Reducing ICU Delirium by Promoting Early Mobility

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Abstract

Delirium is described as an acute confusional state characterized by fluctuating mental status, inattention, and either altered level of consciousness or disorganized thinking (Barr et al., 2013). In the intensive care unit (ICU), delirium has been shown to occur in 60% to 80% of mechanically ventilated patients and 40% to 60% of nonventilated patients. According to the most recent Pain, Agitation, and Delirium (PAD) Clinical Practice Guidelines from the American College of Critical Care Medicine (2013), early mobility is recommended to reduce delirium

Project Purpose: The purpose of the project was to educate nurses about the implementation of an evidence based early mobility protocol to reduce the incidence of delirium in the adult ICU setting. The project also identified barriers to implementing early mobility protocols.

Method: A quality improvement project included a five-step approach; 1) assessed current nursing knowledge about early mobility and protocol implementation; 2) educated unit-based critical care nurses about the early mobility protocol; 3) provided nurses with an Early Mobility Worksheet for documentation of protocol implementation; 4) accessed the electronic medical record of those patients mobilized and trended delirium; 5) The delirium data was compared to the baseline group (pre-education) to identify if there was a reduction in delirium

Results: Analysis was run excluding patients in the post-education group who were mobilized the day of or the day before ICU discharge. It was felt that the mobility intervention was not likely have an effect on delirium during the short time the patients remained in the ICU. After analysis, there was a statistically significant difference between the two groups (mean (SD) pre 44.1% (35.2%) versus post 20.5% (28.3%); p=0.045).

Discussion: The findings indicate that the earlier patients are mobilized in the ICU the better the delirium outcomes.

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Reducing ICU Delirium by Promoting Early Mobility

Background

Delirium is described in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (Text Revision) (DSM IV-TR) as an acute confusional state characterized by fluctuating mental status, inattention, and either altered level of consciousness or disorganized thinking. In the intensive care unit (ICU), delirium has been shown to occur in 60% to 80% of mechanically ventilated patients and 40% to 60% of nonventilated patients. Delirium can be subcategorized based on the patient's level of alertness into hyperactive, hypoactive, and mixed delirium. The hypoactive subtype is the most common accounting for 60% of delirium cases. Risk factors for delirium can be divided into three categories: 1) characteristics of acute illness, 2) patient or host factors, and 3) environmental or iatrogenic factors. While the risk factors for delirium are numerous, some of the more common causes include sedative, opiate, and benzodiazepine medications, age (greater than 65 years), sleep deprivation, immobilization, infection, and underlying dementia or previous delirium (Hipp & Ely, 2012). The most commonly used tool for monitoring delirium in the ICU is the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU). This tool has high sensitivity (93-100%), high specificity (98-100%), and high inter-rater reliability (kappa=0.96). The CAM-ICU is often used in combination with the Richmond Agitation-Sedation Score (RASS) or the Riker Sedation-Agitation Scale (SAS) (Hipp & Ely, 2012). Delirium is important to identify and treat, because long term consequences including cognitive deficits and severe weakness lead to additional costs of $2500 per patient or $6.9 billion annually (O'Mahony, Murthy, Akunne &Young, 2011).

According to the most recent clinical practice guidelines from the American College of Critical Care Medicine (2013), there are a few ways to prevent and treat delirium. Early mobility

is recommended to reduce the incidence and duration of delirium. Pharmacologic prevention is not recommended because there is no compelling data to demonstrate that it reduces the incidence or duration of delirium (Barr et al., 2013). Delirium treatment and prevention is commonly included in a care bundle which are several interventions that together are shown to improve critically-ill patient's outcomes. One of the most common care bundles is the Awakening and Breathing Coordination, Delirium monitoring/management, and Early exercise/mobility (ABCDE bundle). This bundle is an example of an interprofessional evidence-based multicomponent ICU management strategy aimed at reducing sedation exposure, duration of mechanical ventilation, and ICU-acquired delirium and weakness (Balas et al., 2013). Based on this information, a literature review was performed to determine the effect of mobility protocols on the incidence and duration of delirium.

In the development of this study, Avedis Donabedian's conceptual framework for assessing quality of care was utilized. Donabedian (1988) acknowledges that there are many methods for evaluating quality of care, but highlights three specific categories: structure, process, and outcome. To properly assess quality these three categories must have an established relationship. Donabedian (1988) states, "this three-part approach to quality assessment is possible only because good structure increases the likelihood of good process, and good process increases the likelihood of good outcome (p. 1745)." Structure can be described as the setting in which care occurs. This includes material resources (facilities, equipment, and money), human resources (number and qualifications of staff), and organization structure (methods of reimbursement and staff organization). Process describes the care given and received including both patient and staff activities. Lastly, outcome is the effect of care on patients' health status (Donabedian, 1988). All aspects of the structure, process, and outcome framework are addressed

in this study. The structure of this project includes the MICU, mobility equipment, and the qualified staff needed to aid in mobilizing patients. The process is the implementation of the early mobility protocol. The outcome evaluated will be the delirium data.

Literature Review

A literature review was performed to determine if early mobility protocols reduce the incidence or duration of delirium in adult ICU patients. Key terms searched were: "delirium," "intensive care unit" or "ICU," "early mobility" or "early ambulation" or "physical therapy" or "rehabilitation." The inclusion criteria for articles were qualitative or quantitative studies of delirium outcomes, studies with implementation of a mobility protocol, reports secondary data including ICU and hospital length of stay (LOS) and ventilator-free days. Exclusion criteria were articles before 2000, published in language other than English, studies that do not report delirium outcome data, and studies that do not implement a mobility protocol. The above key terms were used to conduct database searches in OVID, Cochrane, and CINAHL, resulting in 33, 7 and 66 articles respectively. Based on a review of abstracts regarding inclusion criteria, 15 articles were retained from the OVID search and one article was retained from the Cochrane search. After duplicate articles were excluded the CINAHL search 16 remained and 5 were retained. After completing an ancestry search, 6 additional articles were included. Based on inclusion and exclusion criteria and further analysis of articles, 19 of the 27 articles were excluded from the review of literature. Of the articles excluded, five did not implement a mobility protocol, seven did not report delirium outcomes, four reported data from the same studies, and three were a duplication of guideline recommendations. For the review of literature, eight articles were retained.

Results

The review of literature was conducted to determine whether early mobility reduced the incidence or duration of delirium and included two literature reviews and six studies. Of the studies included, one was a randomized control trial and five were prospective cohort studies. A summary of the studies is provided in Table 1.

Published literature reviews. Barr et al.'s (2013) literature review was conducted to review, evaluate, and summarize the literature and to develop clinical statements and recommendations for pain, agitation and sedation, and delirium management in the adult ICU patient. The literature review was conducted by a 20-person multidisciplinary, multi-institutional task force who reviewed over 19,000 studies through 2010. The quality of evidence for each recommendation and statement were ranked as high (A), moderate (B), or low/very low (C). Level A evidence included that delirium is associated with increased cost and increased ICU and hospital LOS in adult ICU patients. The Confusion Assessment Method for the ICU (CAM-ICU) and the Intensive Care Delirium Screening Checklist (ICDSC) are the most valid and reliable delirium monitoring tools in adult ICU patients (Barr et al., 2013). Level B evidence included early mobilization of adult ICU patients reduces the incidence and duration of delirium. Also, delirium is associated with post-ICU cognitive impairment. This review of literature indicates that early mobility is effective at reducing the incidence and duration of delirium (Barr et al., 2013).

Collinsworth, Priest, Campbell, Vasilevskis & Masica (2016) completed a literature review to examine the effectiveness, implementation, and costs of multifaceted care approaches for the prevention and mitigation of delirium in patients hospitalized in the ICU. The search was limited to English studies from January 1, 1988 to March 31, 2014. Randomized control trials and comparative studies of multifaceted care approaches with delirium in ICU patients as an

outcome were included. A total of 14 studies met the inclusion criteria. Of those studies, eight examine outcome measures pertaining to delirium. The interventions in these studies had a combination of various therapies including daily breathing trials, reorientation, early rehabilitation, pain assessment, and delirium screening. Of the eight studies, five found that multifaceted care approaches were associated with significant reductions in incidence of delirium, duration of delirium, or days patients spent awake and not delirious. Five studies examined mechanical ventilation and four found that multifaceted care approaches were associated with significant reductions in ventilator days. Additionally, three studies found that the multicomponent care approaches were associated with significant decreases in both ICU and/or hospital LOS. This review of literature illustrates that early mobility in addition to other interventions are effective in reducing the incidence and duration of delirium.

Early mobility studies with delirium outcome measures. Balas, Burke, Gannon, et al. (2014) performed a prospective cohort study to evaluate the effectiveness and safety of implementing the Awakening and Breathing Coordination, Delirium monitoring/management, and Early exercise/mobility (ABCDE) bundle into everyday practice. Previous studies of the ABCDE bundle focused on mechanically ventilated patients, but Balas et al. wanted to evaluate the ABCDE bundle implementation for all ICU patients regardless of mechanical ventilation. The study was implemented in five adult ICUs, one step-down unit and one oncology and hematology special care unit located in a 624-bed tertiary medical center. A total of 296 patients were enrolled in the study. Of those enrolled, 146 were the pre-bundle control patients and 150 were the post-bundle implementation study group. The ABCDE bundle included daily spontaneous awakening trials and daily spontaneous breathing trials if the patient received a continuous infusion of sedative medication and/or mechanical ventilation within the past 24

hours. Additionally, the bundle required delirium documentation using the Richmond Agitation-Sedation Scale (RASS) every two hours and Confusion Assessment Method for the ICU (CAM-ICU) every eight hours. Lastly, mobility was assessed based on physical therapy consultation and daily mobilization out of bed. Outcomes measures evaluated the effectiveness of the ABCDE bundle and included ventilator-free days during a 28-day period, prevalence of delirium, duration of delirium, percent of ICU days with delirium, mobilized out of bed during ICU stay, and time to discharge from the ICU and hospital. Statistical analysis was performed comparing the two groups and comparing outcome measures based on pre-bundle and post-bundle implementation data. Of the mechanically ventilated patients, the post-bundle implementation group had more ventilator free days than those in the pre-bundle implementation group. The pre-bundle median was 21 days (range 0-25 days) and the post-bundle median was 24 days (range 7-26 days); $p=0.04$. Patients treated with the ABCDE bundle experienced less delirium (pre-bundle 62.3% versus post-bundle 48.7%; $p=0.02$). Additionally, patients treated with the ABCDE bundle had a lower percentage of delirious ICU days (pre-bundle 50% versus post-bundle 33.3%; $p=0.003$) (Balas et al., 2014). Delirium duration was not significantly different between groups. The post-bundle group had a higher percentage of mobilized patients (pre-bundle 48% versus post-bundle 66%, $p=0.002$). There was no statistically significant difference in ICU or hospital discharge between the two groups. Overall, implementation of the ABCDE bundle increased ventilator-free days, reduced delirium, and increased the likelihood of patients being mobilized (Balas et al., 2014).

