Evaluation of Early Mobilization Strategies in the Mechanically Ventilated Patient Population

Katherine B. Stewart

University of Kentucky, kbcrush01@hotmail.com

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REVIEW, APPROVAL AND ACCEPTANCE

The document mentioned above has been reviewed and accepted by the student’s advisor, on behalf of the advisory committee, and by the Associate Dean for MSN and DNP Studies, on behalf of the program; we verify that this is the final, approved version of the student’s Practice Inquiry Project including all changes required by the advisory committee. The undersigned agree to abide by the statements above.

Katherine B. Stewart, Student

Dr. Melanie G. Hardin Pierce, Advisor
Final DNP Project Report

Evaluation of Early Mobilization Strategies in the
Mechanically Ventilated Patient Population

Katherine B. Stewart, RN, BSN

University of Kentucky
College of Nursing
December 2016

Melanie G. Hardin-Pierce DNP, APRN, ACNP-BC - Committee Chair
Sheila Melander PhD, APRN, ACNP-BC, FCCM, FAANP – Committee Member
Elizabeth Burckardt DNP, RN, APRN – Committee Member/Clinical Mentor
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Introduction to Final DNP Capstone Report

Katherine B. Stewart RN, BSN

University of Kentucky
College of Nursing
Mechanical ventilation in critically ill patients is becoming a common treatment in intensive care units (ICU) today. In fact, approximately 40% of patients admitted to an ICU need ventilatory support and up to 34% of those patients need prolonged mechanical ventilation, commonly defined by 21 or more days of ventilation or greater than four days of ventilation with a tracheostomy (Cox, Carson, Govert, Chelluri, & Sanders, 2007). Yet, although treatment with mechanical ventilation is improving mortality in patients suffering illnesses that were previously considered deadly, gaps between care delivery processes and high-quality evidence-based practice still exist for this patient population.

One such gap receiving ample examination in the literature is the culture of immobility surrounding critically ill patients requiring prolonged mechanical ventilation. It has been well documented that immobilization in ventilated patients has led to debilitating health outcomes when coupled with prolonged mechanical ventilation: increased ventilatory time, prolonged hospitalization, neurophysiological decline, and an overall decrease in quality of life post-hospital discharge (Azuh et al., 2016; Morris, 2007; Schweickert & Kress, 2011). In fact, over 50% of one-year survivors of prolonged mechanical ventilation need assistance in basic activities of daily living (Choi, Tasota, & Hoffman, 2008).

Researchers have found that incorporating mobilization interventions through a protocol or bundled approach early during mechanical ventilation can mitigate the adverse health outcomes resulting from prolonged immobility (American Association of Critical-Care Nurses, 2015b). The literature describes several benefits associated with implementation of an early mobilization protocol, which include improved functional status at discharge, reduced ICU delirium, decreased ventilation time, reduced ICU and
hospitalization length-of-stay, and decreased incidence of neuromuscular dysfunction including intensive care unit-acquired weakness and critical illness polyneuropathy (Schweickert & Kress, 2011). Yet, despite the documented evidence that mobilizing patients early during ventilation results in such benefits, ICUs still perpetuate a culture of oversedation and bedrest for this vulnerable population.

This practice inquiry project is an evaluation of current mobility practice in a cardiovascular intensive care unit in a private urban hospital in the Southern United States. This evaluation will provide a dissemination of evidence that will identify individual and organizational obstacles for promoting mobility; guide healthcare providers to change the culture of care for mechanically ventilated, critically-ill patients; and provide insight for implementing a multidisciplinary, evidence-based mobility protocol while utilizing a conceptual model that will promote a quality improvement in intensive care practice for patients requiring mechanical ventilation. This practice improvement project includes three manuscripts:

- Manuscript one systemically disseminates evidence surrounding the benefits of incorporating mobility strategies in the mechanically ventilated population and highlights implications for growth related to continued research in this area.
- Manuscript two describes how utilization of the Iowa model of evidence-based practice to promote quality care can guide the healthcare practitioner to not only change the culture of immobilization but implement an early mobility protocol for mechanically ventilated patients in the intensive care environment.
Manuscript three evaluates current mobility practices in a cardiovascular intensive care unit and proposes a mobilization protocol based on the evaluated patient population.
Manuscript One

Early Mobility Initiatives in the Mechanically Ventilated Population:
A Literature Review

Katherine B. Stewart RN, BSN
University of Kentucky
College of Nursing
Abstract

As the nature of critical illness becomes more complex and health outcomes for the critically ill population worsen, the need for evidence-based clinical practice becomes more apparent. Specifically, disparities in care related to mobility practice in critically ill patients requiring mechanical ventilation have resulted in various adverse sequelae, such as infection, long-term cognitive decline, and increased incidence of neuromuscular dysfunction. This precipitates longer hospital stays and increased use of hospital resources, which further extends the economic burden for patients and healthcare systems. Currently, the culture of mobility for mechanically ventilated patients is limited to range of motion within the confines of a hospital bed. The need for evidence-based, multidisciplinary early mobility interventions tailored to this specific patient population is essential in order to reform care and improve these outcomes. Thus, this review of literature will systemically disseminate evidence surrounding the benefits of incorporating mobility strategies in the mechanically ventilated population as well as highlight implications for growth related to continued research in this area.

Keywords: mobility, early ambulation, intensive care unit, ABCDE bundle, early mobilization, physical rehabilitation, mechanical ventilation, early activity, sedation, analgesia, physical therapy, early mobility protocol.
Early Mobility Initiatives in the Mechanically Ventilated Population: 
A Literature Review

In critically ill patients in the intensive care setting, physical immobility can lead to neuromuscular dysfunction and generalized weakness, which can result in prolonged ventilatory time and hospitalization (Schweickert & Kress, 2011). Specifically, De Jonghe et al. (2002) have found that in the immobile mechanically ventilated population, there is a 25% incidence of intensive care unit-acquired weakness, a condition describing neuropathies and myopathies associated with prolonged immobility. In addition, Hopkins and Spuhler (2009) report that “in healthy individuals, immobility results in a 1.3% to 3% loss in muscle strength per day and a 10% reduction in postural muscle strength after only one week of complete bed rest” (p.278). As a result, deleterious complications such as long-term physical, cognitive, and functional impairments have been reported and contribute to the increase in morbidity and mortality rates seen in this specific population (Balas et al., 2012). In fact, “up to 60% of discharged critically ill patients may have long-term complications inhibiting them from complete functional recovery” (Zomorodi, Topley, & McAnaw, 2012, p.2).

The injurious effects of immobility have been established in the literature for more than 60 years (Schweickert & Kress, 2011). A major contributing factor to its perpetuation is the culture of modern intensive care for the mechanically ventilated patient, which consists of continuous sedation and analgesia, as well as restraint overuse (Hopkins & Spuhler, 2009). Although sedation and analgesia are commonly used for comfort and patient safety during ventilation, Banerjee, Girard and Pandharipande (2011) state that these “are overused without goals, thus predisposing patients to untoward
complications of increased time on mechanical ventilation, longer times in the intensive care unit, more radiological testing for altered mental status, intensive care unit-acquired weakness and greater likelihood of delirium” (p.195). Though adequate pain management is important to prevent physiological decline in the critically ill patient, meticulous attention should be taken to not deeply sedate so that early mobility interventions can be performed (Banerjee et al., 2011).

Growing evidence has revealed that in the critically-ill mechanically ventilated population, delirium, intensive care unit-acquired weakness, decubitus ulcers, and pulmonary complications such as ventilator-associated pneumonia can be thwarted with the use of early mobilization strategies (Zomorodi et al., 2012). Specifically, the evidence has shown that the development and utilization of early mobilization protocols tailored to various practice settings and patient populations have been most advantageous in circumventing the deleterious effects of immobility (American Association of Critical-Care Nurses, 2015). As a result, these patients have a higher likelihood of enhanced functional status, increased recovery time, and decreased hospital stay when these mobility interventions occur early during hospitalization (Zomorodi et al., 2012). However, it is only through interdisciplinary collaboration and a coordinated, systematic approach to promote practice change can the quality of health outcomes improve while reducing healthcare associated costs for this vulnerable population (Vasilevskis et al., 2010). Thus, the goal of this literature review is to examine evidence surrounding the follow question: Does integration of mobility strategies through a protocol or bundled approach improve health outcomes in mechanically ventilated patients in the intensive care environment?
Methods

The search strategy for this review incorporated the most current and relevant full-text articles from the following databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, The Cochrane Library, The American Association of Critical Care Nurses, Google Scholar, Critical Care Medicine: The Essentials, EBSCOhost, and Medical Literature Analysis and Retrieval System Online (MEDline). Utilizing a comprehensive search strategy, the following keywords were used in various combinations: mobility, early ambulation, intensive care unit, ABCDE bundle, early mobilization, physical rehabilitation, mechanical ventilation, early activity, sedation, analgesia, physical therapy, and early mobility protocol. References within pertinent and related articles were also reviewed for use in this study.

Articles included in this review followed specific inclusion and exclusion criteria. Inclusion criteria included articles that were 1) printed in English; 2) full-text; 3) peer-reviewed and; 4) printed after the year 2000. Also, articles about experimental clinical trials chosen for this study examined patients that were 1) aged 18 years or older; 2) mechanically ventilated in an intensive care unit and; 3) mobilized using a protocol or bundled approach. Articles of clinical trials that examined mobility strategies outside a protocol were excluded. Systematic reviews that examined the benefits of mobility, the safety and feasibility of protocol implementation, and implications for future clinical practice for mobilizing the mechanically ventilated population were also included so as to establish a thorough evidence-based background for this review. From the comprehensive database search, 20 relevant articles were included in this literature review (See Table 1).
Summary of Findings

The articles selected for this review include eight systematic reviews, three randomized controlled trials, five prospective cohort studies, and three retrospective, quasi-experimental studies. Each article was rated for quality and strength of evidence using guidelines for grading from the Center for Evidence-Based Medicine. These guidelines are used to grade a clinical recommendation based on a body of evidence (Center for Evidence-Based Medicine, 2009). The guidelines describe levels of evidence ranging from 1-5 and grades of recommendation ranging from A-C. For this review, the level of evidence ranged from 1A-3A. The articles chosen for this literature review represent a variety of ICUs including: medicine, cardiovascular, surgical, trauma, neurology, and burn. All studies evaluated the use of an early mobility protocol for mechanically ventilated patients in their critical care setting and found that not only is implementation of early mobility strategies through a protocol approach safe, feasible, and advantageous to functional and cognitive health outcomes of critically ill patients requiring mechanical ventilation, but these strategies are also associated with improvement in clinical and quality metrics for healthcare organizations. This literature review will summarize the evidence surrounding the benefits associated with implementation of an early mobility protocol and highlight future directions and implications for practice.

Benefits of mobility while mechanically ventilated were described in several experimental and systematic reviews included in this study. Such benefits include preservation of cardiovascular, musculoskeletal, and neuromuscular integrity, homeostasis of blood glucose, improved cognition while mechanically ventilated,
decreased incidence of pressure ulcers, deep venous thrombus (DVT), and secondary infections related to prolonged mechanical ventilation, reduced ICU and hospital length of stay, shorten ventilation time, and reduced cost and resource utilization (Azuh et al., 2016; Floyd, Craig, Topley, & Tullmann, 2016; Klein, Mulkey, Bena, & Albert, 2016; Kress, 2009). These benefits have been linked to improved functional and psychological health outcomes as well as clinical quality metrics for mechanically ventilated patients post hospital discharge.

In relation to improvement to clinical quality metrics, several studies discussed how the application of an early mobility protocol improved rates of hospital acquired pressure ulcers, bloodstream infections, ventilator-associated pneumonia, restraint use, and fall rates. For instance, in their prospective cohort study, Azuh et al. (2016) found that pressure ulcer prevalence in mechanically ventilated patients in a medical intensive care unit (MICU) decreased from 9.2% to 6.1% (p=0.0405) after implementation of an early mobility protocol. Similarly, hospital-acquired pressure ulcer prevalence reduced by 3% (p=0.015) and bloodstream infection prevalence reduced by 2.7% (p=0.026) only four months after an early mobility protocol was implemented in a neurointensive care unit (NICU; Klein et al., 2016). And although the same study did not show a significant difference in rates of ventilator-associated pneumonia (VAP) in their patient population, Titsworth et al. (2012), who also implemented an early mobility protocol in mechanically ventilated patients in a NICU, observed no VAP cases during a six-month follow-up period to protocol implementation as compared to their previous VAP rate of 2.14 ± 0.95 per 1000 ventilator days. Titsworth et al. also showed that the average number of days in restraints decreased from 368.57 ± 46.8 to 301.2 ± 55.3 after introduction of their
mobility protocol. Fall rates were also examined as a result of mobility protocol implementation. Several studies have shown that implementation of a mobility protocol does not result in a greater prevalence of falls. In fact, Fraser et al. (2015) showed in their retrospective longitudinal study that two fall events occurred in their routine care group while zero falls were recorded for their mobility group. Similarly, Titsworth et al. (2012) showed that “both the total number of falls per month (mean 1.00 vs 1.00, respectively) and the fall rate per 1000 patient days (1.39 vs. 1.31, respectively) were essentially identical before and after” implementation of their early mobility protocol called the Progressive Upright Mobility Protocol (PUMP).

