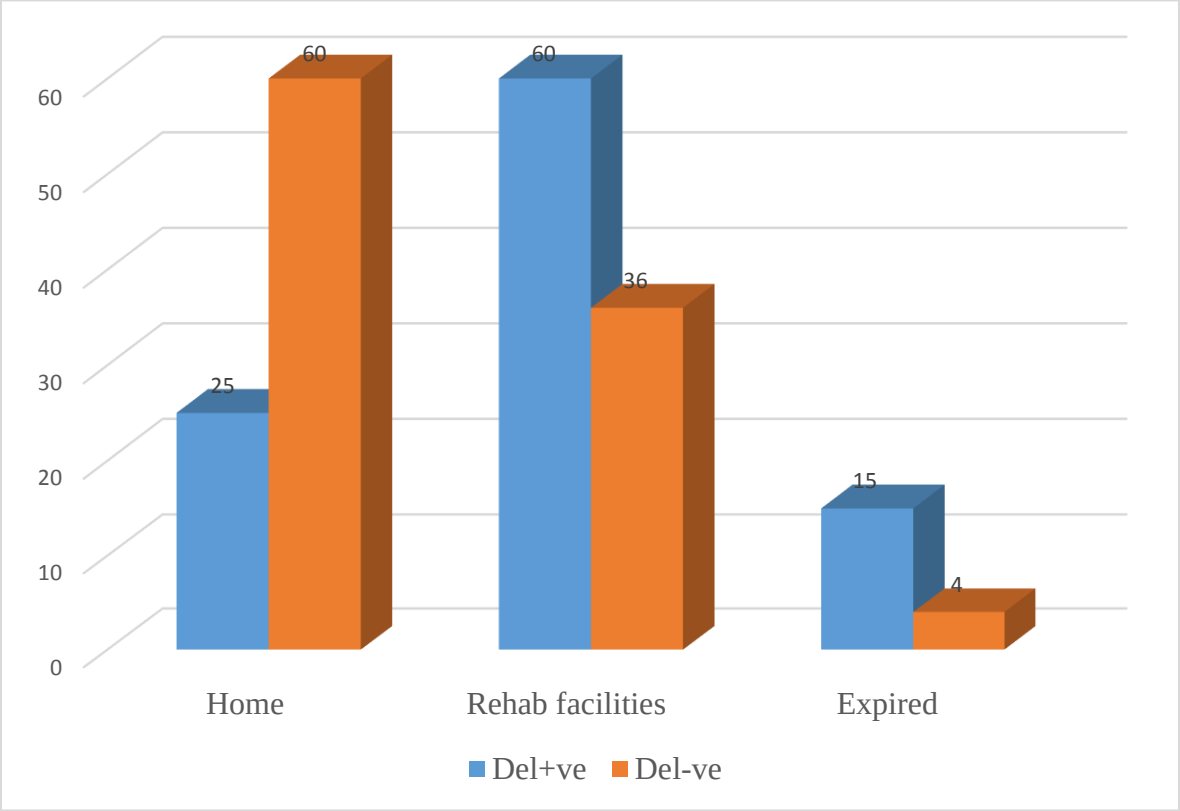
Patient Outcomes



Note: Data shown here in median. All of the above variables are statistically significant.

Appendix C

Discharge disposition



Note: Data shown in percentages.

References

Abelha, F. J., Veiga, D., Parente, D., Fernandas, V., Santos, P., Botelho, M., & Santos, C. (2013). Outcome and quality of life in patients with postoperative delirium during an ICU stay following major surgery. *Critical Care Forum*, *17*(17).

Babine, R. L., Hyrkas, K. E., Bachand, D. A., Chapman, J. L., Fuller, V. J., Honess, C. A., & Wierman, H. R. (2016). Falls in A Tertiary Care Hospital- Association with Delirium: A Replication Study. *The Academy of Psychosomatic Medicine*, *57*, 273-282.

Balas, M., Buckingham, R., Braley, T., Saldi, S., & Vasilevskis, E. E. (2013). Extending the ABCDE bundle to the Post- Intensive Care Unit Settings. *Journal of Gerontological Nursing*, *39*, 38-50.