Foster and Kelly (2013) conducted a prospective, cohort pilot study to determine the feasibility of and to test a multicomponent, nonpharmacological, nurse-driven intervention to prevent delirium. The pilot study took place in a MICU in a Magnet-designated community

hospital in a major metropolitan city in Southwest United States. Inclusion criteria for the study

were patients 18 years or older, hemodynamically stable, and hearing able. After informed

consent, 32 patients enrolled in the study. The multicomponent intervention included daily

sedation cessation, promotion of sleep-wake cycles, promotion of meaningful sensory

stimulation, patient mobility, and preferred music listening. After a training period, the

intervention was initiated and post-intervention data collection began after the first week of

implementation and continued for two months. This data was compared to baseline delirium

data that was collected over one month on all MICU patients. The CAM-ICU tool was used to

collect delirium data. The baseline data included 216 patient delirium assessments. Data was

missing for 24.07% of the assessments. Of the remaining assessments, 28% were positive for

delirium, 12% were unable to be assessed, and 60% were negative for delirium. In the post-

intervention phase 92 patient delirium assessments were reviewed. Data was missing for 8.69%

of delirium assessments. Of those remaining, 31% were positive for delirium, 1% was unable to

be assessed, and 68% were negative (Foster & Kelly, 2013). Overall, adherence to the

intervention was low with barriers identified including documentation deficiencies,

patient/family consent process, and lack of support from other disciplines, mobility protocol

adherence, and poor sleep promotion (Foster & Kelly, 2013).

    Fraser, Spiva, Forman & Hallen (2015), conducted a prospective cohort study to assess

the effect of receiving physical therapy from a dedicated mobility team on patient quality-of-care

outcomes, sedation and delirium measures, and functional outcomes. The study was

implemented in three ICUs at a community acute care hospital in Southeastern United States. A

total of 132 patients were included in the study; 66 patients received routine care and 66 received

the early mobility intervention. The early mobility intervention was carried out by a dedicated

ICU mobility team including a physical therapist, a critical care nurse and a mobility technician. Each day the mobility team visited patients they have previously seen as well as new consults. The intervention consisted of four progressive mobility phases and which phase the patient received was based on patient ability. The intervention period was 3 months and outcomes measures included hospital LOS, ICU LOS, duration of mechanical ventilation, and days with no delirium. Outcome measures were compared between the routine care group and the intervention group. The mean hospital LOS was not significantly different between the two groups (routine care 10.7 days versus mobility 12.6 days, p=0.111). Additionally, there was no difference in the mean ICU LOS (routine care 6.5 days versus 6.4 days, p=0.973). The mean duration of mechanical ventilation was not significantly different between groups (routine care 3.3 days versus 3.8 days, p=0.52) (Fraser, Spiva, Forman & Hallen, 2015). Lastly, the mobility protocol did increase the mean days without delirium (routine care 3.6 days versus mobility 5.05 days, p=0.05). Overall, the mobility protocol demonstrated no effect on outcomes in the majority of measures analyzed, except for a reduction in the number of days that patients exhibited delirium (Fraser, Spiva, Forman & Hallen, 2015).

Inouye et al. (2003) implemented a prospective cohort study to examine the impact of adherence to effective nonpharmacologic interventions on delirium prevention. The study was carried out on a general medicine floor at Yale New Haven Hospital from March 1995-March 1998. Patient inclusion criteria for the study were 70 years or older, no delirium at admission, and at least intermediate risk of delirium based on risk factors. The final study sample included 422 patients. The intervention protocols implemented for all patients included orientation, therapeutic activities, and mobility. The mobility protocol was to provide ambulation or active range-of-motion activities three times daily. The primary outcome measured was new-onset

delirium during hospitalization, defined according to the CAM criteria. Delirium rates were

analyzed based on adherence to the various protocols. Adherence to the protocols was measured

daily. Adherence groups were divided into low, intermediate, and high. For the mobility

protocol, low adherence was 0% to 49%, intermediate was 50% to 74% and high was 75% to

100%. The rate of delirium for each adherence group was reported. For the low adherence

group the delirium rate was 14%, intermediate 10% and high 3% (Inouye et al., 2003). The

difference between the groups was statistically significant with p=0.01. Overall, higher

adherence to the protocols led to lower rates of delirium (Inouye et al., 2003.

Needham et al. (2010) conducted a prospective cohort quality improvement (QI) project

to increase rehabilitation-related consults and treatments in order to improve functional mobility,

to improve patient sedation and delirium status, and evaluate the effects on length of stay. The QI

project was implemented in Johns Hopkins Hospital's Medical ICU (MICU).   The study

involved a 3-month pre-QI project control period followed by a 4-month QI project

implementation period. The pre-QI project group had 27 patients and the QI project group had

30 patients all of whom had been intubated for four or more days in the MICU. Before

implementation of the QI project, the staff underwent education about early mobility in the ICU.

Additionally, standard work and checklists were used to remind staff about rehabilitation

consults and early mobilization in. The staff also held weekly interdisciplinary meetings about

the progress and barriers of the QI project. After QI project implementation, the proportion of

physical therapy consultations increased (pre-QI period 59% versus QI period 93%; p=0.004).

The proportion of non-delirious ICU days was higher in the QI period group (pre-QI period 21%

versus QI period 53%; p=0.003) (Needham et al., 2010). Functional mobility as measured by the

proportion of mobility treatments with sitting at the edge of bed or greater was also higher in the

QI period group (pre-QI period 56% versus QI period 78%; p=0.03). Lastly, MICU and hospital

LOS were significantly reduced in the QI period group. The average MICU LOS for the QI

period group was decreased (pre-implementation group 7.0 days versus QI period group 4.9

days, p=0.02). The average hospital LOS for the pre-QI group was 17.2 days and 14.1 days in

the QI period group with p=0.03. After implementation of the QI project, patients experienced

increased physical therapy consultations and functional mobility which resulted in an

improvement in non-delirious ICU days and a reduction in MICU and hospital LOS (Needham et

al., 2010).

Schweickert et al. (2009) conducted a randomized controlled trial to evaluate the efficacy

of a physical and occupational therapy on functional outcomes for patients receiving mechanical

ventilation in the ICU. The study was implemented in the medical ICUs at the University of

Chicago Medical Center and the University of Iowa Hospitals. The participants were all adults

(18 years or older) who had been on mechanical ventilation for less than 72 hours and will

continue on the ventilator for at least 24 hours. The study included 104 patients; 55 in the

control group and 49 in the intervention group. The intervention included physical and

occupation therapy in coordination with an interruption in sedation. The level of mobility was

dependent on patient ability. Outcomes measured included days with ICU delirium, percent of

time in ICU with delirium, ventilator-free days (out of 28 days), duration of mechanical

ventilation, ICU LOS, and hospital LOS. Patients who received the therapy protocol

experienced fewer delirium days and less time in the ICU with delirium (intervention 2.0 days

versus control 4.0 days, p=0.03 and intervention 33% versus control 57%, p=0.02). The

intervention group also experienced more ventilator free days (intervention 23.5 versus control

21.1, p=0.05) (Schweickert et al., 2009). Additionally, the duration of mechanical ventilation

was reduced for the intervention group (intervention 3.4 days versus control 6.1 days, p=0.02).

The ICU and hospital LOS was not significantly different between the two groups (intervention

5.9 versus control 7.9, p=0.08 and intervention 13.5 versus control 12.9, p=0.93). Overall, the

physical and occupational therapy reduced delirium and mechanical ventilation, but had no effect

on length of stay (Schweickert et al., 2009).

Discussion

This review of literature was conducted to evaluate the effectiveness of mobility

interventions to reduce the incidence and duration of delirium. The review included two reviews

of literature, one randomized control trial, and five prospective cohort studies. Barr et al., (2013)

found moderate strength evidence to support the hypothesis that early mobility protocols reduce

the incidence and duration of delirium. Collinsworth et al., (2016) found that multifaceted care

approaches that included mobility were associated with significant reductions in the incidence of

delirium, duration of delirium, or days patients spent awake and not delirious. Schweickert et al.,

(2009) demonstrated in a randomized control trial that implementing physical and occupational

therapy for intubated ICU patients reduced the duration of delirium. Lastly, five of the six

prospective cohort studies reported that early mobility decreased the incidence and/or the

duration of delirium. Overall, the review of literature reveals that mobility is an effective

intervention for reducing the incidence and duration of delirium. However, more studies are

needed to further evaluate the efficacy of the intervention because of the relatively small number

of studies published.

Study Question

When compared to no nursing education, does implementing nursing education about an evidence based early mobility protocol reduce incidence of delirium for patients in adult intensive care units (ICU)?

Methods

According to the American College of Critical Care Medicine (2013), early mobility is the primary nonpharmacological recommendation for reducing the incidence and duration of delirium. Based on the literature review, an educational project was conducted MICU (setting) to determine the effectiveness of an early mobility protocol on reducing the incidence of delirium. The project included a five-step approach; 1) assessed current nursing knowledge about early mobility and protocol implementation in the critical care unit; 2) educated unit-based critical care nurses about the early mobility protocol and its significance in patient care; 3) provided nurses with an Early Mobility Worksheet for documentation of protocol implementation; 4) accessed the electronic medical record of those patients mobilized and trended delirium data while patient remained in the ICU; 5) the delirium data was compared to the pre-education group (pre group) to identify if there was a reduction in delirium incidence. This study will contribute to the developing body of evidence regarding early mobility and delirium prevention.

Purpose of the study

The purpose of the project was to educate nurses about the implementation of an evidence based early mobility protocol to reduce the incidence of delirium in the adult ICU setting. The project also identified barriers to implementing early mobility protocols. This project was designed to increase nursing knowledge regarding early mobility, encourage mobilization in intensive care patients, to decrease the incidence of delirium, and to identify barriers to early mobilization in the intensive care setting.

Hypothesis

Educating nurses about the implementation of an evidence based early mobility protocol will reduce the incidence of delirium in an adult MICU.

Definition of terms

The key terms for this project are as follows:

Delirium: An acute confusional state characterized by fluctuating mental status, inattention, and either altered level of consciousness or disorganized thinking (Hipp & Ely, 2012)

Early mobility: Assessing a patient's readiness and ability to be mobilized within 24 hours of admission to the ICU (Early Mobility Toolkit, 2014).

Research Design

This study was a quality improvement project with a retrospective pre-post cohort design.