Along with improved clinical quality metrics, psychological outcomes of ventilated patients are also improved. In their prospective cohort study involving 57 mechanically ventilated patients in the MICU, mobilizing with full-time physical and occupational staff, Needham et al. (2010) found that:

benzodiazepine use decreased markedly (proportion of MICU days that patients received benzodiazepines [50% vs. 25%, p=0.002]), with lower median daily sedative doses (47 vs. 15mg midazolam equivalents [p=0.09] and 71 vs. 24 mg morphine equivalents [P<.01]) resulting in patients being more frequently alert (29% vs. 66% of MICU days, [p=0.001]) and less delirious (21% vs. 53% of MICU days, [p=0.003]) (p.536).

Similarly, in a retrospective, longitudinal study, researchers found that patients in a medical, surgical, and coronary intensive care unit that received mobility interventions through a newly implemented mobility protocol had more days without delirium (5.05 days in the mobility intervention group vs. 3.60 days in the routine care group [p=0.05])
as measured by the confusion assessment method for the intensive care unit (CAM-ICU) (Fraser et al., 2015). Also, Schweickert et al. (2009) found that ventilated patients who underwent early mobilization had a significant decrease in duration of delirium (50%) during their ICU and hospitalization stay. And although the literature has demonstrated that early mobility reduces rates of delirium in ventilated patients, Banerjee et al. (2011) found that delirium in this vulnerable population often goes undiagnosed despite guidelines for delirium monitoring set by the Society of Critical Care Medicine. Thus, the authors suggest that sedation and delirium monitoring should be included in early mobility protocols so that more mechanically ventilated patients can be mobilized earlier during their critical illness (Banerjee et al., 2011). This is further supported by Thompson, Snow, Rodriguez, and Hopkins (2008) who found that sedative use, even intermittently, decreases the likelihood of ambulation while mechanically ventilated. And although sedative and narcotic use is sometimes unavoidable so as to prevent physiological decline in this population, the evidence suggests that specifically defined criteria for administration should be protocolized with early mobility interventions.

In addition to improved quality metrics and psychological outcomes for mechanically ventilated patients receiving early mobilization interventions, researchers have also found that independent physical functioning post hospital discharge is also enhanced. In their retrospective review, Patman, Dennis, and Hill (2012) wanted to elucidate the data surrounding physical deconditioning of mechanically ventilated patients in their clinical setting after prolonged mechanical ventilation. They found after review of ICU medical records between the years 2007 and 2008 that “before admission, 189 were ambulating independently, of whom 180 (95%) did not require a gait aid. On
discharge from acute care, 89 (47%; 95% CI, 40%-54%) were ambulating independently, of whom 54 (61%) did not require a gait aid” (Patman et al., 2012, p.1). The authors suggest that the implications for an early mobility practice change in their clinical setting are necessary so that functional health outcomes in their patient population are enhanced. In another study, conducted by Schweickert et al. (2011), 59% of mechanically ventilated patients who received daily sedation interruption combined with physical and occupational therapy had a return to independent functional status at hospital discharge compared to 35% of patients in the control group who received usual care. Also, in a systematic review, Bailey, Miller, and Clemmer (2009), examined several articles that explored physical outcomes of patients that did not receive physical therapy or any type of mobility intervention while mechanically ventilated. These authors suggest, based on the evidence, that physical deconditioning in this population manifests independent of the primary disease process and early mobilization strategies should be implemented so that physical debility will not alter performance in daily activities of living post hospital discharge (Bailey et al., 2009). Finally, Schaller et al. assessed functional capacity for locomotion and transfers on the mini-modified functional independence measure score (mmFIM) which ranged from 1 (near complete dependence) to 4 (complete independence) (2016). They found that use of an early goal-directed mobilization protocol in their surgical intensive care unit (SICU) improved functional independence of patients at the time of discharge (main outcome of 4 for the intervention group vs. 3 for the control group [p=0.009]; Schaller et al, 2016).

Hospital and ICU length-of-stay along with readmission rates for patients experiencing prolonged mechanical ventilation in the intensive care environment have
been shown to decrease when early mobilization interventions were employed early during the ventilation process. In their 2008 study of early mobility therapy in mechanically ventilated patients in the medical intensive care unit (MICU), Morris et al. (2008) found that the average intensive care unit stay for protocol patients was 5.5 days versus 6.9 days for usual care days (p=0.025). Also, hospital length of stay was reduced for protocol patients when compared to usual care patients (11.2 vs. 14.5 days [p=0.006]). Furthermore, Sigler et al. found that after implementation of an early mobility protocol in a MICU the average length of stay for patients requiring mechanical ventilation decreased from 4.8 to 4.1 days (2016). This decrease transpired only four months after implementation of their early mobility protocol. In a multivariate analysis by Klein et al. (2015), mechanically ventilated patients in a NICU that participated in an early mobility protocol initiative had a 33% reduction in hospital stay (p<0.001), a 45% reduction in NICU stay (p<0.001), and discharge to home versus another post-discharge rehabilitation setting increased by 11.3% (p=0.002). Needham and colleagues (2010) also showed a reduction in hospital and ICU length-of-stay in their ventilated population by 3.1 days [95% CI, 0.3–5.9 days] and 2.1 days [95% CI, 0.4–3.8 days], respectively. Length-of-stay was also reduced in Titsworth’s et al. (2012) recent study of NICU ventilated patients: NICU length-of-stay reduced by 13% (p<0.004) and hospital length-of-stay reduced by 28% (p<0.004). Readmission rates also decreased in several studies. Azuh et al. (2016), showed that hospital readmission of MICU patients decreased from 17.1% to 11.5% (p=0.0405) after a 5-point scale mobility protocol was implemented in a MICU while Floyd et al. (2016) showed a reduction from 3 to 1, thirty-day readmission rate (p=0.301). And although the reduction in readmission rate for Floyd et al. was not statistically
significant, the authors impress to clinicians that the potential economic and clinical benefits of this are profound (Floyd et al., 2016).

Because the literature demonstrates many benefits associated with early mobility with mechanically ventilated patients, some studies have further analyzed those benefits through a cost saving analysis for healthcare organizations. Fraser et al. (2015), as previously discussed, showed at the conclusion of their longitudinal study that

\[ t_{130} = -0.42; \, P = 0.68 \]

\[ \text{mean cost per patient was lower in the mobility group than in the routine care group ($125,309 versus $127,000;} \]

\[ \text{inpatient hospital costs were $8,382,001 for the routine care group and $8,270,435 for the mobility group, representing a savings of $111,566 ($1,690 per patient) for the mobility group. The mean cost per patient was lower in the mobility group than in the routine care group ($125,309 versus $127,000;}
\]

\[ \text{hospital length of stay (p. 56).}
\]

Similarly, Morris et al. (2008) showed in their prospective cohort study that the total direct inpatient costs per patient receiving usual care was $44,302 versus $41,142 for patients mobilized by a full-time salaried and benefited Mobility Team (included in the cost analysis) utilizing a newly implemented mobility protocol. Because of the implications associated with cost savings, many organizations, such as the American Association of Critical-Care Nurses and the Society of Critical Care Medicine, advocate and support the implementation of early mobility protocols as part of their dedication to professional development and quality improvement in critical care delivery. Thus, these organizations provide many grants, educational seminars, free publications, and continuing education opportunities to nurses so that incorporation of best known strategies can optimize mobility protocol implementation.
Implications for Practice

All experimental and systematic reviews included in this study indicated that while early mobility interventions in the ventilated population pose many benefits and cost savings as previously discussed, these may only be actualized if early mobility interventions are implemented through a protocol or bundle approach. Morris et al. (2008) showed that ventilated patients in a MICU who participated in an early mobility protocol study received “at least one more physical therapy session than did Usual Care (80% vs. 47%, p< 0.001)”. The authors also reported that “protocol patients were out of bed earlier (5 vs. 11 days, p < .001), and had therapy initiated more frequently in the MICU (91% vs. 13%, p < .001) than the usual care group”. Another study showed that by utilizing a protocol approach to early mobility, physical mobility among ventilated patients in a NICU increased by 300% (p=0.0001; Titsworth et al., 2012). However, because of the complexity of intensive care, a protocol with early mobility strategies must also address process improvements in sedation, analgesia, and delirium so that optimal benefits and associated cost savings can be achieved (Bailey et al., 2009).

One such protocol receiving favorable outcomes for ventilated patients in the intensive care setting is the Awakening and Breathing Coordination, Delirium Monitoring and Management, and Early Mobility bundle (ABCDE bundle). Application of this bundle has demonstrated quality practice changes within the intensive care environment, which has resulted in an evolution of culture for mobilization of ventilated patients. In their systematic review of 62 articles, Balas et al. (2012) found that the ABCDE bundle “incorporates the best available evidence related to delirium, immobility, sedation/analgesia, and ventilator management in the intensive care unit for adoption into
everyday clinical practice” (p.44). The authors further say that this complex bundle holds “tremendous potential for benefit to the sickest patient”; however, successful implementation relies heavily on the nurse’s role to 1) maintain high quality, timely, and independent tasks among multidisciplinary team members; 2) maintain effective communication between disciplines to ensure the proper order of sequence of individual components of the bundle; and 3) demonstrate effective leadership that shapes the progress and outcomes of bundle implementation (Balas et al., 2012).

One of the unique features of this bundle is that early mobility initiatives are combined with spontaneous breathing trials and sedation/delirium monitoring which has been shown to produce more compelling health outcomes than just solely implementing an early mobility protocol (Pandharipande, Banerjee, McGrane, & Ely, 2010; Morandia, Brummela, & Ely, 2011). Banerjee et al. (2011) support this claim in their systematic review by stating that “strategies aimed at reducing sedative exposure through protocols and coordination of daily sedation and ventilator cessation trials, avoiding benzodiazepines in favor of alternative sedative regimens and early mobilization of patients have all shown to significantly improve patient outcomes”. Moreover, in their systematic review of 81 articles, Vasilevskis et al. (2010) reinforce this claim and further suggest that early mobility protocols, like the ABCDE bundle, should be individualized and protocolized for each unique ICU setting and that a multidisciplinary approach should be taken to ensure its success.

Newer studies are now focusing on redefining the meaning of early mobilization and transforming protocolized mobility interventions into strategies that are goal-directed and centered on the individualized patient. The term early goal-directed mobilization
(EGDM) describes “a program of physiotherapist-directed active physical exercises intended to maximize physical activity at the highest functional level the patient could achieve” (Hodgson et al., 2016, p.1146). Hodgson et al. (2016), in fact, have achieved much success with their redefined early mobility program and have found that with the use of EGDM in their randomized controlled trials, “the proportion of [mechanically ventilated] patients who walked in the ICU was almost doubled with early goal-directed mobilization (intervention n=19 [66%] vs. control n=8 [38%]; p = 0.05)”.

**Limitations of Published Data**

Although there is adequate literature addressing daily awakenings and spontaneous breathing trials for delirium and sedation management for mechanically ventilated patients, few rigorous quantitative and qualitative clinical trials exploring various impacts of early mobility protocol implementation on patient, provider, and system/institution outcomes have been conducted. In particular, few randomized controlled trials have been published in the literature, thus resulting in many gaps. Opportunity for study replication is also limited for this reason. Also, of the major clinical trials published in the literature, many have small sample sizes which negate the ability to generalize the data to various clinical settings.

For the few mobilization protocols published in the literature, many fail to address specific ventilatory and hemodynamic parameters that enable or disallow ventilated patients to advance through a mobility protocol. This can pose many safety issues if such criteria are not observed or can limit the patient’s physical progression by not allowing for mobilization. Thus, more specific patient inclusion and exclusion criteria should be tested with protocol implementation. In addition to this, the literature is lacking
evaluation data for adherence to these mobility protocols as well as qualitative data on clinical and patient satisfaction measures. Did clinical staff, patients, and families have increased satisfaction or were unforeseen compliance issues not addressed? Also, few studies address the economic impact associated with patient and organizational level outcomes. By publishing more data on the economic outcomes, buy-in at the organizational level can be promoted and expedite prioritization for early mobility protocol implementation.