Balas, M. C., Vasilevskis, E. E., Burke, W. J., Boehm, L., Pun, B. T., Oslen, K. T., ... Ely, E. W. (2012). Critical Care Nurses' Role in Implementing the "ABCDE Bundle" Into Practice. *Critical Care Nurse*, *32*, 35-37. http://dx.doi.org/10.4037/ccn2012229

Balas, M., Oslen, K., Gannon, D., Sisson, J., Sullivan, J., Stothert, J., ... Ely, W. (2012). SAFETY AND EFFICACY OF THE ABCDE BUNDLE IN CRITICALLY-ILL PATIENTS RECEIVING MECHANICAL VENTILATION. *Critical Care Medicine*, *40*(12). http://dx.doi.org/10.1097/01.ccm.0000424114.76434.7a

Basinski, J. R., Alfano, C. M., Katon, W. J., Syrjala, K. L., & Fann, J. R. (2010). Impact of Delirium on Distress, Health- Related Quality of Life, and Cognition 6 Months and 1 year after Hematopoietic Cell Transplant. *American Society for Blood and Marrow Transplantation*, *16*, 824-831. http://dx.doi.org/10.1016/j.bbmt.2010.01.003

Cheung, A., Thorogood, N. P., Noonan, V. K., Zhong, Y., Fisher, C. G., Dvorak, M. F., & Street, J. (2013). Onset, Risk Factors, and Impact of Delirium in Patients with Traumatic Spinal

Cord Injury. *Journal of Neurotrauma*, *30*, 1824-1829. http://dx.doi.org/10.1089/neu.2013.2975

Chevillion, C., Hellyar, M., Madani, C., Kerr, K., & Kim, S. C. (2015). Preoperative Education on Postoperative Delirium, Anxiety, and Knowledge in Pulmonary Thrombo-endarterectomy Patients. *American Association of Critical Care Nurses*, *24*, 164-171. http://dx.doi.org/10.4037/ajcc2015658

Davydow, D. S. (2009). Symptoms of Depression and Anxiety after Delirium. *Psychosomatics*, *50*, 309-316.

Ely, E. W., Gautam, S., Margolin, R., Francis, J., May, L., Speroff, T., ... Inouye, S. K. (2001). The impact of delirium in the intensive care unit on hospital length of stay. *Intensive Care Medicine*, *27*, 1892-1900. http://dx.doi.org/10.1007/s00134-001-1132-2

Gallagher, T. K., McErlean, S., Farrell, A. O., Hoti, E., Maguire, D., Traynor, O. J., ... Geoghegan, J. G. (2013). Incidence and risk factors of delirium in patients post pancreaticoduodenectomy. *Journal of International Hepato- Pancreato- Biliary Association*, *16*, 864-869. http://dx.doi.org/10.1111-hpb.12266

Girad, T. D., Pandharipande, P. P., & Ely, E. W. (2008, May 14). Delirium in the Intensive Care Unit. *Critical Care*, *12*. http://dx.doi.org/10.1186/cc6149

Goldenberg, G., Kiselev, P., Bharathan, T., Baccash, E., Gill, L., Madhav, V., ... Thakur, C. (2006). Predicting post-operative delirium in elderly patients undergoing surgery for hip fracture. *Journal of Psychogeriatric*, 6, 43-48.

Guo, Y., & Fan, Y. (2016). A Preoperative, Nurse- Led Intervention Program Reduces Acute Postoperative Delirium. *American Association of Neuroscience Nurses*, *48*, 229-235. http://dx.doi.org/10.1097/JNN.0000000000000220

Hipp, D. M., & Ely, E. W. (2012, January). Pharmacological and Nonpharmacological Management of Delirium in Critically ill patients. *Neurotherapeutics*, *9*, 158-175. http://dx.doi.org/DOI10.1007/s13311-011-0102-9

ICU delirium and Cognitive Impairment study group. (2013). http://www.icudelirium.org/delirium.html

Jeon, K., Jeong, B., KO, M. G., Nam, J., Yoo, H., Chung, C. R., & Suh, G. Y. (2016). Impact of delirium on weaning from mechanical ventilation in medical patients. *Official Journal of the Asian Pacific Society of Respirology*, *21*, 313-320. http://dx.doi.org/10.1111/resp.12673

Kram, S. L., Dibartolo, M. C., Hinderer, K. A., & Jones, R. A. (2015). Implementation of the ABCDE Bundle to Improve Patient Outcomes in the Intensive Care Unit in a Rural Community Hospital. *Dimensions of Critical Care Nursing*, *34*, 250-258. http://dx.doi.org/10.1097/DCC.0000000000000129

Lat, I., McMillian, W., Taylor, S., Janzen, J. M., Papadopoulos, S., Korth, L., ... Burke, P. (2009). The impact of delirium on clinical outcomes in mechanically ventilated surgical and trauma patients. *Critical Care Medicine*, *37*, 1898-1905. http://dx.doi.org/10.1097/CCM.ob013e31819ffe38

Leslie, D. L., Zhang, Y., Holford, T. R., Bogardu, S. T., Leo-Summers, L. S., & Inouye, S. K. (2005). Premature Death Associated with Delirium at 1-year Follow-up. *American Medical Association, 165*, 1657-1662.