Sample

Data for the study was obtained through patient charts via the electronic medical record (EMR). The sample was MICU patients deemed eligible by the protocol to receive early mobility. The sample data was gathered over a one month time period to achieve a sample size of 30 (n=30). Inclusion criteria included: adult MICU patients (over 18 years of age) and patient admitted to the MICU for more than 24 hours. Exclusion criteria included: inability to follow commands, RASS score of -3 or less, mechanical ventilation with positive end-expiratory pressure (PEEP) greater than 10, oxygen supplementation with greater than 70% fraction of inspired oxygen (FiO2), respiratory rate less than 5 or greater than 40 breaths per minute, heart rate less than 50 or greater than 140 beats per minute, mean arterial pressure (MAP) less than 55 or greater than 140, systolic blood pressure (SBP) less than 90 or greater than 200, new or increasing vasopressor infusions or new cardiac arrhythmia.

Setting

The setting for the study was the MICU of a large academic medical center in the

Southeast United States. The MICU is a 28 bed unit within the roughly 600 bed medical center.

The MICU treats a wide array of critically ill patients with diagnoses that include septic shock,

liver failure, kidney disease, gastrointestinal bleeding, hypertensive emergency, chronic lung

diseases, cancer, alcohol/drug withdraw, pneumonia, acute respiratory distress syndrome, severe

allergic reactions and others. Approval for study implementation in the MICU was granted by

the medical director and nurse manager of the unit. The Human Subjects Research IRB

approved the study protocol (Appendix A).

Nursing Knowledge and Education

Nursing knowledge about the evidence based early mobility protocol and its significance

in patient care was assessed using an anonymous survey prior to nursing education. The survey

was sent out via e-mail, returned via email on the secure server, and the results were stored in

Excel. The education of the critical care nurses was multi-faceted. First, information regarding

the evidence based early mobility protocol and its importance in patient care was sent out to all

medical intensive care nurses via email. The email also had supporting evidence from the most

recent Pain, Agitation, and Delirium (PAD) Clinical Practice Guidelines from the American

College of Critical Care Medicine (2013). Information regarding project implementation and the

Early Mobility Worksheet was also sent out to familiarize the nurses with the format. The same

information was presented at the MICU staff meeting which occurs the first Tuesday of every

month. Lastly, one-on-one education was provided on the unit the week before project

implementation. One-on-one education was provided to all nurses during day shift for seven

consecutive days. While education was occurring, the unit staffed 95 nurses. Of those nurses,

65 received one-on-one education. The 30 nurses who did not receive one-on-one education were working night shift and the project was designed to be implemented during day shift. The researcher was also available throughout project implementation to respond to the staff's questions.

The Early Mobility Protocol

The early mobility protocol was adapted from Johns Hopkins Armstrong Institute for Patient Safety and Quality's Early Mobility Toolkit (*Early Mobility Toolkit*, 2014) (Appendix B). The early mobility protocol consisted of a patient assessment and progressive levels of mobility. If the patient passed the assessment (stated in inclusion and exclusion criteria above), then progressive mobility was started based on patient ability. The progressive mobility consisted of four levels. The first level consisted of turning the patient in bed every two hours and passive range of motion. Level two included passive transfer to chair or chair position in bed. Level three included standing with assistance or sitting out of bed. Level four consisted of active transfer to chair, standing with minimum or no assistance, and ambulating.

The early mobility protocol first required identification of the patients who were eligible for mobilization. The initial activity screening was performed for all patients within 24 hours of admission to the ICU. This initial screening was performed during interdisciplinary rounds. After orders were placed for the mobility protocol, the bedside nurse performed a basic assessment to determine if mobilizing the patient was safe and appropriate. The basic assessment determined neurologic, respiratory, and cardiovascular stability. The patient failed the basic assessment if any of the exclusion criteria (above) were met. If the patient failed the assessment, the patient only received mobility level one until stabilized. The patients who passed the basic assessment were mobilized starting at level two and progressed based on patient

ability. After the patient was mobilized, the nurse documented the mobility level reached on the

Mobility Protocol Worksheet (described below).

Procedure

After determining which patients were mobilized, the patient medical records were

accessed via the EMR by the researcher. The data were obtained manually from the EMR for

each patient. For each patient mobilized, the CAM-ICU score was obtained starting with the

first day mobilized until the patient was discharged from the ICU. The data were collected from

the Mobility Protocol Worksheet and the EMR. The Mobility Protocol Worksheets were

collected daily and stored in a locked office. After collection, data were de-identified and

organized using Excel. The worksheets were disposed of in appropriate shred bins.

The mobility data was compared to a pre-education group obtained before nursing

education regarding mobility protocol implementation. The pre-education data were collected on

thirty random patients starting on September 1, 2016. The data were obtained by information

technology experts from the medical center. The data were de-identified and stored in Excel.

Measures

Demographic data were obtained from the EMR and included age, gender, ICU LOS, and

hospital LOS. Delirium data were obtained for those patients who were mobilized using the

Mobility Protocol Worksheet (Appendix C). The worksheet was a quality improvement data

collection instrument that was paired with EMR delirium data. The worksheet had several

components and developed in collaboration with a MICU clinical nurse specialist. First, there

were places for the date and a patient information label. Next, the early mobility protocol was on

the worksheet as a reminder for the nurses. Below the mobility protocol illustration, there were

two questions. First, was the patient mobilized to a level greater than level one? The next

question: If not, why? The worksheet had options to choose between to respond to the question

including: patient failed basic assessment, patient/family refused, time, staffing, lack of

equipment, safety, other (comment). The nurse was asked to circle one of the options. An

example of the Mobility Protocol Worksheet is in an appendix below (Appendix C). Delirium

was measured using the CAM-ICU tool. This measure has high sensitivity (93-100%), high

specificity (98-100%), and high inter-rater reliability (kappa=0.96) (Ely et al., 2001).

Data Analysis

The data were analyzed using the statistical package SPSS version 24. Demographic data

were analyzed using descriptive statistics such as means, percentages, and frequencies. Due to

the skewness of the ICU and hospital LOS data, medians and interquartile range (IQR) were used

to describe the data. To test for a statistically significant difference between the pre and post-

education groups' length of stays, a Mann-Whitney U test was performed. Statistical analysis for

the delirium data was run in two ways. First, the average number of delirium positive days was

calculated for each patient in the pre and post group. Due to skewness of the pre and post

delirium data, a Mann-Whitney U test was performed to analyze for a statistically significant

difference between the two groups. Additionally, before any analysis was performed, it was

noted that many patients in the post-education group were mobilized on the day of or the day

before discharge. It was believe that the mobility intervention was not likely to have an effect on

delirium for these patients due to the short period of time the patient remained in the ICU.

Therefore, an additional analysis was performed excluding the patients who were mobilized the

day of or the day before ICU discharge. The patients in the pre group with only one or two day

ICU stays were also excluded. An independent-t test was run comparing the two groups to test

for statistical significance. (Norman & Streiner, 2003).

Protection of Human Subjects

The appropriate IRB application was submitted and approved. The risk of the study was the confidentiality of the data. The Mobility Protocol Worksheets were collected daily and stored in a locked office. Once the Worksheets were used to obtain delirium information from the EMR, they were disposed of in appropriate locked shredding bins. The information obtained from the Worksheets and the EMR was de-identified and stored in Excel.

<div align="center">Results</div>

Nursing Education

Before nursing education regarding the MICU's early mobility protocol was completed, a survey was sent to all MICU nurses via email. The survey was to assess baseline nursing knowledge of the unit's early mobility protocol and consisted of three questions: 1) Do you know about the MICU's Early Progressive Mobility Protocol (not the physician's order)? 2) Do you know where to locate the protocol? 3) Do you use the protocol in your daily practice? The survey had 31 respondents from the 95 nurses it was sent to. In response to the first question, 61% answered yes to knowing about the protocol. For the second question, 29% responded that they knew where to locate the protocol. Lastly, in response to the third question only 13% of respondents answered that they used the mobility protocol in their daily practice. This indicated to the researcher that education regarding the early mobility protocol needed to be conducted.

After the project was implemented and completed, the same survey was sent out to assess if there was a change in nursing knowledge and use of the mobility protocol. The follow-up survey had 15 respondents. In response to the first question, 93% answered yes to knowing about the mobility protocol. For the second question, 80% of the respondents answered yes to

knowing where to locate the protocol. Lastly, 36% of the respondents stated that they use the protocol in their daily practice.

Delirium Outcomes

Demographic and delirium data were compared between the two groups of subjects. The first group (pre-education group) consisted of 30 subjects who were admitted to the MICU before nursing education and project implementation. The post-education group consisted of 30 subjects who were mobilized using the MICU's early mobility protocol. Demographic data included age, race, gender, ICU LOS, and hospital LOS. In the MICU, delirium is assessed at least twice daily (day and night shift) using the CAM-ICU delirium assessment tool. Delirium was recorded as either positive or negative based on the patient's CAM-ICU score. Delirium data was collected in the pre-education group each day of their ICU admission. In the post-education group, delirium data was collected each day starting from the day the patient was mobilized until their discharge from the ICU. The patient was considered negative for delirium if every CAM-ICU assessment was negative for that given day. If one assessment yielded a positive result, that patient would be recorded as delirium positive for the day. For each patient in the pre and post-education groups, the average percentage of delirium positive days were calculated for analysis.

The demographic data for each group is shown in Table 2. Additionally, a Mann-Whitney U test was run comparing ICU LOS and hospital LOS between the two groups. There was a statistically significant difference in ICU and hospital LOS when comparing the pre and post groups (median ICU LOS- pre-education 2.7 days versus post 6.0 days; $p=0.003$ and median hospital LOS- pre 5.5 days versus post 15.5 days; $p=0.002$). While this was not an anticipated finding, reasons for these outcomes will be discussed below.

As stated above, due to significant skewness, the delirium data for the pre and post-education were compared using a Mann-Whitney U test. The median number of days that delirium data were collected was similar between the groups (pre 2.5 days versus post 3 days). The range of days varied between the two groups, but had the same interquartile range (pre 1-38 days, IQR 5 days versus post 1-17 days, IQR 5 days). The average number of delirium days for each patient in the pre and post-education groups were calculated. The median percentage of delirium positive days between the two groups was relatively similar (pre 14.6% versus post 0%). A Mann-Whitney U test was run and showed that the difference between the two groups was not statistically significant (p=0.139). Results can be found in Table 3.