In addition to the aforementioned limitations, the term “early” may need redefining within early mobilization guidelines. The time in which early mobilization strategies should begin is unclear in the literature. Currently, the term has various meanings as demonstrated in assorted clinical trials (Taito, Shime, Ota, & Yasuda, 2016). Also, further research is needed to develop consensus recommendations on the methods and frequency of early mobilization in mechanically ventilated patients (Taito et al., 2016). A synthesis outlining specific guidelines that are universally supported by national nursing and medical organizations has yet to be established.

**Translating Early Mobility Research into Clinical Practice: Closing the Gap**

Despite available evidence that implementation of an early mobility protocol results in many advantageous clinical and quality improvements for ventilated patients in the intensive care environment, many clinicians still promote a culture of sedation and bedrest for patients requiring mechanical ventilation. In fact, Taito et al. (2016) describe surveys that were performed at multiple sites that showed “active mobilization beyond sitting is not commonly practiced and that it varies among countries” (p.1). Similarly, Jolley et al. (2016) in their point prevalence study of forty-two ICUs across seventeen
Acute Respiratory Distress Syndrome Network hospitals found that only 16% of mechanically ventilated patients achieved sitting on the edge of the bed or greater and that the presence of an endotracheal tube and delirium were negatively associated with out-of-bed mobility. Based on the evidence, clinicians need to take steps in closing the gap between research and practice. To accomplish this, a culture of early mobility must be promoted, along with a dedication from intensive care providers to stimulate a change in mobility practice patterns and advocate for leadership that commits to sustaining that change (Hashem, Nelliot, & Needham, 2016; Morris & Herridge, 2007).

**Conclusion**

Critically ill patients that require mechanical ventilation in the intensive care setting are susceptible to limited activity, thus increasing vulnerability to functional deconditioning, cognitive decline, and secondary sequelae such as infection, clot formation, and skin ulcers as a result of prolonged immobility while ventilated (Azuh et al., 2016; Floyd, Craig, Topley, & Tullmann, 2016; Klein, Mulkey, Bena, & Albert, 2016; Kress, 2009; Morris, 2007). These phenomena can occur rather quickly, thus prioritization for early mobility protocol implementation should become a gold standard for clinical practice in the intensive care environment. The ABCDE bundle is one example of an early mobility bundle that when implemented with a multidisciplinary, collaborative approach has resulted in many advantageous outcomes associated with clinical, psychological, and quality metrics. Yet, despite its success and the evidence surrounding benefits of early mobility, the culture of intensive care still perpetuates a model of sedation and bedrest for mechanically ventilated patients. Through a multidisciplinary, collaborative approach, steps should be taken towards integrating
evidence-based mobility research into intensive care practice so that clinical and quality outcomes for this vulnerable population can be optimized.
References


doi:10.1097/CCM.0b013e318168f986.

doi:10.3171/2012.2.JNS111881.