Lin, S., Liu, C., Wang, C., Lin, H., Huang, C., Huang, P., ... Kuo, H. (2004). The impact of delirium on the survival of mechanically ventilated patients. *Critical Care Medicine, 32*, 2254-59. http://dx.doi.org/10.1097/01.CCM.0000145587.16421.BB

Magarey, J. M., & McCutcheon, H. H. (2005). Fishing with the dead'- Recall of memories from the ICU. *Intensive and Critical Care Nursing, 21,* 344-354. http://dx.doi.org/10.1016/j.iccn.2005.02.004

Mason, S. E., Noel-Storr, A., & Ritchie, C. W. (2010). The Impact of General and Regional Anesthesia on the Incidence of Post-Operative Cognitive Dysfunction and Post-Operative Delirium: A Systematic Review with Meta- Analysis. *Journal of Alzheimers Disease, 22,* 67-70. http://dx.doi.org/10.3233/JAD-2010-101086

McCusker, J., Cole, M., Abrahamowicz, M., Primeau, F., & Belzile, E. (2002). Delirium Predicts 12-Month Mortality. *Journal of American Medical Association, 162,* 457-463.

Mion, L. C. (2008). Physical Restraint in Critical Care Settings: Will They Go Away? *Geriatric Nursing, 29,* 421-423. http://dx.doi.org/10.1016/j.gerinurse.2008.09.006

Noriega, F. J., Vidan, M. T., Sanchez, E., Diaz, A., Serra-Rexach, J. A., Fernandez-Aviles, F., & Bueno, H. (2015). Incidence and impact of delirium on clinical and functional outcomes in older patients hospitalized for acute cardiac diseases. *American Heart Journal, 170,* 938-944.

Olin, K., Eriksdotter-Jonhagen, M., Jansson, A., Herrington, M. K., & Kristainsson, M. (2005). Postoperative Delirium in elderly patients after major abdominal surgery. *British Journal of Surgery Society, 92,* 1559-1564. http://dx.doi.org/10.1002/bjs.5053

Roberts, B. L., Rickard, C. M., Rajbhandari, D., & Reynolds, P. (2006). Patients' dreams in ICU: Recall at two years' post discharge and comparison to delirium status during ICU admission- A Multicenter cohort study. *Journal of Intensive and Critical Care Nursing, 22,* 264-273. http://dx.doi.org/10.1016/j.iccn.2006.02.002

Speed, G. (2015). The Impact of a Delirium Educational Intervention with Intensive Care Unit Nurses. *Clinical Nurse Specialist*, 89-94. http://dx.doi.org/10.1097/NUR.0000000000000106

The American Geriatrics Society Expert Panel. (2015). American Geriatrics Society Abstracted Clinical Practice Guideline for Postoperative Delirium in Older Adults. *Clinical Management of the Geriatric Patient, 163,* 142-150. http://dx.doi.org/10.1111/jgs.13281

Theuerkauf, N., Guenther, U., & Putensen, C. (2012). Postoperative delirium in the PACU and Intensive Care Unit. *Trends in Anesthesia and Critical Care*, 148-155. http://dx.doi.org/10.1016/j.tacc.2012.03.002

Wacker, P., Nunes, P. V., Cabrita, H., & Forlenza, O. V. (2006). Post-Operative Delirium Is Associated with Poor Cognitive Outcome and Dementia. *Dementia and Geriatric Cognitive Disorders, 2006*, 221-227. http://dx.doi.org/10.1159/000091022

Zaal, I. J., & Slooter, A. J. (2013, December 19). Light levels of sedation and DSM-5 criteria for delirium. *Intensive Care Medicine, 40,* 300-301. http://dx.doi.org/10.1007/s00134-013-3192-5

Zhang, Z., Pan, L., & Ni, H. (2013). Impact of delirium on clinical outcome in critically ill patients: a meta-analysis. *General Hospital Psychiatry, 35*, 105-111. http://dx.doi.org/10.1016/j.genhosppsych.2012.11.003