Additionally analysis was run excluding patients in the post-eduation group who were mobilized the day of or the day before ICU discharge. It was believed that the mobility intervention was not likely to have an effect on delirium during the short time the patients remained in the ICU. In order to keep the two groups similar in size, the patients in the pre-education group with a one or two day ICU length of stay were also excluded. After exclusion, the pre-education group n=18 and the post-education group n=15. For these two groups, the median number of days that delirium data were collected was the same (median- pre 6 days versus post 6 days) The range and IQR varied between the two groups (range- pre 3-38 days versus post 3-17 days; IQR- pre 6 days versus post 8 days). Also, the average number of delirium positive days for each patient was calculated. Due to the normal distribution, an independent T-test was run on the groups. After analysis, there was a statistically significant difference between the two groups (mean (SD) pre 44.1% (35.2%) versus post 20.5% (28.3%); p=0.045). Results can be found in Table 4.

Barriers to Mobilization

The Early Mobility Worksheets included a place to document if the nurse was unable to mobilize a patient. This could have been because the patient failed the basic assessment, but also included a list of likely barriers to mobilizing patients in the ICU. During the project implementation, barriers to mobilization were identified on 81 occasions. The primary reason patients were not mobilized was that the patient failed the basic assessment. This accounted for 31 out of the 81 responses. Safety as a barrier to mobilization was reported in 25 of the 81 responses. Having enough time was identified on 10 occasions as a barrier to mobilization. Next, inadequate staffing was a barrier to mobilization in eight cases. For two patients, the barrier to mobilization was lack of equipment. Lastly, five patients or their families refused mobilization. Approaches to reduce these barriers are discussed below.

<div align="center">

Discussion

</div>

Nursing Education

The need for nursing education regarding the MICU early mobility protocol was assessed using a survey sent out to all nursing staff on the unit. After receiving the results from the initial survey, it was clear that there was a nursing knowledge deficit about the early mobility protocol. The multi-faceted education process was systematic and appeared effective, but occurred over a relatively short period of time (two weeks). Given more time, all of the nursing staff would have received one-on-one education rather than just those who were working day shift. The same survey was sent out after project implementation to see if there was increased knowledge of the early mobility protocol. Only 15 nurses responded to the follow-up survey which was half the number of initial respondents. After education and project implementation, only 36% of the 15 respondents stated that they use the early mobility protocol in their daily practice. In the post survey, the responses demonstrated an increased knowledge about the protocol, but it did not

show a significant increase in the use of the mobility protocol in daily practice. This could

indicate the need for a different mobility protocol in the MICU. Perhaps one that is more user-

friendly and easier to understand. It may also indicate the need for further education about the

barriers nurses face when trying to mobilize patients and how to address those issues. Overall, it

would be easier to extrapolate nursing education outcomes if more nurses were to respond to the

surveys. In the future, it may be more effective to hand out a paper post-survey after education

to increase compliance with completion.

Delirium

First, ICU and hospital length of stay were compared between the two groups. The

difference between the groups for both ICU and hospital LOS were statistically significant.

However, it was the opposite of the expected finding. The ICU and hospital LOS were

significantly shorter for the pre-education group. One explanation for this finding is higher

acuity illness in the post-education group patients. The data was collected during November and

December which is typically when the unit sees an increase in the number of flu and pneumonia

cases. Although, this may be the case no measure of acuity was collected for these patients. For

future studies, the acuity of patients may be an important measurement to include.

Next, the delirium data were analyzed. When comparing both groups, the difference in

the average number of days with delirium was not significantly different. However, when

patients who were mobilized on the day of discharge or the day before discharge from the ICU

were excluded the difference between the two groups became statistically significant. The post-

education group had less than half of the average delirium days when compared to the pre-

education group. This indicates that the earlier patients are mobilized in the ICU the better the

delirium outcomes. There are several reasons why patients may not be mobilized until the end of

the ICU stay. First, patients may not be mobilizing earlier in their stay because nurses feel they

are too sick to mobilize. Although there is an assessment in the mobility protocol to determine if

a patient is safe to mobilize, nurses may feel that their knowledge of the patient's ability

supersedes the assessment. Additionally, the nurses may feel more comfortable mobilizing

patients when they are ready to leave the ICU because this indicates more stability. Also, nurses

identified several barriers to mobilizing patients which may have prevented earlier mobility.

This may indicate the need for more education and training about patients who are safe to

mobilize and how to do it. In future studies, this would be an important to teach nurses that

earlier mobility decreases delirium and to provide them with the tools to accomplish this.

It is also important to note that before implementation of this project another DNP project

occurred that taught nurses about how to accurately document delirium using the CAM-ICU tool.

The project occurred during the summer and fall before project implementation. The same staff

was educated for both projects. This may have had an unforeseen impact on delirium data for

this project. For future studies, it may be beneficial to provide education about CAM-ICU

documentation.

Barriers to Mobilization

There were numerous barriers to mobilization identified by the nurses which highlight the

need for practice changes in several areas. First, mobilization needs to be more highly

prioritized in the daily care of MICU patients. In order to ensure patients are being mobilized

safely, proper equipment should be readily available for all patients. As in Fraser, Spiva, Forman

& Hallen (2015), it may also be helpful for the MICU to develop a mobility team including a

physical therapist, ICU nurse, and mobility technician. The implementation of a mobility team

would hopefully eliminate barriers such as inadequate staffing and timing. Lastly, training staff

on how to properly mobilize critically ill patients could help reduce the safety barriers. Overall, to decrease barriers to mobilization in the ICU, unit based leaders and staff must identify and prioritize areas for realistic improvement.

Strengths and Limitations

While many studies have shown the importance of mobilizing ICU patients, few have examined the impact of mobility interventions in reducing or preventing delirium. This study will contribute to the existing literature regarding the effectiveness of mobility protocols in reducing delirium. Limitations of this study include the lack of generalizability to other ICUs, data collection over a relatively short time period, and lack of randomization.

Nursing Practice Implications

This study will contribute to nursing knowledge about mobility protocols in the ICU, barriers to implementation, and delirium reduction with mobility. The study will add to the literature regarding mobility protocols reducing the incidence of delirium. Several nursing practice implication were identified as a result of this project. First, the need for a new mobility protocol in the MICU since nurses are still not frequently using the current protocol in their daily practice. The new protocol should be chosen in coordination with the nursing staff. The next nursing practice implication is the need for increased staffing to help with patient mobilization. Specifically, it would be helpful to have a patient care technician to serve as a mobility technician and an additional respiratory therapist specifically for mobilizing patients. Along with staffing, the unit should have more frequent physical therapy visits. Most patients with physical therapy consults are not seen every day and if they were it would drastically increase mobility. This would likely require hiring more physical therapists. Physical therapists could also hold educational meetings to teach the nursing staff how to safely mobilize ICU patients.

This would increase the nurses' knowledge and confidence in mobilizing critically ill patients while also addressing safety concerns. Another area for improvement is easier access to equipment for mobilization. Each patient room should have a high back chair to safely mobilize patients out of bed. Additionally, there should be more access to bariatric equipment and passive transfer chairs. Currently, all 28 beds in the MICU share just a few pieces of equipment. If mobility is to become a priority, more equipment would need to be purchased. Lastly, as in Balas et al., (2014) it may be more effective to include mobility into a bundle like the ABCDE bundle. The implementation of this bundle would likely further improve delirium outcomes.

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Table 1.

Studies of mobility protocols with reported delirium outcomes

Citation	Study Design & Purpose	Setting and sample size	Intervention	Outcome Measures	Findings
Balas, et al., (2014).	Prospective cohort study to evaluate the safety and effectiveness of implementing the Awakening and Breathing coordination, Delirium monitoring/management, and Early exercise/mobility bundle into everyday practice	Five adult ICUs, one step-down unit and one oncology and hematology special care unit located in a 624-bed tertiary medical center N=296 (146 pre-bundle and 150 post-bundle implementation)	Implementation of Awakening and Breathing Coordination, Delirium monitoring and management, and early exercise/mobility bundle	Prevalence/duration of delirium and coma, early mobility, mortality, time to discharge, and ventilator-free days	Delirium anytime pre-bundle 62.3% and post-bundle 48.7%, p=0.02, adjusted p= 0.03 Percent of ICU days spent delirious (median and range): pre-bundle 50% (30-64.3%) and post-bundle 33.3% (18.8-50%); p=0.003 Duration of delirium days (median and range): pre-bundle 3 (1-6) and post bundle 2(1-4); p=0.52 Early exercise/mobility: mobilized out of bed anytime in ICU- pre-bundle 48% and post-bundle 66%; p=0.002; adjusted odds ratio 2.11 (1.3-3.45); adjusted p=0.003 Ventilator free days (median and range): pre-bundle 21 (0-25) and post-bundle 24 (7-26), p=0.04 Time to discharge from ICU (median and range) pre-bundle 5 (3-8) and post-bundle 4 (3-5), p=0.21. Time to discharge from the hospital (median and range): pre-bundle 13 (9-15) and post-bundle 11 (9-13), p=0.99
Foster & Kelly (2013).	Prospective cohort pilot study to determine the feasibility of and test a	A 12 bed medical ICU in a magnet-designated	Multicomponent intervention included: daily sedation	Delirium based on CAM-ICU score	Delirium data between the two groups was not significantly different. From the baseline data (216 delirium assessments),

	multicomponent, nonpharmacological, nurse-driven intervention for prevention of delirium	community hospital in a metropolitan in the Southwest United States N=32	cessation, promotion of sleep-wake cycles, promotion of meaningful sensory stimulation, patient mobility, and preferred music listening.		28% of screenings were positive for delirium and 12% were unable to be assessed. In the post-intervention data (92 delirium screenings), 31% of delirium assessments were positive for delirium and 1% were unable to be assessed.
Fraser, Spiva, Forman & Hallen (2015).	Prospective cohort pilot study comparing ICU patients who received physical therapy from a dedicated mobility team to ICU patients who received routine care.	3 different ICUs in an acute care hospital in Southeastern United States N=132	The formation of an early mobility team and mobility program	Hospital LOS, ICU LOS, duration of mechanical ventilation, days with no delirium	Hospital LOS, mean days and SD: routine care 10.6 (7) vs mobility 12.6 (7.4), p=0.111 ICU LOS, mean days and SD: routine care 6.5 (4.8) vs mobility 6.4 (5.3; p=0.973 Duration of mechanical ventilation, mean days and SD: routine care 3.3 (4.8) vs mobility 3.8 (5.3); p=0.52 Days with no delirium, mean day and SD: routine care 3.6 (1.6) vs mobility 5.05 (3); p=0.05
Inouye, Bogardus, Williams, Leo-Summers & Agostini, (2003)	Prospective cohort pilot study To examine the impact of level of adherence on effectiveness of nonpharmacologic interventions to prevent delirium	One general medicine floor at Yale New Haven Hospital for March 1995-March 1998. N=422	Implementation of protocols specifically targeted to manage risk factors for delirium. All patients received orientation, therapeutic activities, and mobility protocols.	New onset delirium during hospitalization according to the CAM-ICU criteria. Adherence to the intervention.	Delirium was analyzed based on adherence to protocol. Adherence groups were divided into low, intermediate, and high. For the mobility protocol, low adherence was 0% to 49%, intermediate was 50% to 74%, and high was 75% to 100%. The rate of delirium for each adherence group was reported. For the low adherence group the delirium rate was 14%, intermediate 10%, and high 3%. The difference between the groups was statistically significant with p=0.01.
Needham &Korupolu (2010).	A quality improvement (QI) project to increase rehabilitation-related consults and treatments in order to improve functional mobility, to improve	Johns Hopkins Hospital's Medical ICU (16 bed unit) Pre-QI project n=27	A multidisciplinary team focused on reducing heavy sedation and increasing MICU staffing to include	Physical therapy consultations, proportion of ICU days not delirious, functional mobility, MICU length of stay,	Physical therapy consultations: pre-QI 59% and post-QI 93%; p=0.004 Proportion of ICU days not delirious: pre-QI 21% and post-QI 53%; p=0.003