## Table 1

### Summary of Reviewed Articles

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<td>Azuh, O., Gammon, H., Burmeister, C., Frega, D., Nerenz, D., DiGiovine, B., &amp; Siddiqui, A. (2016). Benefits of early active mobility in the medical intensive care unit: A pilot study. <em>The American Journal Of Medicine, 129</em>(8), 866-871. doi:10.1016/j.amjmed.2016.03.032.</td>
<td>Qualitative, prospective pre-post cohort study</td>
<td>Three thousand two hundred thirty-three patients in a MICU were enrolled over a year time. Pre-implementation data from the year prior was used in the comparative analysis.</td>
<td>The purpose of this study was to implement a mobility protocol using a 5 point mobility scale so as to impact hospital-acquired pressure ulcers incidence as well as factors associated with ICU deconditioning.</td>
<td>The 2011 pre-implementation MICU hospital-acquired pressure ulcer rate was 9.2%. After 1 year of employing the mobility team, there was a statistically significant decrease in the MICU hospital-acquired pressure ulcer rate to 6.1% (P ≈ .0405). Hospital readmission of MICU patients also significantly decreased from 17.1% to 11.5% (P ≈ .0010). The mean MICU length of stay decreased by 1 day.</td>
<td>Level IIA Evidence</td>
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<td>Bailey P. P., Miller R. R., &amp; Clemmer, T. P. (2009). Culture of early mobility in mechanically ventilated patients. <em>Critical Care Medicine</em> 37*(10), 429-435. doi:10.1097/CCM.0b013e3181b6e227.</td>
<td>Systematic Review</td>
<td>Eighty-three articles were included in this study.</td>
<td>Eighty-three articles were reviewed to examine the culture of the ICU environment and barriers to early mobilization of mechanically ventilated patients.</td>
<td>The complexity of ICU care prevents early mobility from being viewed as a single entity and requires process improvement in all areas that may affect physical functioning: sedation, delirium, and sleep. Interventions for sedation, delirium, and sleep share similar characteristics with mobility and should respond to the same transformation in ICU culture.</td>
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<td>Banerjee, A., Girad, T.D., &amp; Pandharipande, P. (2011). The complex interplay between delirium, sedation, and early mobility during critical illness: Applications in the trauma unit. <em>Current Opinion in Anesthesiology</em>, 24, 195-201. doi:10.1097/ACO.0b013e3283445382.</td>
<td>Systematic Review</td>
<td>Seventy-two articles were included in this study</td>
<td>Seventy-two articles were reviewed to examine delirium and ICU-AW associated with sedative and analgesia use in the ICU patient population. Also, the ABCDE bundle is described with regards to early ambulation of mechanically ventilated patients.</td>
<td>This studied showed that delirium and ICU-AW are associated with a longer hospital stay, increased cost, and decreased quality of life after discharge from the ICU. Strategies aimed at reducing sedative exposure through protocols and coordination of daily sedation and ventilator cessation trials, avoiding benzodiazepines in favor of alternative sedative regimens, and early mobilization of patients have all shown to significantly improve patient outcomes.</td>
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<td>Floyd, S., Craig, S. W., Topley, D., &amp; Tullmann, D. (2016). Evaluation of a progressive mobility protocol in postoperative cardiothoracic surgical patients. <em>Dimensions of Critical Care Nursing</em> 35(5), 277-282. doi:10.1097/DCC.0000000000000197.</td>
<td>Retrospective study with a descriptive comparative research design using matched pairs</td>
<td>Thirty patients for the pre-intervention group were matched with thirty patients in the post-intervention group in a 16-bed adult TCV-ICU in an academic medical center located in central Virginia.</td>
<td>The purpose of this study is to evaluate the effectiveness of a progressive mobility protocol on patient outcomes related to immobility: length of hospital and ICU LOS, ICU readmission occurrence, and the incidence of pressure ulcers and DVT/pulmonary embolus. Although statically significant differences (P &gt;0.05) were not found in the outcomes between the pre-intervention and post-intervention groups in this evaluation, it is clear that there were decreases in hospital LOS, ICU readmission rates, DVT, and pressure ulcer prevalence.</td>
<td>Level IIA Evidence</td>
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<td>Fraser, D., Spiva, L., Forman, W., &amp; Hallen, C. (2015). Original research: Implementation of an early mobility program in an ICU. <em>American Journal Of Nursing</em> 115(12), 49-58. doi:10.1097/01.NAJ.0000475292.73985.fc.</td>
<td>Retrospective longitudinal study</td>
<td>Sixty-six patients enrolled in the mobility intervention group were compared to sixty-six patients enrolled in the pre-intervention group. The study took place in a medical, surgical, and coronary intensive care unit.</td>
<td>This study’s purpose was to assess four nurse-sensitive quality-of-care indicators (falls, ventilator-associated events, pressure ulcers, and catheter-associated urinary tract infections [CAUTIs]), as well as hospital costs, sedation levels using RASS scores, delirium days, and functional outcomes using Barthel Index scores by comparing ICU patients who received an early mobility intervention from a dedicated mobility team with ICU patients who received routine care. The 66 patients who received the mobility intervention had significantly fewer falls, ventilator-associated events, pressure ulcers, and CAUTIs than the 66 patients in the routine care group. The mobility group also had lower hospital costs, fewer delirium days, lower sedation levels, and improved functional independence compared with the routine care group. Patients in the mobility group got out of bed on 2.5 more days than patients in the routine care group. There were also no adverse events in the mobility group.</td>
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<td>Hodgson, C., Bailey, M., Bellomo, R., Berney, S., Buhr, H., Denehy, L., . . . Webb. (2016). A binational multicenter pilot feasibility randomized controlled trial of early goal-directed mobilization in the ICU. Critical Care Medicine, 44(6), 1145-1152. doi:10.1097/CCM.0000000000001643.</td>
<td>A binational pilot randomized controlled trial.</td>
<td>Five ICUs in Australia and New Zealand involving fifty critically ill adults mechanically ventilated for greater than 24 hours.</td>
<td>To determine if the early goal-directed mobilization intervention could be delivered to patients receiving mechanical ventilation with increased maximal levels of activity compared with standard care.</td>
<td>The highest level of activity (ICU mobility scale) recorded during the ICU stay between the intervention and control groups was mean (95% CI) 7.3 (6.3-8.3) versus 5.9 (4.9-6.9), p = 0.05. The proportion of patients who walked in ICU was almost doubled with early goal-directed mobilization (intervention n = 19 [66%] vs. control n = 8 [38%]; p = 0.05). There was no difference in total inpatient stay (days) between the intervention versus control groups (20 [15-35] vs. 34 [18-43]; p = 0.37).</td>
<td>Level IB Evidence</td>
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<td>Hopkins, R.O. &amp; Spuhler, V.J. (2009). Strategies for promoting early activity in critically ill mechanically ventilated patients. AACN Advanced Critical Care, 20(3), 277-289. doi:10.1097/NCL.0b013e3181aace0.</td>
<td>Systematic Review</td>
<td>Seventy articles were reviewed for this study</td>
<td>To compile all available evidence on the benefits, safety, and feasibility of mobilizing mechanically ventilated patients while also examining adverse health outcomes associated with the culture of immobility in intensive care. This study also highlights an early mobility protocol that has been initiated in a respiratory intensive care setting.</td>
<td>This article not only shows that early mobility is safe and feasible for those patient mechanically ventilated but it also shows evidence to support the benefits of early ambulation with this patient population. Other factors discussed are the roles of sedation and strategies that the ICU team can utilize to promote early mobility.</td>
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<td>Klein, K., Mulkey, M., Bena, J. F., &amp; Albert, N. M. (2015). Clinical and psychological effects of early mobilization in patients treated in a neurologic ICU: A comparative study. Critical Care Medicine, 43(4), 865-873. doi:10.1097/CCM.0000000000000787.</td>
<td>Prospective, two-group pre/post comparative design with data collection 4 months pre- and post-intervention with a 4-month run-in period</td>
<td>Critically ill patients with primary neurologic injury admitted to the neurologic ICU in a 22 bed neurologic ICU in a 1,200-bed urban, quaternary-care, academic hospital in Northeast Ohio</td>
<td>The purpose of this study was to examine if an early mobilization protocol, applied in a neuroscience ICU population, improved clinical, quality metric, and psychological outcomes</td>
<td>Compared with pre-intervention, post-intervention patients had higher mobility levels and decreased hospital and neurologic ICU length of stay; were more likely to be discharged home (all p ≤ 0.002); had decreased bloodstream infection, hospital-acquired pressure ulcer, and anxiety rates (all p &lt; 0.03); and had no change in mortality, ventilator-associated pneumonia, deep vein thrombosis, depression, and hostility. In multivariable analyses, post-intervention patients had higher mobility levels (p &lt; 0.001), had shorter mean hospital and neurologic ICU length of stay (both p &lt; 0.001), and were more likely to be discharged home (p = 0.033) compared with pre-intervention patients.</td>
<td>Level IIA Evidence</td>
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<td>Kress, J. P. (2009). Clinical trials of early mobilization of critically ill patients. Critical Care Medicine 37(10), 442-447. doi:10.1097/CCM.0b013e3181b6f9e0.</td>
<td>Systematic Review</td>
<td>Thirty-seven articles were included in this systematic review.</td>
<td>Thirty-seven articles were included in this systematic review.</td>
<td>This review shows a need for early mobilization of ICU patients to prevent neuromuscular weakness and functional impairment. It showed that early mobilization of mechanically ventilated patients is feasible and safe. In addition to this, this article features a previously outlined progressive activity regime from Morris et al. specifically catered to the mechanically ventilated patient in the ICU.</td>
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<td>Morris, P. E., Goad, A., Thompson, C., Taylor, K., Harry, B, Passmore, L.,...Haponik, E. (2008). Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Critical Care Medicine 36(8), 2238-2243. doi:10.1097/CCM.0b013e31818b90e.</td>
<td>Prospective cohort study</td>
<td>Medical intensive care unit patients with acute respiratory failure requiring mechanical ventilation on admission</td>
<td>To assess whether a mobility protocol increased the proportion of intensive care unit patients receiving physical therapy vs. usual care.</td>
<td>More protocol patients received at least one physical therapy session than did Usual Care (80% vs. 47%, p &lt; .001). Protocol patients were out of bed earlier (5 vs. 11 days, p &lt; .001), had therapy initiated more frequently in the intensive care unit (91% vs. 13%, p &lt; .001), and had similar low complication rates compared with Usual Care. For Protocol patients, intensive care unit length of stay was 5.5 vs. 6.9 days for Usual Care (p=.025); hospital length of stay for Protocol patients was 11.2 vs. 14.5 days for Usual Care (p=.006).</td>
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<td>Needham, D. M., Korupolu, R., Zanni, J. M., Pradhan, P., Colantuoni, E., Palmer, J. B.,...Fan, E. (2010). Early physical medicine and rehabilitation for patients with acute respiratory failure: A quality improvement project. <em>Archives of Physical Medicine and Rehabilitation, 91</em>(4), 536-542. doi:10.1016/j.apmr.2010.01.002.</td>
<td>Prospective cohort study</td>
<td>Fifty-seven patients mechanically ventilated 4 days or longer in a sixteen-bed medical intensive care unit in an academic hospital.</td>
<td>To reduce deep sedation and delirium, permit mobilization, increase the frequency of rehabilitation consultations and treatments to improve patients’ functional mobility, and evaluate effects on length of stay.</td>
<td>Benzodiazepine use decreased markedly (proportion of MICU days that patients received benzodiazepines, with lower median daily sedative doses (47 vs. 15mg midazolam equivalents [P .09] and 71 vs. 24 mg morphine equivalents [P .01]). Patients had improved sedation and delirium status. There were a greater median number of rehabilitation treatments per patient (1 vs 7) with a higher level of functional mobility. Hospital administrative data demonstrated that across all MICU patients, there was a decrease in intensive care unit and hospital length of stay by 2.1 and 3.1 days and a 20% increase in MICU admissions compared with the same period in the prior year.</td>
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<td>Pandharipande, P., Banerjee, A., McGrane, S., &amp; Ely, E. W. (2010). Liberation and animation for ventilated ICU patients: The ABCDE bundle for the back-end of critical care. <em>Critical Care</em> 14(157), 1-3. doi:10.1186/cc8999.</td>
<td>Systematic Review</td>
<td>Twenty articles were reviewed for this study</td>
<td>To examine early ambulation initiatives in the ICU setting and implementation of the ABCDE bundle.</td>
<td>This study describes the need for an ICU culture change. It encourages healthcare providers to incorporate strategies that lead to early liberation and animation. The ABCDE bundle represents just one method of approaching the organizational changes that need to occur to effect a change of culture that will breed success.</td>
<td>Level IIIA Evidence</td>
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<td>Patman S. M., Dennis D. M., &amp; Hill, K. (2012). Exploring the capacity to ambulate after a period of prolonged mechanical ventilation. <em>Journal of Critical Care</em>, 27(6), 542-548. doi:10.1016/j.jcrc.2011.12.020.</td>
<td>A retrospective review of medical records of ICU patients between 2007 and 2008</td>
<td>One hundred ninety patients who were mechanically ventilated for 168 hours or more between 2007 and 2008 in an intensive care unit.</td>
<td>The primary aim of this study was to report the prevalence of patients who were unable to ambulate independently, with or without a gait aid, at the time of discharge from acute care after a period of prolonged mechanical ventilation.</td>
<td>Before admission, 189 were ambulating independently, of whom 180 (95%) did not require a gait aid. On discharge from acute care, 89 (47%, 95% CI, 40%-54%) were ambulating independently, of whom 54 (61%) did not require a gait aid. Compared with those who stood within 30 days of ICU admission, a delay in standing of between 30 and 60 days increased the odds 5-fold of being unable to ambulate independently at the time of discharge. After a prolonged ICU admission, more than 50% of patients were unable to ambulate independently by hospital discharge, with the time between admission and first stand, being an important predictor of this outcome.</td>
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<td>Schaller, S., Anstey, M., Blobner, T., Edrich, S., Grabitz, I., Gradwohl-Matis, N., . . . Eikermann, M. (2016). Early, goal-directed mobilisation in the surgical intensive care unit: A randomised controlled trial. The Lancet, 388(10052), 1377-1388. <a href="http://dx.doi.org/10.1016/S0140-6736(16)31637-3">http://dx.doi.org/10.1016/S0140-6736(16)31637-3</a>.</td>
<td>A multicentre, international, parallel-group, assessor-blind, randomized controlled trial in SICUs of five university hospitals.</td>
<td>Between July 1, 2011 and Nov 4, 2015, 200 randomly assigned patients to receive standard treatment (control; n=96) or mobility intervention (n=104) in surgical intensive care units.</td>
<td>This study tested if early, goal-directed mobilization, using a strict mobilization algorithm combined with facilitated inter-professional communication, in critically ill SICU patients leads to improved mobility during SICU admission, decreased length of stay on the SICU, and increased functional independence at hospital discharge.</td>
<td>Intention-to-treat analysis showed that the intervention improved the mobilization level (mean achieved SOMS 2·2 [SD 1·0] in intervention group vs. 1·5 [0·8] in control group, p&lt;0·0001), decreased SICU length of stay (mean 7 days [SD 5–12] in intervention group vs. 10 days [6–15] in control group, p=0·0054), and improved functional mobility at hospital discharge (mmFIM score 8 [4–8] in intervention group vs. 5 [2–8] in control group, p=0·0002).</td>
<td>Level IA Evidence</td>
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<td>Schweickert, W.D. &amp; Kress, J.P. (2011). Implementing early mobilization interventions in mechanically ventilated patients in the ICU. CHEST, 140(6), 1612-1617. doi:10.1378/chest.10-2829.</td>
<td>Systematic Review</td>
<td>Fifty-eight publications were included in this review</td>
<td>This review specifically highlights benefits of incorporating early mobility interventions in the mechanically ventilated patient population while describing impediments to mobilization.</td>
<td>This study describes the culture shift in intensive care unit care. It explores and validates the idea that early mobility initiatives and minimum sedation in intubated patients reduces ICU delirium, improves functional independence, reduces duration of mechanically ventilation, reduces length of stay in the intensive care unit and hospital, improves muscle strength, improves SF-36 physical function score, and improves 6 minute walk distance.</td>
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<td>Sigler, M., Nugent, K., Alalawi, R., Selvan, K., Tseng, J., Edriss, H., . . . Krause, D. (2016). Making of a successful early mobilization program for a medical intensive care unit. <em>Southern Medical Journal, 109</em>(6), 342-345. doi:10.14423/SMJ.0000000000000472.</td>
<td>Retrospective evaluation study of a mobility protocol implemented a year prior</td>
<td>An ICU at University Medical Center in Lubbock, Texas where an early mobilization program was started in 2014. This retrospective study analyzes mobility data of more than 50 patients that were ambulated using this program while mechanically ventilated during 2014.</td>
<td>To provide a guideline for intensive care unit (ICU) early mobilization program development and implementation and to describe the patient characteristics and endpoints for those who participated in our hospital’s early mobilization program.</td>
<td>More than 50 mechanically ventilated patients ambulated in the first year following early mobilization initiation. Patients with an FiO2 as high as 1.0 and on non-conventional modes of mechanical ventilation successfully ambulated without adverse events. The mean ambulation distance was 102 ± 152 feet and usually required three ICU staff members with 5 to 10 minutes of preparation before ambulation. After implementation, a retrospective analysis revealed a decrease in the average length of ICU stay, from 4.8 to 4.1 days.</td>
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<td>Schweickert, W. D., Pohlman, M. C., Pohlman, A. S., Nigos, C., Pawlik, A. J., Esbrook, C. L., ...Kress, J. P. (2009). Early physical and occupational therapy in mechanically ventilated, critically ill patients: A randomized controlled trial. The Lancet, 373(9678), 1874-1882. doi:10.1016/S0140-6736(09)60658-9.</td>
<td>Qualitative, randomized control trial</td>
<td>One hundred four sedated adults (≥18 years of age) in an ICU who had been on mechanical ventilation for less than 72 hours, were expected to continue for at least 24 hours, and who met criteria for baseline functional independence.</td>
<td>The purpose of this study is to evaluate functional and neuropsychiatric outcomes of mechanically ventilated patients that receive daily sedation interruption combined with physical and occupational therapy.</td>
<td>Return to independent functional status at hospital discharge occurred in 29 (59%) patients in the intervention group compared with 19 (35%) patients in the control group (p=0.02; odds ratio 2.7 [95% CI 1.2–6.4]). Patients in the intervention group had shorter duration of delirium and more ventilator-free days during the 28-day follow-up period than did controls. There was one serious adverse event in 498 therapy sessions (desaturation less than 80%). Discontinuation of therapy as a result of patient instability occurred in 19 (4%) of all sessions, most commonly for perceived patient-ventilator asynchrony.</td>
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<td>Thomsen, G.E., Snow, G.L.,</td>
<td>Qualitative, prospective,</td>
<td>One hundred four respiratory failure patients who require mechanical ventilation greater than four days.</td>
<td>To determine if ambulation of patients with acute respiratory failure would increase with transfer to an intensive care unit where activity is a key component of patient care.</td>
<td>Transferring a patient to the respiratory intensive care unit substantially increased the probability of ambulation (p &lt; .0001). After 2 days in the respiratory intensive care unit, the number of patients ambulating had increased three-fold compared with pre-transfer rates. The intensive care environment may contribute unnecessary immobilization throughout the course of acute respiratory failure. Sedatives, even given intermittently, substantially reduce the likelihood of ambulation.</td>
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<td>Rodriguez, L., &amp; Hopkins, R. O.</td>
<td>pre-post cohort study</td>
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<td>Titsworth, W. L., Hester, J., Correia, T., Reed, R., Guin, P., Archibald, L., ... Mocco, J. (2012). The effect of increased mobility on morbidity in the neurointensive care unit. <em>Journal of Neurosurgery, 116</em>(6), 1379-1388. doi:10.3171/2012.2.JNS111881.</td>
<td>Quantitative, prospective, pre-post cohort study</td>
<td>Three thousand two hundred ninety-one patients included in a 10-month preintervention surveillance period followed by a 6-month prospective intervention phase in a neurointensive care unit.</td>
<td>This study was a single institution prospective intervention trial to investigate the effectiveness of increased mobility among neurointensive care unit patients.</td>
<td>Implementation of the PUMP Plus increased mobility among neurointensive care unit patients by 300% (p &lt; 0.0001). Initiation of this protocol also correlated with a reduction in neurointensive care unit length of stay (LOS; p &lt; 0.004), hospital LOS (p&lt;0.004), hospital-acquired infections (p&lt; 0.05), and ventilator-associated pneumonias (p&lt; 0.001), and decreased the number of patient days in restraints (p&lt; 0.05). Additionally, increased mobility did not lead to increases in adverse events as measured by falls or inadvertent line disconnections.</td>
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<td>Vasilevskis , E. E., Ely, E. W., Speroff, T., Pun, B. T., Boehm, L., &amp; Dittus, R. S. (2010). Reducing iatrogenic risks: ICU-acquired delirium and weakness-Crossing the quality chasm. CHEST 138(5):1224–1233. doi:10.1378/chest.10-0466.</td>
<td>Systematic Review</td>
<td>Eighty-one articles were reviewed for this study</td>
<td>To discuss the current best practices for assessing delirium, sedation monitoring, and implementation of the ABCDE bundle</td>
<td>This article suggests that the ABCDE bundle should be protocolized in the ICU setting and that a multidisciplinary approach be taken to ensure its success.</td>
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*Note.* MICU=medical intensive care unit; ICU=intensive care unit; ABCDE bundle=Awakening and Breathing Coordination, Delirium Monitoring and Management, and Early Mobility bundle; ICU-AW=intensive care unit-acquired weakness; TCV-ICU=thoracic cardiovascular-intensive care unit; LOS=length of stay; DVT=deep vein thrombosis; RASS=Richmond Agitation Sedation Scale; CAUTI=catheter-associated urinary tract infection; SICU=surgical intensive care unit; PUMP Plus=Progressive Upright Mobility Protocol Plus
Utilizing the Iowa Model of Evidence-Based Practice to Promote Quality Care to Guide Implementation of an Early Mobility Protocol for Mechanically Ventilated Patients

Katherine B. Stewart RN, BSN

University of Kentucky

College of Nursing
Abstract

The gap between research and clinical practice in our healthcare system is profound. Too often, clinicians rely on clinical experience and antiquated standards of care to treat the sickest patients, although a wealth of studies have found that an evidence-based approach to care delivery has resulted in improved clinical, safety, and quality outcomes while reducing cost and resource burden. Furthermore, studies have shown that organizations that cultivate an evidence-based culture have significantly decreased morbidity and mortality rates for their patient populations. Yet clinical care rooted in traditional practice still remains, resulting in the continuation of suboptimal patient outcomes.