	patient sedation and delirium status, and to evaluate the effects on length of stay	Post-QI project n=30	full-time physical and occupational therapists with new consultation guidelines	hospital length of stay	Functional mobility: pre-QI 56% and post-QI 78%; p=0.03 MICU LOS, days: pre-QI 7.0 and post-QI 4.9; p=0.02 Hospital LOS, days: Pre-QI 17.2 and post-QI 14.1; p=0.02
Schweickert, Pohlman, Pohlman, Nigos, Pawlik, Esbrook,… Press (2009).	Randomized control trial to assess the efficacy of combining daily interruption of sedation with physical and occupational therapy on functional outcomes in patients receiving mechanical ventilation in intensive care.	Medical ICUs of University of Chicago Medical Center and University of Iowa Hospitals N= 104 adult patients; 49 intervention and 55 control	Daily physical and occupational therapy provided by physical and occupational therapists for patients who have been mechanically ventilated for less than 72 hours and will remain ventilated for the next 24 hours.	ICU delirium (days), time in ICU with delirium (%), ventilator free days, duration of mechanical ventilation, ICU LOS, hospital LOS	ICU delirium (days): intervention 2.0 versus control 4.0; p=0.03 Time in ICU with delirium (%): intervention 33% versus control 57%; p=0.02 Ventilator-free days (of 28 days): intervention 23.5 versus control 21.1; p=0.05 Duration of mechanical ventilation (days): intervention 3.4 versus control 6.1; p=0.02 ICU LOS (days): intervention 5.9 versus control 7.9; p=0.08 Hospital LOS (days): intervention 13.5 versus 12.9; p=0.93

Table 2.

Demographic Data

	Pre-Education Group	Post-Education Group
Sex (% female)	70%	46.7%
Age, years (mean, SD)	60.9 (18.8)	56.1 (20.7)
Race (%)		
Caucasian	80%	80%
African American	16.7%	13.3%
Hispanic	3.3%	6.7%
ICU length of stay, days (median, range, IQR)	2.7, 1-37, 5	6, 2-34, 8
Hospital length of stay, days (median, range, IQR)	5.5, 1-48, 8	15.5, 3-53, 15

Table 3.

Delirium outcomes

	Pre-Education	Post-Education
Sample Size	n=30	n=30
Median % delirium positive days	14.6%	0%

Mann-Whitney U test; p=0.139

Table 4.

Delirium outcomes excluding patients mobilized day of or day before ICU discharge

	Pre-Education	Post-Education
Sample Size	n=18	n=15
Mean % Delirium Positive Days (Standard Deviation)	44.1% (35.2%)	20.5% (28.3%)

Independent T-test; p=0.045

Appendix A

University of Virginia
Institutional Review Board for Health Sciences Research
HIPAA Privacy Board

IRB - HSR # 19359		
Event: Approval New Protocol - Expedited	**Type:** Protocol	**Sponsor(s):** Sponsor Protocol #:
		Principal Investigator: Regina DeGennaro, RN-C, MSN, AOCN, CNL

Title: Early Mobility and its Effect on Delirium

Assurance: Federal Wide Assurance (FWA)#: 00006183

Certification of IRB Review: The IRB-HSR/HIPAA Privacy Board abides by 21CFR50, 21CFR56, 45CFR46, 45CFR160, 45CFR164, 32CFR219 and ICH guidelines. This activity has been reviewed in accordance with these regulations.

Event Date: 11/10/16

Protocol Expiration Date: 11/09/17

Number of Subjects: 175

HSR Protocol Version Date: 10/25/16

Data Security Plan Date: 11/01/16

Current Status: Open to enrollment

Consent Version Dates:

Committee Members (did not vote):

Comments: The IRB determined the protocol met the criteria for approval per the federal regulations and was approved.

It is open to enrollment.

The purpose of this medical record review is to evaluate the effectiveness of an evidence based early mobility clinical protocol to reduce the incidence and/or duration of delirium in the adult ICU setting.

This research protocol will also identify barriers to implementing early mobility as defined per standard of care.

There is no outside sponsor for this study.

N= 175 subjects

Ages: greater than or equal to 18 years

The following documents were submitted with this protocol: mobility worksheet.

No additional committee approvals are required.

No compensation.

REGULATORY INFORMATION:

The IRB determined this protocol met the criteria of minimal risk.

Protocol Expedited by Category #5: Research involving materials (data, documents, records or specimens) that have been collected solely for non-research purposes (such as medical treatment and/or diagnosis).

This protocol has been granted a Waiver of Consent to identify potential subjects via 45CFR46.116.

This protocol has been granted a waiver of consent under 45CFR46.116 for the main study.

This protocol has been granted a waiver of HIPAA authorization under 45CFR 164.512(i)(2) for the main study.

The following HIPAA identifiers will be collected: name, all elements of dates, medical record number, account numbers, other information that could be used alone or in combination with other information to identify an individual.

The minimum necessary PHI to be collected includes: CAM-ICU scores (delirium information), Length of hospital and ICU stays, admitting diagnosis.

Subjects may not be contacted by any method (email, phone, in person etc.) to obtain more information for this study without additional IRB-HSR approval.

No identifiable health information will be taken or shared outside of the UVa HIPAA covered entity.

PLEASE REMEMBER:
* If an outside sponsor is providing funding or supplies, you must contact the SOM Grants and Contracts Office/ OSP regarding the need for a contract and letter of indemnification. If it is determined that either of these documents is required, participants cannot be enrolled until these documents are complete.
* You must notify the IRB of any new personnel working on the protocol PRIOR to them beginning work.
* You must obtain IRB approval prior to implementing any changes to the approved protocol or consent form except in an emergency, if necessary to safeguard the well-being of currently enrolled subjects.
* If you are obtaining consent from subjects, prisoners are not allowed to be enrolled in this study unless the IRB-HSR previously approved the enrollment of prisoners. If one of your subjects becomes a prisoner after they are enrolled in the protocol you must notify the IRB immediately.
* You must notify the IRB-HSR office within 30 days of the closure of this study.
* Continuation of this study past the expiration date requires re-approval by the IRB-HSR.

The IRB-HSR official noted below certifies that the information provided above is correct and that, as required, future reviews will be performed and certification will be provided.	
Name: Margaret W. Ball, BSN, MEd, CIP Title: Member, Institutional Review Board for Health Sciences Research Phone: 434-924-9634 Fax: 434-924-2932	Name and Address of Institution: Institutional Review Board for Health Sciences Research PO Box 800483 University of Virginia Charlottesville, VA 22908
Approval: Approved by Margaret W. Ball, BSN, MEd, CIP From IP Address: 128.143.219.231	Date: 11/10/16 at 03:35 PM

Appendix B

The MEDICAL INTENSIVE CARE UNIT

June 15, 2016

Megan Boehling, RN, BSN, CCRN
Medical ICU
UVA Health System

Megan,

This letter represents permission given to you to conduct your DNP scholarly project on the implementation of early mobility to reduce the incidence of delirium in the Medical ICUs. Please let us know if we can be of further assistance.

R.M. Carpenter, MSN, RN   Kyle Enfield, MD, MS
Manager, Medical ICU   Medical Director, Medical ICU

Appendix B
Early Mobility Protocol

START HERE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Initial Activity Screening Within 24-hrs of admission	**No / Low Cooperation** RASS -5 to – 3	**Moderate Cooperation** RASS > -3 to -1	**[Close to] Full cooperation** RASS > -2 to -1	**Full Cooperation** RASS > 0
	FAILS BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT
BASIC ASSESSMENT **Neurologic** RASS > -3 Follows 3-4 commands **Respiratory** PEEP < 10 / FiO2 < 70 SpO2 > 90% RR > 5 < 40 bpm **Cardiovascular** HR > 50 < 140 MAP > 55 < 140 SBP > 90 < 200 No new or increasing vasopressor infusion No new arrhythmia	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Consider specialty bed	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Progressive upright mobility • Passive transfer to chair	**BODY POSITIONING** • HOB > 30° • Splinting • Passive transfer to chair • Sitting out of bed • Standing with assistance	**BODY POSITIONING** • HOB > 30° • Splinting • Active transfer to chair • Sitting out of bed • Standing with min. or no assist
	ACTIVITY • Passive ROM 2x d • Passive bed cycling (Letto)	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Passive/active leg &/or arm cycling in bed (Letto) or chair	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Standing with assistance • ADLs	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Walking • ADLs
FAILS — Start level 1 **PASSES** — Start level 2	Tolerates level 1 activities →	Tolerates level 2 activities →	Tolerates level 3 activities →	Ambulate progressively longer distances
PM & R CONSULTATIONS	OT: PROM / Splinting	PT: If deconditioned OT: PROM / splinting	PT: If deconditioned OT: ADL's / PROM SLP: Cognitive	PT: If deconditioned OT: ADL's / PROM SLP: cognitive

Appendix C
Early Mobility Worksheet

Date:

Patient Label

START HERE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Initial Activity Screening Within 24-hrs of admission	**No / Low Cooperation** RASS -5 to – 3 **FAILS** BASIC ASSESSMENT	**Moderate Cooperation** RASS > -3 to -1 **PASSES** BASIC ASSESSMENT	**[Close to] Full cooperation** RASS > -2 to -1 **PASSES** BASIC ASSESSMENT	**Full Cooperation** RASS > 0 **PASSES** BASIC ASSESSMENT
BASIC ASSESSMENT **Neurologic** RASS > -3 Follows 3-4 commands **Respiratory** PEEP < 10 / FiO2 < 70 SpO2 > 90% RR > 5 < 40 bpm **Cardiovascular** HR > 50 < 140 MAP > 55 < 140 SBP > 90 < 200 No new or increasing vasopressor infusion No new arrhythmia	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Consider specialty bed **ACTIVITY** • Passive ROM 2x d • Passive bed cycling (Letto)	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Progressive upright mobility • Passive transfer to chair **ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Passive/active leg &/or arm cycling in bed (Letto) or chair	**BODY POSITIONING** • HOB > 30° • Splinting • Passive transfer to chair • Sitting out of bed • Standing with assistance **ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Standing with assistance • ADLs	**BODY POSITIONING** • HOB > 30° • Splinting • Active transfer to chair • Sitting out of bed • Standing with min. or no assist **ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Walking • ADLs
FAILS — Start level 1 **PASSES** — Start level 2	Tolerates level 1 activities →	Tolerates level 2 activities →	Tolerates level 3 activities →	Ambulate progressively longer distances
PM & R CONSULTATIONS	OT: PROM / Splinting	PT: If deconditioned OT: PROM / splinting	PT: If deconditioned OT: ADL's / PROM SLP: Cognitive	PT: If deconditioned OT: ADL's / PROM SLP: cognitive

Was the patient mobilized?