One of the challenges in closing the gap between evidence-based knowledge and clinical practice is the effective use of conceptual models or frameworks specifically designed to guide evidence-based practice integration. Although there are numerous models available, this study will focus on utilizing the Iowa model of evidence-based practice to promote quality care to guide the integration and implementation of an evidence-based early mobility protocol for mechanically ventilated patients in the intensive care setting.
Advances in science and technology in healthcare have contributed to an increase in life-expectancy for our aging population. Today, more patients suffering from acute illnesses that were previously considered deadly are being discharged from intensive care units with full recovery. Still, because of the complexity of critical illness coupled with the myriad of chronic diseases that plague our patient population, the demand for safe and effective care while delivering superior quality has never been greater. Gaps between best known research and clinical practice still remain, creating vulnerability for our intensive care patients. To mitigate this, it is vital for healthcare providers to not only integrate evidence-based, multidisciplinary clinical practice but also transform the culture of care so that these practice enhancements will uphold and optimize the wellness of our critically-ill population.

**Physical Immobility: A Gap between Research and Clinical Practice**

One such gap receiving substantial examination within the literature is physical immobility in patients requiring mechanical ventilation. It has been well documented that prolonged immobilization among critically-ill patients has resulted in variegated, adverse health outcomes such as neuromuscular dysfunction, cognitive decline, and organ and metabolic system disturbances that complicate the condition of critical illness already present in this patient population (Drolet et al., 2013). It has been demonstrated through clinical trials that prolonged mechanical ventilation due to immobility has resulted in up to 80% of patients experiencing cognitive decline, up to 60% experiencing intensive care unit-acquired weakness, and up to 25% experiencing critical illness polyneuropathy.
(DeJonghe et al., 2002; Ely et al., 2001). This has been shown to not only increase ventilation and hospitalization time, but also increase cost utilization and the amount of resources needed for extended care (Cox, Carson, Govert, Chelluri, & Sanders, 2007). In fact, an economic evaluation of prolonged mechanical ventilation showed that incremental costs per quality-adjusted life-year gained by prolonged mechanical ventilation provision exceeded $100,000 with patients aged 68 and greater (Cox et al., 2007). In addition to this, it has been determined that patients mechanically ventilated for seven or more days can consume 37% of the total ICU resources available (Carson & Bach, 2002). And although reducing healthcare cost is crucial, improving patient outcomes to promote optimal wellness in the mechanically ventilated population is paramount.

**Implementation of Early Mobility Strategies through a Protocol Approach**

Researchers have explored many venues for incorporating early mobilization strategies for mechanically ventilated patients. Such options include formation of mobility teams, stepwise programs that progress mobility based on acuity, and providing exercise equipment at the patient’s bedside. However, none are more valid and established in the literature than implementation of early mobility strategies through a bundle or protocol approach. The American Association of Critical-Care Nurses (AACN) has recommended that the current standard of practice with regards to early mobility with the mechanically ventilated patient population, as part of the ABCDE bundle (the Awakening and Breathing, Coordination, Delirium Monitoring and Management and Early Mobility Bundle), is to implement early mobilization strategies through a bundle or protocol approach (AACN, 2015b). The AACN has developed a
standard protocol within their PEARLs (Physical Evidence and Reasoned Logic) for practice; however, they recommend that early mobilization protocols be tailored to individual patient populations (AACNPearl, 2015a). In other words, each distinct mobility intervention within an early mobility protocol should accommodate unique patient populations and their individual characteristics served in various intensive care environments. Table 1 depicts a list of clinical conditions to examine when individualizing mobility interventions to include in an early mobility protocol for mechanically ventilated patients (Hoyer, Brotman, Chan, & Needham, 2015).

**Barriers to Implementation of an Early Mobility Protocol**

For successful protocol implementation, barriers to adoption and implementation from staff as well as patients and families should be considered. The literature describes several of these perceived barriers that have hindered previous implementation studies. Such barriers encountered include the number of invasive catheters used in the intensive care environment, time restraints, limited staff to participate in mobility exercises, and perceived safety issues (Honiden & Connors, 2015). Hoyer et al. (2015) conducted a cross-sectional, self-administered survey in two different hospital settings of 120 nurses and physical and occupational therapists from six general medicine units and found that the item reflecting the highest perceived barrier in their study was “increasing mobilization of patients will cause more work for staff” (p.309). And although Hoyer’s finding is encountered regularly throughout the literature, no barrier is discussed more than overcoming the traditional culture of intensive care.
Transforming the Intensive Care Culture to Promote Mobilization

The culture of modern intensive care for mechanically ventilated patients consists of continuous sedation and analgesia, as well as restraint use, all of which augment immobility (Hopkins & Spuhler, 2009). Although sedation and analgesia are commonly used for comfort and patient safety during mechanical ventilation, Banerjee, Girard and Pandharipande (2011) state that these “are overused without goals and targets, thus predisposing patients to untoward complications of increased time on mechanical ventilation” (p.195). Although adequate pain management is important to prevent physiological decline in the critically ill patient, meticulous attention should be taken to not deeply sedate so that early mobility interventions can be performed (Banerjee et al., 2011). In essence, the traditional idea of sedation and prolonged bedrest while mechanically ventilated should transform into a systematic approach to minimize sedation and mobilize every patient early during the ventilation process. Such a transformation has been demonstrated by Needham and colleagues (2010), who piloted a quality improvement project seeking to change the culture of sedation and bedrest so that mobilization of their mechanically ventilated population was possible. Not only did patients in this study receive more mobility interventions, but functional mobility as well as intensive care length-of-stay decreased. Upon completion of the study, Needham and his team also noted that sedative and opiate use decreased, as did incidence of delirium in their study population. The authors attributed these changes to an evolution in their culture of care (Needham et al., 2010).

In another study, conducted at the University of Michigan, a mobility program for mechanically ventilated patients was implemented in the surgical intensive care unit,
trauma burn intensive care unit, and critical care medical unit (Dammeyer, Dickinson, Packard, & Ricklemann, 2013). Although implementation of their mobility protocol was met with much success, the authors describe many challenges faced. One of the most challenging hurdles to overcome was their culture of intensive care:

In large critical care units, where nurses have various levels of knowledge and motivation as well as many competing priorities, staff need to understand the evidence around the initiative and participate in the development of the program to be successful. Initially, mobility was not viewed as a priority and many of the patients were seen as too ill or had too many complicated lines and devices. Today, we are mobilizing some of most complicated patients (burn and surgical, cardiac, renal, and multisystem organ failure) with various therapies, such as extracorporeal membrane oxygenation, ventricular assist devices, stable ventriculostomies, and mechanical ventilation without complications. (Dammeyer, Dickinson, Packard, & Ricklemann, 2013, p.47)

To transform the culture of intensive care so that mobilization of mechanically ventilated patients will be promoted, employing a change theory in order to create “the Learning Organization” is necessary (White, 2012a). First, to change the intensive care environment, the unit must develop systems thinking, or the ability to see the overall picture and distinguish patterns. With regard to mobility, this means that team members actualize organizational goals that result from mobilizing ventilated patients: decreased length-of-stay, reduced readmissions, and decreased hospitalization time which translates into reduced resource utilization and ultimately reduced cost burden. Second, the intensive care team must develop personal mastery where a commitment to career and
lifelong learning is achieved. The team must commit that mobilizing their ventilated patients will result in improved wellness as well as personal career satisfaction. Third, the use of mental models can stimulate self-reflection and reveal personal antiquated beliefs about care for the ventilated patient and challenge a transformation in ideas about mobilization in their care environment. Fourth, building shared visions about goals related to reducing sedation and opiate use so that mobilization of ventilated patients is achievable will foster long-term commitments to changing the culture of care. Lastly, the intensive care environment must stimulate team learning so as to develop mobilization goals, create a desire to attain results, and an even deeper desire to sustain those results (White, 2012a). Mastering these five disciplines while rooted in an organizational theory of change will ensure that the culture of oversedation and immobilization that surrounds ventilated patients will transform into an environment of action.

Using the Iowa Model of Evidence-Based Practice to Promote Quality Care to Implement a Change in Practice

The Iowa model of evidence-based practice to promote quality of care was developed to guide healthcare providers and researchers to incorporate best known research into clinical practice using a decision-making algorithm approach (Figure 1; White, 2012b). It has been shown to be one of the most effective tools for incorporating practice changes at the organizational level. This model uses clinical problem-focused or new knowledge-focused triggers so as to engage providers to consider an inquiry in an organizational context while establishing the strength and quality of evidence available in order to translate and institute a change in practice (White, 2012b). Using this model as a guide, healthcare providers in the intensive care environment can systematically plan,
implement, and evaluate the process of restructuring the environment of intensive care so as to promote quality interventions tailored to promote physical activity in the mechanically ventilated patient population. The following steps from the model should be employed so generation, implementation, and evaluation of a mobility protocol for mechanically ventilated patients will be efficacious and provide a serviceable organizational practice change: 1) problem identification; 2) forming a team; 3) review and critique of relevant research and related literature; 4) implementation of the practice change; and 5) dissemination of findings (Polit & Beck, 2012).

**Problem Identification: Immobilization in the Mechanically Ventilated Population**

As previously discussed, immobilization in mechanically ventilated patients is an extensive problem that requires a change in practice. However, before implementation of a mobility protocol, it must be decided what inclusion and exclusion criteria patients in a particular care setting must meet in order to benefit from instituting a mobility program. Criteria should be determined based on the unique patient population served in the individual organization necessitating the practice change. Examples of such criteria used in previous studies are depicted in Table 2. When determining criteria for a particular care setting, patient, staff, and environmental aspects unique to the environment should be considered (previously discussed in Table 1). Once the inclusion and exclusion criteria are determined, a retrospective chart review from previous admissions of patients requiring mechanical ventilation in a specified time frame should be conducted to determine the percentage of patients that would qualify for mobility using a protocol approach. If the percentage of patients qualifying for mobilization is sufficient as determined by the organization, and it is determined that instituting a change would
directly affect patient outcomes, priority for planning and implementing mobility interventions should be decided. By aligning the problem with the organization’s strategic plan and mission, garnering support and leadership necessary to carry out a mobility practice change can occur (Ciliska et al., 2011).

**Forming a Mobility Team**

Once the problem is identified and prioritization for the organization is determined, formation of the mobility team should follow. Members of the team should represent several disciplines so that an interdisciplinary, collaborative approach to change can occur. Such disciplines that should be represented in the development and implementation of a mobility program for mechanically ventilated patients include medicine, nursing, physical therapy, respiratory therapy, and nursing specialists. Together, goals and outcomes for the program should be established. These goals should reflect not only a united yet detailed perspective from each discipline, but also align with the organization’s mission (Melneyk & Fineout-Overholt, 2011). By doing this, coordination of a single vision that defines the program’s purpose and goals will ensure that optimal patient outcomes will be attained (Ciliska et al., 2011; Melneyk & Fineout-Overholt, 2011). Other factors to consider when forming a multidisciplinary mobility team is choosing members with unique skill sets that will maximize output toward project goals (Ciliska et al., 2011). For a mobility team, utilizing skills from physical therapy, respiratory therapy, and nursing will ensure that mobility for ventilated patients will be comprehensive, safe, and feasible. Also, including a clinical nurse specialist or nursing researcher will affirm that most current, applicable research will be used to guide protocol formation.
Review and Critique of Relevant Research and Related Literature Regarding Mobility

After the multidisciplinary team identifies the purpose, mission, goals, and outcomes for implementation of a mobility program in their mechanically ventilated population, the team should then select, review, critique and synthesize all research available about implementing a mobility program in this specific population (O’Mathuna, Fineout-Overholt, & Johnston, 2011). Synthesis should include an evaluation of randomized controlled trials, systematic reviews, as well as correlational/observational and descriptive studies. Evidence should be appraised and graded for sufficiency to address project triggers (O’Mathuna et al., 2011). Consider if the evidence is valid, the magnitude of the effect, and peripheral benefits and costs associated with implementing a mobility program. If the evidence aligns with the team’s and organization’s goals and is relevant to the individual clinical scenario, then integration of evidence is applicable for development of a mobility program (Polit & Beck, 2012). Other aspects of the literature to examine are benefits, risks, challenges safety, and feasibility of mobility as well as types of physical interventions included in mobility protocols piloted in clinical trials (O’Mathuna et al., 2011).

Along with appraising the evidence, financial issues and clinical relevance should be determined (Polit & Beck, 2012). With regard to resources needed for each intervention of the mobility protocol, costs should be calculated and presented to the organization before implementation occurs. Such anticipated costs would include transportable ventilators, exercise equipment, transport monitoring equipment, safety equipment, additional staff, etc. Also, appraising the evidence in terms of relevance to
the clinical situation will help to determine if making a mobility practice change is beneficial. A retrospective chart review (as previously discussed) for prior admissions that identifies the percentage of patients that would qualify for mobility under evidence-based guidelines will help determine if implementing a mobility practice change would create a compelling quality improvement in your particular clinical scenario. Finally, once it is determined that making a clinical practice change in current mobility strategies is relevant, financially feasible, and a fundamental step towards quality improvement, the team should design the mobility practice change by integrating the best evidence available into a protocol that directly targets the intended population and clinical scenario in which implementation will occur (Polit & Beck, 2012).

**Implementing a Practice Change: Mobility Program for Mechanically Ventilated Patients**

A key action for implementing a clinical practice change is conducting and designing the evaluation of a pilot. Ciliska et al. (2011) have stated that “even if the new practice is specific to just one unit, its use should be pilot tested to evaluate it for any necessary adaptation before making it a standard of care” (p.256). This means that before implementing the mobility protocol throughout all intensive care units in the organization, the mobility team should design a pilot study for one intensive care unit so as to test the interventions of the protocol and determine the process and outcomes data that result. Once data are collected and analyzed for that unit, adaptations to interventions and measures of the protocol can ensue before a house-wide rollout occurs (Ciliska et al., 2011). When making changes to the protocol based on data collected from the pilot, it is important to not only include feedback from the entire mobility team, but also from
clinical staff, patients, and families (Ciliska et al., 2011). This will help to establish a comprehensive yet conducive mobility protocol that will likely be adopted as a standard of care. While designing the implementation and evaluation pieces for the mobility protocol, Ciliska et al. (2011) also suggest that translational strategies be considered so that adoption of the mobility protocol will occur. Such strategies mentioned are “the use of change champions, opinion leaders, educational sessions, educational materials, reminder systems, and audit and feedback” (Ciliska et al., 2011).

After collection of outcomes and process data from the pilot and adjustments to practice measures are made, the team should implement and evaluate the change in mobility practice in all intensive care units that house mechanically ventilated patients. It is important to evaluate while implementing the new mobility protocol so that minor adjustments can be made during the process, if necessary (Ciliska et al., 2011). According to Ciliska et al. (2011), “Monitoring and reporting trends of structure, process, and outcome indicators with actionable feedback to clinicians can promote sustained integration of the practice change” (p.254). Once all post-pilot data, including process, outcomes, and cost data are analyzed, the mobility team should compare results to baseline data and make recommendations for actions needed to integrate and maintain the change in practice (Ciliska et al., 2011).

**Dissemination of Mobility Findings and Integration into Practice As a Standard of Care**

Dissemination of data with stakeholders within and outside the organization is a fundamental part of incorporating evidence-based practice into clinical care (Ciliska et al., 2011). Dissemination of the project’s results, whether through presentation or
publication, is a vital component in order to gain awareness, understanding, support, and eventually commitment to change for mobility practice in the intensive care environment. With the knowledge generated from integrating evidence-based mobility changes for mechanically ventilated patients, not only can we improve the quality of care this population receives, but through dissemination, we can develop evidence-based practice in other clinical areas.

**Conclusion**

The Iowa model of evidence-based practice to promote quality care is an integral guideline for clinicians to promote evidence-based practice into clinical care. Like many practice improvement projects, this model can efficiently and effectively guide clinicians to incorporate evidence surrounding promotion of mobility and culture change for the mechanically ventilated patient in the intensive care environment. Because the model includes several important triggers and feedback loops that stimulate critical analysis of data during the planning, implementation, and evaluative portions of the practice change process while supporting interdisciplinary team involvement, use of this model is extensive with results expanding the evidence-based practice culture.
References


Table 1

*Clinical Conditions to Consider when Designing an Early Mobility Protocol*

<table>
<thead>
<tr>
<th>Clinical Conditions to Consider when Individualizing Mobility Interventions to Include in an Early Mobility Protocol</th>
</tr>
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<tbody>
<tr>
<td><strong>Patient</strong></td>
</tr>
<tr>
<td>• Diagnosis</td>
</tr>
<tr>
<td>• Number and type of invasive catheters</td>
</tr>
<tr>
<td>• Number and type of intravenous vasoactive medications</td>
</tr>
<tr>
<td>• Number and type and comorbidities</td>
</tr>
<tr>
<td>• Number and type of sedative/opiate medication</td>
</tr>
<tr>
<td>• Individual patient RASS score</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>• Availability of ICU resources</td>
</tr>
<tr>
<td>• Availability of mobility and safety equipment</td>
</tr>
<tr>
<td>• Unit layout</td>
</tr>
<tr>
<td><strong>Staff</strong></td>
</tr>
<tr>
<td>• Patient:Staff ratio</td>
</tr>
<tr>
<td>• Interdisciplinary team involvement</td>
</tr>
<tr>
<td>• Time restraints for staff</td>
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</tbody>
</table>

* (Hoyer, Brotman, Chan, Needham, 2015)
Table 2

*Example of Patient Inclusion and Exclusion Criteria for Mobility*

<table>
<thead>
<tr>
<th>Patient Specific Inclusion and Exclusion Criteria for Mobility</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Inclusion Criteria</strong></td>
</tr>
<tr>
<td>• Adults mechanically ventilated for greater than 72 hours</td>
</tr>
<tr>
<td>• RASS score between -1 and +1</td>
</tr>
<tr>
<td>• FIO2 &lt;60% and PEEP &lt;10cmH2O</td>
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<tr>
<td>• Have progressive mobility orders</td>
</tr>
<tr>
<td>• Patients must reach a level of mentation that permits meaningful interaction with clinical staff</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Exclusion Criteria</strong></td>
</tr>
<tr>
<td>• Presence of low-dose catecholamine infusions do not exclude mobility</td>
</tr>
<tr>
<td>• Presence of an invasive femoral catheter</td>
</tr>
<tr>
<td>• Has acute lower extremity instability</td>
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<tr>
<td>• Has orthostatic hypotension</td>
</tr>
<tr>
<td>• Has hemodynamic instability defined by MAP &lt;55mmHg or CI</td>
</tr>
<tr>
<td>&lt;2.0L/min</td>
</tr>
<tr>
<td>• Has physician orders for strict bedrest</td>
</tr>
<tr>
<td>• Has continuous neuromuscular blockade</td>
</tr>
<tr>
<td>• Has orders for comfort care only</td>
</tr>
</tbody>
</table>

* (Schweickert & Kress, 2011; Zomorodi, Topley, & McAnaw, 2012).
Figure 1. The Iowa Model of Evidence-Based Practice to Promote Quality Care

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Manuscript Three

An Evaluation of Current Mobility Practice in a Cardiovascular Intensive Care Unit

Katherine B. Stewart RN, BSN

University of Kentucky

College of Nursing
Abstract

Purpose

This practice inquiry project was designed to evaluate current mobility practice and identify associations between mobility practice and specific patient characteristics in a cardiovascular intensive care unit.

Population and Setting

The sample consisted of electronic medical records of adult patients that required mechanical ventilation in a 16-bed cardiovascular intensive care unit in a private, urban hospital in Southern U.S. Of the selected participants, 48 were male and 52 were female with an average age of 64.49 (SD=14.58).

Inclusion Criteria

Inclusion criteria for this study were patients who 1) were aged 18 and older; 2) were mechanically ventilated for greater than six hours; 3) had a Richmond Agitation Sedation Scale score of -1 to +1 while mechanically ventilated; and 4) had physician orders for progressive mobility activities.

Design and Methods

This study uses a retrospective descriptive design to analyze mobility data from 100 randomly selected electronic medical records of mechanically ventilated patients receiving care between January and October 2015.

Results

Of the 100 randomly selected patients included in this study, one patient was mobilized while mechanically ventilated with the following mobility interventions: passive range-of-motion, active range-of-motion, sitting on side of bed, standing at side
of bed, and ambulating. This patient, compared to the sample demographics, had an average BMI, slightly more comorbidites and invasive catheters, and no infusing vasoactive medications. Due to a lack of mobility data, analysis to determine the association between mobility practice and specific patient characteristics could not be performed. Also, of the 100 patients in this study, 74 patients received a physical therapy consultation and of those 74 consulted, 64 patients received an evaluation. The average number of days between physical therapy consultation and evaluation was 4.57 days (SD=6.00). Patients did not receive a physical therapy evaluation while intubated.

**Conclusion**

The results of this study reveal that, despite best known evidence, early mobility interventions are not commonly practiced for mechanically ventilated patients in this cardiovascular intensive care unit. An early mobility protocol, designed to cater to the specific demographic and clinical variables of this particular patient population, is proposed at the end of this study.
Critically ill patients requiring mechanical ventilation in the intensive care environment are subject to prolonged physical immobility, which can result in various adverse functional and psychological outcomes. The literature has established that immobility in this vulnerable patient population can lead to neuromuscular dysfunction; cognitive decline; and development of critical illness polyneuropathies and secondary sequela such as ventilator associated pneumonia, deep vein thrombosis, catheter-associated infections, and hospital-acquired pressure ulcers (Schweickert & Kress, 2011; Balas et al., 2012; DeJonghe et al., 2002; Ely et al., 2001). In severe cases, patients experiencing prolonged immobility coupled with long periods of ventilation have suffered life-altering functional impairments resulting in the inability to perform daily activities of living post-hospital discharge (Patman, Dennis, & Hill, 2012). The consequences of these outcomes have produced stagnating quality metrics such as increased intensive care and hospital length-of-stay, increased readmission rates, worsening rates of hospital-acquired infections and skin ulcers, and increased incidence of falls in this population (Floyd, Craig, Topely, & Tullmann, 2016). Not only does this amount in more healthcare cost and resource utilization but has been associated with increased morbidity and mortality rates in this patient population (Balas et al., 2012).

The benefits of mobility have been well established in the literature for more than 60 years. Integration of early mobility strategies in this population through clinical trials has shown that clinical and psychological outcomes as well as quality metrics are improved and further result in a decrease in cost and resource utilization (Azuh et al.,
Yet, integration of this evidence-based knowledge into clinical practice is still lacking. The American Association of Critical-Care Nurses (AACN) has recommended that the current standard of practice with regards to early mobility with the mechanically ventilated patient population, as part of the ABCDE bundle (the Awakening and Breathing, Coordination, Delirium Monitoring and Management and Early Mobility Bundle), is to implement early mobilization strategies through a bundle or protocol approach (AACN, 2015b). The AACN has developed a standard protocol within their PEARLs (Physical Evidence and Reasoned Logic) for practice; however, they recommend that early mobilization protocols be tailored to specific patient populations (AACN, 2015a). Thus, it is the aim of this project to evaluate current mobility practice in the mechanically ventilated patient population in a cardiovascular intensive care unit, determine association between mobility practice and characteristics specific to their patient population, and, based on findings, describe implications related to implementing a nurse-driven early mobility protocol tailored to their mechanically ventilated patient population so as to improve early mobility efforts and enhance patient outcomes.

**Description of Practice Inquiry Project**

By conducting a retrospective review of medical records, this practice inquiry project evaluated current mobility practices in a 16-bed cardiovascular intensive care unit in a private, urban hospital in the Southern United States and determined the association between ongoing mobility practice patterns and characteristics specific to the patient population.
Objectives

The objectives of this practice inquiry project were to (i) determine current mobility practice (defined by evidence of documentation of passive range-of-motion, active range-of-motion, sitting on side of bed, standing at side of bed, and ambulating as well as evidence of documentation of physical therapy consultation, evaluation, and date of evaluation) and (ii) to determine the association between current mobility practice and patient body mass index (BMI), admission diagnosis, number and type of comorbidities, number and type of invasive catheters, and number and type of intravenous vasopressor, vasodilator, and inotropic medications required in a random sample of 100 mechanically ventilated patients in a cardiovascular intensive care unit between January 01, 2015 and October 01, 2015.

Methods

Study Design

A retrospective descriptive design using 100 randomly selected electronic health records of mechanically ventilated patients who received care in a cardiovascular intensive care unit between January 01, 2015 and October 01, 2015 was utilized to meet the objectives of this project.