    If so, to what level?

If the patient was not mobilized, why? (circle one)

Pt. failed basic assessment   Pt/family refused   Time   Staffing   Lack of equipment

Safety   Other (comment)

Appendix D

Reducing ICU Delirium by Promoting Early Mobility

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Abstract

Delirium is described as an acute confusional state characterized by fluctuating mental status,

inattention, and either altered level of consciousness or disorganized thinking (Barr et al., 2013).

In the intensive care unit (ICU), delirium has been shown to occur in 60% to 80% of

mechanically ventilated patients and 40% to 60% of nonventilated patients. According to the

most recent Pain, Agitation, and Delirium (PAD) Clinical Practice Guidelines from the American

College of Critical Care Medicine (2013), early mobility is recommended to reduce delirium

Project Purpose: The purpose of the project was to educate nurses about the implementation of

an evidence based early mobility protocol to reduce the incidence of delirium in the adult ICU

setting. The project also identified barriers to implementing early mobility protocols.

Method: A quality improvement project included a five-step approach; 1) assessed current

nursing knowledge about early mobility and protocol implementation; 2) educated unit-based

critical care nurses about the early mobility protocol; 3) provided nurses with an Early Mobility

Worksheet for documentation of protocol implementation; 4) accessed the electronic medical

record of those patients mobilized and trended delirium; 5) The delirium data was compared to

the baseline group (pre-education) to identify if there was a reduction in delirium

Results: Analysis was run excluding patients in the post-education group who were mobilized

the day of or the day before ICU discharge. It was felt that the mobility intervention was not

likely have an effect on delirium during the short time the patients remained in the ICU. After

analysis, there was a statistically significant difference between the two groups (mean (SD) pre

44.1% (35.2%) versus post 20.5% (28.3%); p=0.045).

Discussion: The findings indicate that the earlier patients are mobilized in the ICU the better the

delirium outcomes.

58   *Reducing ICU Delirium by Promoting Early Mobility*

59

60   **Background**

61   Delirium is described in the Diagnostic and Statistical Manual of Mental Disorders-

62   Fourth Edition (Text Revision) (DSM IV-TR) as an acute confusional state characterized by

63   fluctuating mental status, inattention, and either altered level of consciousness or disorganized

64   thinking. In the intensive care unit (ICU), delirium has been shown to occur in 60% to 80% of

65   mechanically ventilated patients and 40% to 60% of nonventilated patients. Delirium can be

66   subcategorized based on the patient's level of alertness into hyperactive, hypoactive, and mixed

67   delirium. The hypoactive subtype is the most common accounting for 60% of delirium cases.

68   Risk factors for delirium can be divided into three categories: 1) characteristics of acute illness,

69   2) patient or host factors, and 3) environmental or iatrogenic factors. While the risk factors for

70   delirium are numerous, some of the more common causes include sedative, opiate, and

71   benzodiazepine medications, age (greater than 65 years), sleep deprivation, immobilization,

72   infection, and underlying dementia or previous delirium (Hipp & Ely, 2012). The most

73   commonly used tool for monitoring delirium in the ICU is the Confusion Assessment Method for

74   the Intensive Care Unit (CAM-ICU). This tool has high sensitivity (93-100%), high specificity

75   (98-100%), and high inter-rater reliability (kappa=0.96). The CAM-ICU is often used in

76   combination with the Richmond Agitation-Sedation Score (RASS) or the Riker Sedation-

77   Agitation Scale (SAS) (Hipp & Ely, 2012). Delirium is important to identify and treat, because

78   long term consequences including cognitive deficits and severe weakness lead to additional costs

79   of $2500 per patient or $6.9 billion annually (O'Mahony, Murthy, Akunne &Young, 2011).

80   According to the most recent clinical practice guidelines from the American College of

81   Critical Care Medicine (2013), there are a few ways to prevent and treat delirium. Early mobility

82   is recommended to reduce the incidence and duration of delirium. Pharmacologic prevention is

83   not recommended because there is no compelling data to demonstrate that it reduces the

84   incidence or duration of delirium (Barr et al., 2013). Delirium treatment and prevention is

85   commonly included in a care bundle which are several interventions that together are shown to

86   improve critically-ill patient's outcomes. One of the most common care bundles is the

87   Awakening and Breathing Coordination, Delirium monitoring/management, and Early

88   exercise/mobility (ABCDE bundle). This bundle is an example of an interprofessional evidence-

89   based multicomponent ICU management strategy aimed at reducing sedation exposure, duration

90   of mechanical ventilation, and ICU-acquired delirium and weakness (Balas et al., 2013). Based

91   on this information, a literature review was performed to determine the effect of mobility

92   protocols on the incidence and duration of delirium.

93   **Literature Review**

94   A literature review was performed to determine if early mobility protocols reduce the

95   incidence or duration of delirium in adult ICU patients. Key terms searched were: "delirium,"

96   "intensive care unit" or "ICU," "early mobility" or "early ambulation" or "physical therapy" or

97   "rehabilitation." The inclusion criteria for articles were qualitative or quantitative studies of

98   delirium outcomes, studies with implementation of a mobility protocol, reports secondary data

99   including ICU and hospital length of stay (LOS) and ventilator-free days.   Exclusion criteria

100 were articles before 2000, published in language other than English, studies that do not report

101 delirium outcome data, and studies that do not implement a mobility protocol. For the review of

102 literature, eight articles were retained.

103   The review included two reviews of literature, one randomized control trial, and five

104 prospective cohort studies. Barr et al., (2013) found moderate strength evidence to support the

105 hypothesis that early mobility protocols reduce the incidence and duration of delirium.

106 Collinsworth et al., (2016) found that multifaceted care approaches that included mobility were

107 associated with significant reductions in the incidence of delirium, duration of delirium, or days

108 patients spent awake and not delirious. Schweickert et al., (2009) demonstrated in a randomized

109 control trial that implementing physical and occupational therapy for intubated ICU patients

110 reduced the duration of delirium. Lastly, five of the six prospective cohort studies reported that

111 early mobility decreased the incidence and/or the duration of delirium. Overall, the review of

112 literature reveals that mobility is an effective intervention for reducing the incidence and

113 duration of delirium.

114 **Methods**

115 According to the American College of Critical Care Medicine (2013), early mobility is

116 the primary nonpharmacological recommendation for reducing the incidence and duration of

117 delirium. Based on the literature review, an educational project was conducted MICU (setting) to

118 determine the effectiveness of an early mobility protocol on reducing the incidence of delirium.

119 The project included a five-step approach; 1) assessed current nursing knowledge about early

120 mobility and protocol implementation in the critical care unit; 2) educated unit-based critical care

121 nurses about the early mobility protocol and its significance in patient care; 3) provided nurses

122 with an Early Mobility Worksheet for documentation of protocol implementation; 4) accessed

123 the electronic medical record of those patients mobilized and trended delirium data while patient

124 remained in the ICU; 5) the delirium data was compared to the pre-education group (pre group)

125 to identify if there was a reduction in delirium incidence.

126 **Purpose of the study**

127   The purpose of the project was to educate nurses about the implementation of an

128 evidence based early mobility protocol to reduce the incidence of delirium in the adult ICU

129 setting. The project also identified barriers to implementing early mobility protocols. This

130 project was designed to increase nursing knowledge regarding early mobility, encourage

131 mobilization in intensive care patients, to decrease the incidence of delirium, and to identify

132 barriers to early mobilization in the intensive care setting.

133 **Hypothesis**

134   Educating nurses about the implementation of an evidence based early mobility protocol

135 will reduce the incidence of delirium in an adult MICU.

136 **Research Design**

137   This study was a quality improvement project with a retrospective pre-post cohort design.

138 **Sample**

139   Data for the study was obtained through patient charts via the electronic medical record

140 (EMR). The sample was MICU patients deemed eligible by the protocol to receive early

141 mobility. The sample data was gathered over a one month time period to achieve a sample size

142 of 30 (n=30). Inclusion criteria included: adult MICU patients (over 18 years of age) and patient

143 admitted to the MICU for more than 24 hours. Exclusion criteria included: inability to follow

144 commands, RASS score of -3 or less, mechanical ventilation with positive end-expiratory

145 pressure (PEEP) greater than 10, oxygen supplementation with greater than 70% fraction of

146 inspired oxygen (FiO2), respiratory rate less than 5 or greater than 40 breaths per minute, heart

147 rate less than 50 or greater than 140 beats per minute, mean arterial pressure (MAP) less than 55

148 or greater than 140, systolic blood pressure (SBP) less than 90 or greater than 200, new or

149 increasing vasopressor infusions or new cardiac arrhythmia.

150   **Setting**

151   The setting for the study was the MICU of a large academic medical center in the

152   Southeast United States. The MICU is a 28 bed unit within the roughly 600 bed medical center.

153   Approval for study implementation in the MICU was granted by the medical director and nurse

154   manager of the unit. The Human Subjects Research IRB approved the study protocol (Appendix

155   A).

156   **Nursing Knowledge and Education**

157   Nursing knowledge about the evidence based early mobility protocol and its significance

158   in patient care was assessed using an anonymous survey prior to nursing education. The survey

159   was sent out via e-mail, returned via email on the secure server, and the results were stored in

160   Excel. The education of the critical care nurses was multi-faceted. First, information regarding

161   the evidence based early mobility protocol and its importance in patient care was sent out to all

162   medical intensive care nurses via email. The email also had supporting evidence from the most

163   recent Pain, Agitation, and Delirium (PAD) Clinical Practice Guidelines from the American

164   College of Critical Care Medicine (2013). Information regarding project implementation and the

165   Early Mobility Worksheet was also sent out to familiarize the nurses with the format. The same

166   information was presented at the MICU staff meeting which occurs the first Tuesday of every

167   month. Lastly, one-on-one education was provided on the unit the week before project

168   implementation. One-on-one education was provided to all nurses during day shift for seven

169   consecutive days. While education was occurring, the unit staffed 95 nurses. Of those nurses,

170   65 received one-on-one education. The 30 nurses who did not receive one-on-one education

171   were working night shift and the project was designed to be implemented during day shift. The

172   researcher was also available throughout project implementation to respond to the staff's

173   questions.