Study Setting

The setting of this project is a 16-bed cardiovascular intensive care unit in a private, urban hospital in the Southern United States. This unit houses patients aged 18 years and older with a variety of medical ailments that include myocardial infarction, heart failure, cardiac dysrhythmias, structural heart disease, hypothermia post-cardiac arrest, and pre/post-op vascular and cardiac surgery.
Inclusion and Exclusion Criteria

Patients were selected for study analysis if specific inclusion and exclusion criteria were met. Inclusion criteria for this study were patients who 1) were aged 18 and older; 2) were mechanically ventilated for greater than six hours; 3) had a Richmond Agitation Sedation Scale score of -1 to +1 while mechanically ventilated; and 4) had physician orders for progressive mobility activities. Exclusion criteria were patients who 1) were prescribed comfort care only; 2) had spinal fractures and spinal instability including patients with intraventricular draining devices; 3) had extremity instability; 4) required continuous neuromuscular blockade; 5) had femoral central catheter placement; 6) had open abdomen or chest wounds; 7) had hemodynamic instability defined by MAP <55mmHg or CI <2.0L/min; 8) had pulmonary instability including at least one of the following: FiO₂ > 60%, PEEP > 10 cmH₂O, and any lung abnormalities that a patient’s advanced care provider has deemed exclusionary; or 9) had physician orders for strict bedrest.

Subject Recruitment Methods

The hospital’s electronic medical record system, the EPIC database, was accessed to obtain a generated report through a Microsoft Excel spreadsheet of patient medical record numbers that met the inclusion and exclusion criteria, as stated above, between January 01, 2015 and October 01, 2015. Using the simple random sample feature within Microsoft Excel, 100 random records were selected for review in this study. Data collected, as guided by the data collection form (Appendix A), were used to define current mobility practice within this cardiovascular intensive care unit. Evidence of nurse-assisted patient mobility, determined as documentation in the electronic health
record of passive range of motion, active range of motion, sitting on side of bed, standing
at side of bed, or ambulating while mechanically ventilated, was recorded on the data
collection form. In addition to this, since physical therapy is regularly consulted for
mechanically ventilated patients within this unit, the following data was also extracted: 1)
evidence of physical therapy consultation; 2) evidence of evaluation; and 3) date of
evaluation. Other data collected were demographic variables which included: 1) gender;
2) age; 3) ethnicity; 4) BMI; and clinical variables which included: 5) diagnosis; 6)
number and type of comorbidities; 7) number and type of invasive catheters; 8) number
and type of intravenous vasopressors; 9) number and type of intravenous vasodilators;
10) number and type of intravenous inotropes. These data were recorded on the data
collection form and entered into statistical analysis software.

**Procedures for Human Subject Protection**

Following approval from the doctoral committee for this practice inquiry project,
the protocol outlining study procedures was developed and subsequently approved in
accordance with the regulations for expedited review with the Medical Institutional
Review Board with the University of Kentucky (Appendix B). Approval was also
obtained from the Office of Research Administration (Appendix C) as well as from the
vice president for the Institute of Nursing and Workforce Outreach at the study site
(Appendix D).

**Measures**

Collection of data to define current mobility practice in this cardiovascular
intensive care unit included evidence of patient mobility in the electronic medical record
(EMR) determined by documentation of passive range of motion, active range of motion,
sitting on side of bed, standing at side of bed, or ambulating while mechanically ventilated between the dates of January 01, 2015 and October 01, 2015. Within the EPIC database, these data points were extracted from Braden scores within the nursing record and annotated notes by medicine, nursing, physical therapy, and respiratory therapy. Evidence of staff-assisted physical mobility was recorded if a score of 2 or greater was attained on the Braden scale (ability to transfer to a chair with assistance) or if specific mobility interventions were documented in any annotated note within the EMR. Braden scores of 1 or the absence of annotated documentation of any physical mobility intervention were considered “not performed.” Also, measures of association between current mobility practice and patient BMI, admission diagnosis, number and type of comorbidities, number and type of invasive catheters, and number and type of intravenous vasopressor, vasodilator, and inotropic medications required were recorded and analyzed.

**Data Analysis**

Data Analysis Statistical Package for the Social Sciences (SPSS) software version 22.0 was used for this data analysis. Sample demographics and frequency of patient mobility interventions including passive range-of-motion, active range-of-motion, sitting on side of bed, standing at side of bed, and ambulating were analyzed using descriptive statistics. To analyze the association between current mobility practice and patient characteristics including BMI, admission diagnosis, number and type of comorbidities, number and type of invasive catheters, and number and type of intravenous vasopressor, vasodilator, and inotropic medications required, regression analysis was planned.
However, due to limited evidence of patient mobility collected in this study, descriptive analysis was utilized.

**Results**

**Sample Characteristics**

Sample demographics of the 100 randomly selected patients meeting inclusion and exclusion criteria for this study are depicted in Table 1. Of the 100 patients, 48 were male and 52 were female. The distribution of ethnicity among the study participants was as follows: 85 Caucasian; 13 African American; 1 Hispanic; and 1 Asian American. The average age among the study population was 64.49 years (SD=14.58) and the average BMI was 29.17. Normal BMI distribution is 18.5-24.9 with less than 18.5 meaning underweight while greater than 24.9 is overweight and greater than 30 is obese. Admitting diagnoses for the study cohort included 14 participants with coronary artery disease, two each for aortic aneurysm and cardiac arrest, four with congestive heart failure, 38 with respiratory failure, eight with valvular disease, and 32 admitted with another diagnosis (Figure 1). The average number and distribution of comorbidities for the study population was also analyzed. Comorbidities included in this study were coronary artery disease, hypertension, hyperlipidemia, Diabetes Mellitus Type I and II, congestive heart failure, gastro-esophageal reflux disease, osteoarthritis, obstructive sleep apnea, anxiety, depression, thyroid disease, chronic obstructive pulmonary disease, alcohol dependence, tobacco dependence, obesity, and chronic kidney disease. The average number of comorbidities among study participants was 7 (SD=3.5) and the distribution of disease is depicted in Figure 2. The average number of invasive catheters including an endotracheal tube (ETT), peripheral intravenous catheter (PIV), central
venous catheter (CVC), foley catheter (FC), nasogastric tube (NGT), peripherally inserted central catheter (PICC), percutaneous endoscopic gastrostomy tube (PEG), chest tube (CT), mediastinal tube (MT), gastric tube (Gtube), Jackson-Pratt drain (JP), arterial line (Aline), pulmonary artery catheter (PAC), epicardial wires, port-o-cath (POC), tracheostomy tube (Trach) was 6.48 (SD=1.89). Figure 3 shows the distribution of invasive catheters among the study population. Finally, number and type of intravenous vasoactive medications infusing at the time of study qualification was recorded for each participant. Intravenous vasoactive medications were categorized by vasopressor (Levophed, Epinephrine, Neosynephrine, Dopamine, Vasopressin), vasodilator (Nitroglycerin, Nicardipine), and inotrope (Milrinone, Dobutamine). The average number of vasopressors per patient selected for this study was 0.39 (SD=0.63), the number of vasodilators was 0.13 (SD=0.42), and the number of inotropes was 0.09 (SD=0.32). Figure 4 shows the frequency distribution of each medication infusing at the time the patient met inclusion and exclusion criteria for this study.

**Description of Early Mobility Practice**

Data points for early mobility practice were recorded if evidence of staff-assisted mobility interventions (determined by passive range-of-motion, active range-of-motion, sitting on side of bed, standing on side of bed, and ambulating) were annotated in the EMR. Various documents examined included progress notes, consultation notes, history and physicals, and shift notes written by medicine, nursing, physical therapy, and respiratory therapy. Braden scores were also analyzed for physical activity data. Within the Braden scale is a physical activity component whereby scoring a 2 or greater indicates that the patient is able to transfer out of the bed even with maximal assistance from staff.
Thus, sitting on side of bed and standing at side of bed were recorded if a patient scored a 2 on the Braden scale and sitting on side of bed, standing at side of bed, and ambulating were recorded if a patient scored a 3 or greater on the scale. Individual nurse annotations within the nursing record were also examined for evidence of staff-assisted patient mobility interventions.

Between the dates of January 01, 2015 and October 01, 2015, 528 patients were mechanically ventilated in the cardiovascular intensive care unit. After a retrospective review of all 528 electronic medical records, 128 patients met inclusion criteria for this study. Using randomization, 100 records of the 128 were randomly selected for analysis in this study. Of the 100 records, one patient was mobilized (Figure 5). Staff-assisted mobility interventions for this patient included passive range-of-motion, active range-of-motion, sitting on side of bed, standing on side of bed, and ambulating while mechanically ventilated. Because regression analysis to show the association between mobility performance and specific patient characteristics (BMI, admission diagnosis, number and type of comorbidities, number and type of invasive catheters, and number and type of intravenous vasoactive medications) cannot be performed due to lack of sufficient mobility data, Table 2 depicts a descriptive analysis of demographic and clinical data for the single patient mobilized during the time frame of this study.

Frequency of consultation and evaluation by physical therapy and the average number of days were also analyzed in this study so as to provide additional insight to mobility practice in this study’s setting. Table 3 depicts these data. Of the 100 patients selected for the study, 74 patients received a physical therapy consultation and of those
74 consulted, 64 patients received an evaluation. The average number of days between physical therapy consultation and evaluation was 4.57 days (SD=6.00).

Discussion

Critically-ill patients requiring mechanical ventilation are susceptible to long periods of immobility, which have been associated with poor clinical and psychological outcomes including neuromuscular dysfunction, cognitive decline, and an increased risk of adverse sequelae such as infection, blood clots, and pressure ulcers (Azuh et al., 2016; Floyd et al., 2016; Klein, Mulkey, Bena, & Albert, 2016; Kress, 2009). This results in longer hospital stays and increased use of hospital resources, which further extends the economic burden for this patient population and healthcare systems (Cox, Carson, Govert, Chelluri, & Sanders, 2007).

Currently, the culture of mobility for mechanically ventilated patients is limited to range of motion within the confines of a hospital bed. The need for evidence-based, multidisciplinary early mobility interventions tailored to this specific patient population is essential in order to reform care and improve outcomes. Specifically, the American Association of Critical-Care Nurses (AACN) has recommended that the current standard of practice with regards to early mobility with the mechanically ventilated patient population should include early mobilization protocols that are individualized to specific patient populations (AACN, 2015a). For patients requiring mechanical ventilation, this means designing mobility interventions that will optimize physical and cognitive functionality while maintaining a safe environment. And while implementing changes in mobility practice is crucial to improve the quality of care delivery for mechanically ventilated patients, implementation of a protocol cannot be successful without having a
foundational awareness of the specific patient population being served and current mobility practices being employed. Thus, the purpose of this evaluation was to elucidate the current mobility practice in a cardiovascular intensive care unit and propose future directions for improved mobility processes specific to the patient population served in this setting.

The results of this study demonstrate that staff-assisted patient mobility, defined by passive range-of-motion, active range-of-motion, sitting on side of bed, standing on side of bed, and ambulating, is not commonly practiced with mechanically ventilated patients in the setting of this study. Of the 100 randomly selected patients for this review, only one patient received staff-assisted mobility interventions, indicating a profound need for quality improvement in early mobility interventions in this intensive care unit. Descriptively, this patient, compared to the sample demographics, had an average BMI, slightly more comorbidities and invasive catheters, and no infusing vasoactive medications. However, because this patient was the only one mobilized, additional analysis to determine the association between mobility practice and specific patient characteristics would be ineffectual. Essentially, because no mobility practices for mechanically ventilated patients are employed in this setting, prioritization for a practice change that incorporates high-quality evidence-based research in early mobility should be developed.

Of the 100 patients included in this study, 74 received a physical therapy consult. Of those 74 consulted, 64 (86%) received evaluations. The average number of days between physical therapy consultation and evaluation for those 64 patients was 4.57 days (SD=6.00). All evaluation notes were examined for evidence of staff-assisted mobility
interventions while ventilated as guided by the objectives of this study. It was found that while a patient was receiving ventilatory support, that individual patient was deemed “medically unstable” and required a new consultation once extubation occurred. Thus, no patients in this study received physical therapy while ventilated, explaining the large average number of days between consultation and evaluation. Additionally, 26 patients included in this study did not receive a physical therapy consultation even in the setting of prolonged ventilation and extended intensive care stay. Based on the best evidence available in the literature, mobility interventions should occur early during mechanical ventilation so as to enhance physical and cognitive functional status, lessen the duration of ventilation, improve the severity of critical illness, and promote an increase in quality of life post hospital discharge (Azuh et al., 2016; Balas et al., 2012; Banerjee, Girad, & Pandharipande, 2011). These mobility interventions should occur through a multidisciplinary, collaborative approach, involving input from medicine, nursing, physical therapy, and respiratory therapy so that the patient may receive a well-rounded, safe approach to early mobilization.