174   **The Early Mobility Protocol**

175   The early mobility protocol was adapted from Johns Hopkins Armstrong Institute for

176   Patient Safety and Quality's Early Mobility Toolkit (*Early Mobility Toolkit*, 2014) (Appendix B).

177   The early mobility protocol consisted of a patient assessment and progressive levels of mobility.

178   If the patient passed the assessment (stated in inclusion and exclusion criteria above), then

179   progressive mobility was started based on patient ability. The progressive mobility consisted of

180   four levels. The first level consisted of turning the patient in bed every two hours and passive

181   range of motion. Level two included passive transfer to chair or chair position in bed. Level

182   three included standing with assistance or sitting out of bed. Level four consisted of active

183   transfer to chair, standing with minimum or no assistance, and ambulating.

184   The early mobility protocol first required identification of the patients who were eligible

185   for mobilization. The initial activity screening was performed for all patients within 24 hours of

186   admission to the ICU. This initial screening was performed during interdisciplinary rounds.

187   After orders were placed for the mobility protocol, the bedside nurse performed a basic

188   assessment to determine if mobilizing the patient was safe and appropriate. The basic

189   assessment determined neurologic, respiratory, and cardiovascular stability. The patient failed

190   the basic assessment if any of the exclusion criteria (above) were met. If the patient failed the

191   assessment, the patient only received mobility level one until stabilized. The patients who

192   passed the basic assessment were mobilized starting at level two and progressed based on patient

193   ability. After the patient was mobilized, the nurse documented the mobility level reached on the

194   Mobility Protocol Worksheet (described below).

195   **Procedure**

196   After determining which patients were mobilized, the patient medical records were

197   accessed via the EMR by the researcher. The data were obtained manually from the EMR for

198   each patient. For each patient mobilized, the CAM-ICU score was obtained starting with the

199   first day mobilized until the patient was discharged from the ICU. The data were collected from

200   the Mobility Protocol Worksheet and the EMR. The Mobility Protocol Worksheets were

201   collected daily and stored in a locked office. After collection, data were de-identified and

202   organized using Excel. The worksheets were disposed of in appropriate shred bins.

203   The mobility data was compared to a pre-education group obtained before nursing

204   education regarding mobility protocol implementation. The pre-education data were collected on

205   thirty random patients starting on September 1, 2016. The data were obtained by information

206   technology experts from the medical center. The data were de-identified and stored in Excel.

207   **Measures**

208   Demographic data were obtained from the EMR and included age, gender, ICU LOS, and

209   hospital LOS. Delirium data were obtained for those patients who were mobilized using the

210   Mobility Protocol Worksheet (Appendix C). The worksheet was a quality improvement data

211   collection instrument that was paired with EMR delirium data. First, there were places for the

212   date and a patient information label. Next, the early mobility protocol was on the worksheet as a

213   reminder for the nurses. Below the mobility protocol illustration, there were two questions.

214   First, was the patient mobilized to a level greater than level one? The next question: If not, why?

215   The worksheet had options to choose between to respond to the question including: patient failed

216   basic assessment, patient/family refused, time, staffing, lack of equipment, safety, other

217   (comment). The nurse was asked to circle one of the options. An example of the Mobility

218   Protocol Worksheet is in an appendix below (Appendix C). Delirium was measured using the

219   CAM-ICU tool. This measure has high sensitivity (93-100%), high specificity (98-100%), and

220   high inter-rater reliability (kappa=0.96) (Ely et al., 2001).

221   **Data Analysis**

222   The data were analyzed using the statistical package SPSS version 24. Demographic data

223   were analyzed using descriptive statistics such as means, percentages, and frequencies. Due to

224   the skewness of the ICU and hospital LOS data, medians and interquartile range (IQR) were used

225   to describe the data. To test for a statistically significant difference between the pre and post-

226   education groups' length of stays, a Mann-Whitney U test was performed. Statistical analysis for

227   the delirium data was run in two ways. First, the average number of delirium positive days was

228   calculated for each patient in the pre and post group. Due to skewness of the pre and post

229   delirium data, a Mann-Whitney U test was performed to analyze for a statistically significant

230   difference between the two groups. Additionally, before any analysis was performed, it was

231   noted that many patients in the post-education group were mobilized on the day of or the day

232   before discharge. It was believe that the mobility intervention was not likely to have an effect on

233   delirium for these patients due to the short period of time the patient remained in the ICU.

234   Therefore, an additional analysis was performed excluding the patients who were mobilized the

235   day of or the day before ICU discharge. The patients in the pre group with only one or two day

236   ICU stays were also excluded. An independent-t test was run comparing the two groups to test

237   for statistical significance. (Norman & Streiner, 2003).

238   **Protection of Human Subjects**

239   The appropriate IRB application was submitted and approved. The risk of the study was

240   the confidentiality of the data. The Mobility Protocol Worksheets were collected daily and

241   stored in a locked office. Once the Worksheets were used to obtain delirium information from

242   the EMR, they were disposed of in appropriate locked shredding bins. The information obtained

243   from the Worksheets and the EMR was de-identified and stored in Excel.

Results

Nursing Education

246   Before nursing education regarding the MICU's early mobility protocol was completed, a

247   survey was sent to all MICU nurses via email. The survey was to assess baseline nursing

248   knowledge of the unit's early mobility protocol and consisted of three questions: 1) Do you

249   know about the MICU's Early Progressive Mobility Protocol (not the physician's order)? 2) Do

250   you know where to locate the protocol? 3) Do you use the protocol in your daily practice? The

251   survey had 31 respondents from the 95 nurses it was sent to. In response to the first question,

252   61% answered yes to knowing about the protocol. For the second question, 29% responded that

253   they knew where to locate the protocol. Lastly, in response to the third question only 13% of

254   respondents answered that they used the mobility protocol in their daily practice. This indicated

255   to the researcher that education regarding the early mobility protocol needed to be conducted.

256   After the project was implemented and completed, the same survey was sent out to assess

257   if there was a change in nursing knowledge and use of the mobility protocol. The follow-up

258   survey had 15 respondents. In response to the first question, 93% answered yes to knowing

259   about the mobility protocol. For the second question, 80% of the respondents answered yes to

260   knowing where to locate the protocol. Lastly, 36% of the respondents stated that they use the

261   protocol in their daily practice.

Delirium Outcomes

263   Demographic and delirium data were compared between the two groups of subjects. The

264   first group (pre-education group) consisted of 30 subjects who were admitted to the MICU

265   before nursing education and project implementation. The post-education group consisted of 30

266   subjects who were mobilized using the MICU's early mobility protocol. Demographic data

267   included age, race, gender, ICU LOS, and hospital LOS. In the MICU, delirium is assessed at

268   least twice daily (day and night shift) using the CAM-ICU delirium assessment tool. Delirium

269   was recorded as either positive or negative based on the patient's CAM-ICU score. Delirium

270   data was collected in the pre-education group each day of their ICU admission. In the post-

271   education group, delirium data was collected each day starting from the day the patient was

272   mobilized until their discharge from the ICU. The patient was considered negative for delirium

273   if every CAM-ICU assessment was negative for that given day. If one assessment yielded a

274   positive result, that patient would be recorded as delirium positive for the day. For each patient

275   in the pre and post-education groups, the average percentage of delirium positive days were

276   calculated for analysis.

277   The demographic data for each group is shown in Table 2. Additionally, a Mann-

278   Whitney U test was run comparing ICU LOS and hospital LOS between the two groups. There

279   was a statistically significant difference in ICU and hospital LOS when comparing the pre and

280   post groups (median ICU LOS- pre-education 2.7 days versus post 6.0 days; p=0.003 and median

281   hospital LOS- pre 5.5 days versus post 15.5 days; p=0.002). While this was not an anticipated

282   finding, reasons for these outcomes will be discussed below.

283   As stated above, due to significant skewness, the delirium data for the pre and post-

284   education were compared using a Mann-Whitney U test. The median number of days that

285   delirium data were collected was similar between the groups (pre 2.5 days versus post 3 days).

286   The range of days varied between the two groups, but had the same interquartile range (pre 1-38

287   days, IQR 5 days versus post 1-17 days, IQR 5 days). The average number of delirium days for

288   each patient in the pre and post-education groups were calculated. The median percentage of

289   delirium positive days between the two groups was relatively similar (pre 14.6% versus post

290   0%). A Mann-Whitney U test was run and showed that the difference between the two groups

291   was not statistically significant (p=0.139). Results can be found in Table 3.

292   Additionally analysis was run excluding patients in the post-eduation group who were

293   mobilized the day of or the day before ICU discharge. It was believed that the mobility

294   intervention was not likely to have an effect on delirium during the short time the patients

295   remained in the ICU. In order to keep the two groups similar in size, the patients in the pre-

296   education group with a one or two day ICU length of stay were also excluded. After exclusion,

297   the pre-education group n=18 and the post-education group n=15. For these two groups, the

298   median number of days that delirium data were collected was the same (median- pre 6 days

299   versus post 6 days) The range and IQR varied between the two groups (range- pre 3-38 days

300   versus post 3-17 days; IQR- pre 6 days versus post 8 days). Also, the average number of

301   delirium positive days for each patient was calculated. Due to the normal distribution, an

302   independent T-test was run on the groups. After analysis, there was a statistically significant

303   difference between the two groups (mean (SD) pre 44.1% (35.2%) versus post 20.5% (28.3%);

304   p=0.045). Results can be found in Table 4.

305   **Barriers to Mobilization**

306   The Early Mobility Worksheets included a place to document if the nurse was unable to

307   mobilize a patient. This could have been because the patient failed the basic assessment, but also

308   included a list of likely barriers to mobilizing patients in the ICU.   During the project

309   implementation, barriers to mobilization were identified on 81 occasions. The primary reason

310   patients were not mobilized was that the patient failed the basic assessment. This accounted for

311   31 out of the 81 responses. Safety as a barrier to mobilization was reported in 25 of the 81

312   responses. Having enough time was identified on 10 occasions as a barrier to mobilization.

313   Next, inadequate staffing was a barrier to mobilization in eight cases. For two patients, the

314   barrier to mobilization was lack of equipment. Lastly, five patients or their families refused

315   mobilization. Approaches to reduce these barriers are discussed below.

316   **Discussion**

317   **Nursing Education**

318   The need for nursing education regarding the MICU early mobility protocol was assessed

319   using a survey sent out to all nursing staff on the unit. After receiving the results from the initial

320   survey, it was clear that there was a nursing knowledge deficit about the early mobility protocol.

321   The multi-faceted education process was systematic and appeared effective, but occurred over a

322   relatively short period of time (two weeks). Given more time, all of the nursing staff would have

323   received one-on-one education rather than just those who were working day shift. The same

324   survey was sent out after project implementation to see if there was increased knowledge of the

325   early mobility protocol. Only 15 nurses responded to the follow-up survey which was half the

326   number of initial respondents. After education and project implementation, only 36% of the 15

327   respondents stated that they use the early mobility protocol in their daily practice. In the post

328   survey, the responses demonstrated an increased knowledge about the protocol, but it did not

329   show a significant increase in the use of the mobility protocol in daily practice. This could

330   indicate the need for a different mobility protocol in the MICU. Perhaps one that is more user-

331   friendly and easier to understand. It may also indicate the need for further education about the

332   barriers nurses face when trying to mobilize patients and how to address those issues. Overall, it

333   would be easier to extrapolate nursing education outcomes if more nurses were to respond to the

334   surveys. In the future, it may be more effective to hand out a paper post-survey after education

335   to increase compliance with completion.

336   **Delirium**

337   First, ICU and hospital length of stay were compared between the two groups. The

338   difference between the groups for both ICU and hospital LOS were statistically significant.

339   However, it was the opposite of the expected finding. The ICU and hospital LOS were

340   significantly shorter for the pre-education group. One explanation for this finding is higher

341   acuity illness in the post-education group patients. The data was collected during November and

342   December which is typically when the unit sees an increase in the number of flu and pneumonia

343   cases. Although, this may be the case no measure of acuity was collected for these patients. For

344   future studies, the acuity of patients may be an important measurement to include.

345   Next, the delirium data were analyzed. When comparing both groups, the difference in

346   the average number of days with delirium was not significantly different. However, when

347   patients who were mobilized on the day of discharge or the day before discharge from the ICU

348   were excluded the difference between the two groups became statistically significant. The post-

349   education group had less than half of the average delirium days when compared to the pre-

350   education group. This indicates that the earlier patients are mobilized in the ICU the better the

351   delirium outcomes. There are several reasons why patients may not be mobilized until the end of

352   the ICU stay. First, patients may not be mobilizing earlier in their stay because nurses feel they

353   are too sick to mobilize. Although there is an assessment in the mobility protocol to determine if

354   a patient is safe to mobilize, nurses may feel that their knowledge of the patient's ability

355   supersedes the assessment. Additionally, the nurses may feel more comfortable mobilizing

356   patients when they are ready to leave the ICU because this indicates more stability. Also, nurses

357   identified several barriers to mobilizing patients which may have prevented earlier mobility.

358   This may indicate the need for more education and training about patients who are safe to

359   mobilize and how to do it. In future studies, this would be an important to teach nurses that

360   earlier mobility decreases delirium and to provide them with the tools to accomplish this.

361   **Barriers to Mobilization**

362   There were numerous barriers to mobilization identified by the nurses which highlight the

363   need for practice changes in several areas. First, mobilization needs to be more highly

364   prioritized in the daily care of MICU patients. In order to ensure patients are being mobilized

365   safely, proper equipment should be readily available for all patients. As in Fraser, Spiva, Forman

366   & Hallen (2015), it may also be helpful for the MICU to develop a mobility team including a

367   physical therapist, ICU nurse, and mobility technician. The implementation of a mobility team

368   would hopefully eliminate barriers such as inadequate staffing and timing. Lastly, training staff

369   on how to properly mobilize critically ill patients could help reduce the safety barriers.   Overall,

370   to decrease barriers to mobilization in the ICU, unit based leaders and staff must identify and

371   prioritize areas for realistic improvement.

372   **Strengths and Limitations**

373   While many studies have shown the importance of mobilizing ICU patients, few have

374   examined the impact of mobility interventions in reducing or preventing delirium. This study

375   will contribute to the existing literature regarding the effectiveness of mobility protocols in

376   reducing delirium. Limitations of this study include the lack of generalizability to other ICUs,

377   data collection over a relatively short time period, and lack of randomization.

378   **Nursing Practice Implications**

379   This study will contribute to nursing knowledge about mobility protocols in the ICU,

380   barriers to implementation, and delirium reduction with mobility. The study will add to the

381   literature regarding mobility protocols reducing the incidence of delirium. Several nursing

382   practice implications were identified as a result of this project. First, the need for a new mobility

383   protocol in the MICU since nurses are still not frequently using the current protocol in their daily

384   practice. The new protocol should be chosen in coordination with the nursing staff. The next

385   nursing practice implication is the need for increased staffing to help with patient mobilization.

386   Specifically, it would be helpful to have a patient care technician to serve as a mobility

387   technician and an additional respiratory therapist specifically for mobilizing patients. Along

388   with staffing, the unit should have more frequent physical therapy visits. Most patients with

389   physical therapy consults are not seen every day and if they were it would drastically increase

390   mobility. Physical therapists could also hold educational meetings to teach the nursing staff how

391   to safely mobilize ICU patients. This would increase the nurses' knowledge and confidence in

392   mobilizing critically ill patients while also addressing safety concerns. Another area for

393   improvement is easier access to equipment for mobilization. Each patient room should have a

394   high back chair to safely mobilize patients out of bed. Additionally, there should be more access

395   to bariatric equipment and passive transfer chairs. Currently, all 28 beds in the MICU share just

396   a few pieces of equipment. If mobility is to become a priority, more equipment would need to be

397   purchased. Lastly, as in Balas et al., (2014) it may be more effective to include mobility into a

398   bundle like the ABCDE bundle. The implementation of this bundle would likely further improve

399   delirium outcomes.

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479   Table 1.

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481   *Demographic Data*

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	Pre-Education Group	Post-Education Group
Sex (% female)	70%	46.7%
Age, years (mean, SD)	60.9 (18.8)	56.1 (20.7)
Race (%) Caucasian African American Hispanic	 80% 16.7% 3.3%	 80% 13.3% 6.7%
ICU length of stay, days (median, range, IQR)	2.7, 1-37, 5	6, 2-34, 8
Hospital length of stay, days (median, range, IQR)	5.5, 1-48, 8	15.5, 3-53, 15

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506   Table 2.

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508   *Delirium outcomes*

	Pre-Education	Post-Education
Sample Size	n=30	n=30
Median % delirium positive days	14.6%	0%

509   Mann-Whitney U test; p=0.139

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515   Table 3.

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517   *Delirium outcomes excluding patients mobilized day of or day before ICU discharge*

	Pre-Education	Post-Education
Sample Size	n=18	n=15
Mean % Delirium Positive Days (Standard Deviation)	44.1% (35.2%)	20.5% (28.3%)

518   Independent T-test; p=0.045

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552   Appendix A
553   Early Mobility Protocol
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START HERE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Initial Activity Screening Within 24-hrs of admission	**No / Low Cooperation** RASS -5 to – 3	**Moderate Cooperation** RASS > -3 to -1	**[Close to] Full cooperation** RASS > -2 to -1	**Full Cooperation** RASS > 0
	FAILS BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT	**PASSES** BASIC ASSESSMENT
BASIC ASSESSMENT **Neurologic** RASS > -3 Follows 3-4 commands **Respiratory** PEEP < 10 / FiO2 < 70 SpO2 > 90% RR > 5 < 40 bpm **Cardiovascular** HR > 50 < 140 MAP > 55 < 140 SBP > 90 < 200 No new or increasing vasopressor infusion No new arrhythmia	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Consider specialty bed	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Progressive upright mobility • Passive transfer to chair	**BODY POSITIONING** • HOB > 30° • Splinting • Passive transfer to chair • Sitting out of bed • Standing with assistance	**BODY POSITIONING** • HOB > 30° • Splinting • Active transfer to chair • Sitting out of bed • Standing with min. or no assist
	ACTIVITY • Passive ROM 2x d • Passive bed cycling (Letto)	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Passive/active leg &/or arm cycling in bed (Letto) or chair	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Standing with assistance • ADLs	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Walking • ADLs
FAILS **PASSES** Start level 1 Start level 2	Tolerates level 1 activities →	Tolerates level 2 activities →	Tolerates level 3 activities →	Ambulate progressively longer distances
PM & R CONSULTATIONS	OT: PROM / Splinting	PT: If deconditioned OT: PROM / splinting	PT: If deconditioned OT: ADL's / PROM SLP: Cognitive	PT: If deconditioned OT: ADL's / PROM SLP: cognitive

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Appendix B
Early Mobility Worksheet

Date: Patient Label

START HERE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
Initial Activity Screening Within 24-hrs of admission	No / Low Cooperation RASS -5 to -3 **FAILS** BASIC ASSESSMENT	Moderate Cooperation RASS > -3 to -1 **PASSES** BASIC ASSESSMENT	[Close to] Full cooperation RASS > -2 to -1 **PASSES** BASIC ASSESSMENT	Full Cooperation RASS > 0 **PASSES** BASIC ASSESSMENT
BASIC ASSESSMENT **Neurologic** RASS > -3 Follows 3-4 commands **Respiratory** PEEP < 10 / FiO2 < 70 SpO2 > 90% RR > 5 < 40 bpm **Cardiovascular** HR > 50 < 140 MAP > 55 < 140 SBP > 90 < 200 No new or increasing vasopressor infusion No new arrhythmia	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Consider specialty bed	**BODY POSITIONING** • HOB > 30° • Turning Q 2 hours • Splinting • Progressive upright mobility • Passive transfer to chair	**BODY POSITIONING** • HOB > 30° • Splinting • Passive transfer to chair • Sitting out of bed • Standing with assistance	**BODY POSITIONING** • HOB > 30° • Splinting • Active transfer to chair • Sitting out of bed • Standing with min. or no assist
	ACTIVITY • Passive ROM 2x d • Passive bed cycling (Letto)	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Passive/active leg &/or arm cycling in bed (Letto) or chair	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Standing with assistance • ADLs	**ACTIVITY** • Passive/active ROM 2x d • Resistance training (PT) • Active leg &/or arm cycling in bed or chair • Walking • ADLs
FAILS **PASSES** Start level 1 Start level 2	Tolerates level 1 activities →	Tolerates level 2 activities →	Tolerates level 3 activities →	Ambulate progressively longer distances
PM & R CONSULTATIONS	OT: PROM / Splinting	PT: If deconditioned OT: PROM / splinting	PT: If deconditioned OT: ADL's / PROM SLP: Cognitive	PT: If deconditioned OT: ADL's / PROM SLP: cognitive

Was the patient mobilized?

   If so, to what level?

If the patient was not mobilized, why? (circle one)

Pt. failed basic assessment   Pt/family refused   Time   Staffing   Lack of equipment

Safety   Other (comment)