**Implications for Practice**

The results of this study clearly demonstrate a need for quality improvement in mobility practice for patients requiring mechanical ventilation in this cardiovascular intensive care unit. Based on the sample demographics and results of this study, the framework of an early mobility protocol should be developed and implemented using a multidisciplinary, collaborative approach. Appendix E depicts an early mobility protocol designed as a result of this study. This protocol is evidence-based and designed to cater
to the individual patient population served in this study setting based on the demographic and clinical variables collected.

To successfully impact patient outcomes with regard to mobility, formation of a multidisciplinary mobility team dedicated to the planning, implementation, and evaluation of this protocol is necessary to ensure that translation of this evidence is safe, feasible, and effective in transforming the culture of mobility in this unit. This mobility team, guided by a conceptual model for practice change, will be responsible for creating a united vision, mission, and goals for implementation of this early mobility protocol; identifying possible barriers to implementation; designing the evaluation model that will analyze structure, process, and outcome measures associated with implementation of this protocol; and disseminating those results for future work (Cileski et al., 2011). Using the collaboration and input from medicine, nursing, physical therapy, respiratory therapy, and administration will also be vital so as to create a coordinated vision of the culture of mobility to be achieved in this specific patient population.

**Limitations**

Extraction of mobility data from electronic medical records within the EPIC database was limited to annotated notes from medicine, nursing, physical therapy, and respiratory therapy as well as Braden scores within the nursing record. Patient assessments, charted every four hours within the electronic medical record, did not provide an inquiry for nurses to document an assessment on physical mobility or daily activity. This electronic “charting by exception” system was limited to provide minimal data that portrayed nursing contribution to patient mobility. If nursing did perform mobility interventions as defined by the objectives of this study, those data would have to
be extracted from individual shift notes or Braden scores. Documenting physical
mobility or daily activity is an essential element of care that conveys patient progress,
thus, needs to be added to this charting system.

Braden scores were also assessed for mobility data. As previously discussed,
within the Braden scale is a physical activity component that illustrates mobility capacity
of the patient. Scoring a 2 on the Braden scale indicates that a patient is able to transfer
to a chair with assistance and scoring a 3 or greater indicates that the patient is able to
ambulate. These scores were assessed for patients that met inclusion criteria for the study
while mechanically ventilated. Although no data were extracted from Braden scores,
limitations to this do exist, in that these scores alone do not depict the extent to which the
patient can mobilize. In other words, did the patient sit on the side of the bed, stand, and
pivot into a chair while ventilated or was the patient laterally transferred in a supine
position to a specialty chair? Also, were mechanical lift devices used to transfer the
patient to sit in a chair? Even though all these mechanisms indicate that the patient did
mobilize out of bed, the extent of mobilization is not defined here. Thus, to accurately
portray the ability of the patient to mobilize, an additional section for daily
activity/mobilization intervention should be added to the electronic nursing
documentation system.

Also data collection from this retrospective review depends on documentation of
mobility interventions. If mobility interventions were performed in this patient
population but not documented within the electronic medical record, an accurate
depiction of current mobility practice could not be actualized. Thus, again, an assessment
piece for activity/mobility intervention should be added to the patient assessment domain within the electronic charting database for nursing in this unit.

**Implications for Future Research**

This retrospective review provides baseline evidence of current mobility practice for mechanically ventilated patients within a cardiovascular intensive care unit. Before a change in mobility practice can be implemented in an intensive care setting, a foundational knowledge outlining demographic and clinical variables specific to the patient population served along with understanding baseline mobility practices currently employed is necessary so as to accurately formulate an early mobility protocol that is specialized to the practice change setting. Future implementation studies should include a more rigorous design that includes identification of these variables before mobility practice processes are tested, so that mobility protocols can be more individualized to the specific population being served and baseline mobility practices currently in place will not act to impede the implementation process. Based on recommendations from the AACN, mobility protocols should be tailored to the specific population it will serve so as to achieve highest mobility levels during the implementation process (AACN, 2015b). Thus, doing a retrospective analysis to collect these variables will ensure that mobility interventions developed will specifically cater to the population served and optimally progress their mobilization capacity. Also, by obtaining these data, researchers can secure buy-in and increase prioritization from stakeholders so that adequate resources for implementation studies can be procured.
Conclusion

Immobilization in the mechanically ventilated patient population can result in debilitating physical and cognitive functional outcomes that result in a decrease in quality-of-life post-critical illness (Klein et al, 2015; Kress, 2009; Patman et al., 2012). In addition to this, longer intensive care and hospital stays have been associated with prolonged immobility while mechanically ventilated, which further result in an increase in resource and cost utilization for the patient and healthcare systems (Fraser et al., 2015; Schweickert et al., 2009). Research has shown that by implementing mobilization strategies early during mechanical ventilation, adverse functional outcomes can be circumvented while promoting evidence-based practice (Vasilevskis et al., 2010). Specifically, implementation of early mobility protocols in this vulnerable population has resulted in numerous benefits that have resulted in positive clinical outcomes and cost savings for organizations. This study demonstrates that early mobility practice in the mechanically ventilated patient population is still lacking. Incorporation of high-quality, evidence-based research is vital to enhance the quality of care provided to this particular patient population and develop a culture that exudes evidence-based practice as its foundation. Through a multidisciplinary, collaborative approach, steps should be taken towards integrating evidence-based mobility research into intensive care practice so that clinical and quality outcomes for this vulnerable population can be optimized.
References


### Table 1

*Sample Demographics*

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Table 2

Demographic and Clinical Data for Single Mobilized Patient in Study

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<td>Type of Comorbidites</td>
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Table 3

*Physical Therapy Data for Study Population*

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<tr>
<td>Aortic Aneurysm</td>
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<tr>
<td>Cardiac Arrest</td>
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<td></td>
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<tr>
<td>Cardiac Dysrhythmia</td>
<td></td>
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</tr>
<tr>
<td>Respiratory Failure</td>
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<td></td>
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<tr>
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<td></td>
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<td>Myocardial Infarction</td>
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<td></td>
</tr>
<tr>
<td>Vascular Disease</td>
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</tr>
<tr>
<td>Other</td>
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</table>

*Figure 1. Distribution of Admitting Diagnoses in Study Population*
Figure 2. Distribution of Comorbidities in Study Population
Figure 3. Distribution of Invasive Catheters in Study Population
Figure 4. Distribution of Intravenous Vasoactive Medications in Study Population
Figure 5. Frequency of Mobility Activities in Study Population
Conclusion to Final DNP Capstone Report

Katherine B. Stewart RN, BSN

University of Kentucky
College of Nursing
The literature has established that prolonged immobility in patients requiring mechanical ventilation has resulted in deleterious clinical and quality outcomes and has even left some patients with life-long functional impairment (Zomorodi, Topley, & McAnaw, 2012). Clinical trials exploring the use of mobility protocols in this vulnerable population has shown that the majority of patients can return to baseline functional status and experience enhanced quality-of-life after critical illness (Fraser, Spiva, Forman, & Hallen, 2015; Klein, Mulkey, Bena, & Albert, 2015; Schaller et al., 2016). Yet, adoption of these evidence-based mobility practices are still lacking in most intensive care units. The need for a transformation in the culture of critical care to one that augments translation of evidence into standards of care is paramount. With regard to mobility, this need has never been greater. Based on the evidence, clinicians need to take steps in closing the gap between research and practice so that a culture of early mobility can be promoted. Only through a multidisciplinary, collaborative approach, guided by a conceptual model for change, can healthcare providers in the intensive care environment transform their culture of mobility so that patients requiring mechanical ventilation can receive the highest quality of care rooted in evidence-based knowledge and, thus, achieve optimal clinical outcomes.
Appendix A

Data Collection Tool

An Evaluation of Current Mobility Practice in the Open Heart Unit at Norton Audubon Hospital

**Data Collection Form**

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<thead>
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<td>Patient Identification Code</td>
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<td>Active ROM</td>
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<tr>
<td>Sat on side of bed</td>
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<td>(Yes: 0; No: 1)</td>
</tr>
<tr>
<td>Stood at side of bed</td>
<td>_____________</td>
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</tr>
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<td>Ambulated</td>
<td>_____________</td>
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<td>*Type of Invasive Catheters</td>
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<tr>
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Appendix B

Approval Letter from University of Kentucky’s Institutional Review Board

TO: Katherine Stewart, RN, DNPw
5320 Dove Trail
Heritage, TN 37076
Phone # (502) 255-2416

FROM: Chairperson/Vice Chairperson
Medical Institutional Review Board (IRB)

SUBJECT: Approval of Protocol Number 15-1055-P3H

DATE: February 16, 2017

On February 16, 2016, the Medical Institutional Review Board approved your protocol titled:

"UCC: An Evaluation of Current Identifiability Practice in the Open Heart Unit at Norton Audubon Hospital"

Approval is effective from February 16, 2016 until February 16, 2017 and extends to any consent/assent form, cover letter, or other script. If applicable, attach the IRB approved consent/assent document(s) to be used when enrolling subjects. [Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless a special waiver has been obtained from the IRB.] Prior to the end of this period, you will be sent a Continuation Review Report Form which must be completed and returned to the Office of Research Integrity so that the protocol can be reviewed and approved for the next period.

NOTE: Please be reminded to contact Norton Healthcare Office of Research Administration (NHORA) for their review and approval. Any changes to the request must be submitted as a modification request to the UK IRB.

In implementing the research activities, you are responsible for complying with IRB decisions, conditions, and requirements. The research procedures should be implemented as approved in the IRB protocol. It is the principal investigator’s responsibility to ensure any changes planned for the research are submitted for review and approval by the IRB prior to implementation. Protocol changes made without prior IRB approval to eliminate apparent hazards to the subject(s) should be reported in writing immediately to the IRB. Furthermore, discontinuing a study or completion of a study is considered a change in the protocol’s status and therefore the IRB should be promptly notified in writing.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research" from the Office of Research Integrity’s IRB Survival Handbook web page [http://www.research.uky.edu/irb/ resources/Handbook.html#Responsibilities]. Additional information regarding IRB review, federal regulations, and institutional policies may be found through ORI’s web site [http://www.research.uky.edu/irb]. If you have questions, need additional information, or would like a paper copy of the above-mentioned document, contact the Office of Research Integrity at (859) 257-9428.

Chairperson/Vice Chairperson

An Equal Opportunity University
Appendix C

Approval Letter from the Office of Research Administration at the Study Site

March 1, 2016
Katharine Stewart, RN, BSN
5202 Dover Trail
Norton Healthcare Office of Research Administration (NHORA)

Dear Ms. Stewart,

The Norton Healthcare Office of Research Administration (NHORA) is pleased to notify you that your application to conduct the above-mentioned research study in the following Norton Healthcare (NHC) facility has been approved.

- Norton Audubon Hospital

Please note: NHORA approval reflects permission to conduct the study at a Norton Healthcare facility from a regulatory and contractual perspective, and is independent of approval by the sponsor for initiation of the study. The sponsor or site may have additional requirements to address before the study can begin.

The following items must be submitted to the NHORA if your study continues to be conducted in a NHC facility and are applicable to your study:

- Annual Progress Report/Continuation Review form
- Annual Approval letter and current Informed Consent Forms approved by the IRB, if applicable
- Amendments and Amendment Approval letters
- Revised IRBAA documents such as revised Partial Waivers/Complete Waivers of authorization for each change in personnel
- Changes in the Conflict of Interest status
- Status change of study, i.e. closed to enrollment, study termination etc.

To comply with IRBAA regulations:
- A copy of the Partial Waiver of Authorization must be filed with the medical record of every patient screened for the study, if applicable.
- For retrospective chart review, a copy of the Complete Waiver of Authorization must be filed with the medical record of every patient whose chart is reviewed for the study.

For studies utilizing an Informed Consent Form, a signed copy of the Informed Consent Form and Research Authorization must be filed with the medical record of each subject enrolled in your study in a NHC facility.

If applicable, the Research Patient ID form must be submitted to NHORA Billing daily with reportable activities. Please email the form to NHORABilling@nortonhealthcare.org. Please contact Regina Schaefer at 502-629-3599 for specific instructions regarding the notification of your subject enrollment at NHIC.

If the study will include the use of sponsor provided and/or personal equipment of any type (for example: tablets, ECG machines, fQRS, personal laptops etc.), that equipment must be checked, tracked and/or inspected by Norton Healthcare’s Clinical Engineering department prior to its use or placement in a patient care setting. Requests for an initial incoming inspection of the equipment as follows:

- Norton employed researchers - contact Clinical Engineering on NSITE at http://nurse.departments/clinicalengineering/SitePages/Home.aspx
- Non-Norton employed researchers - contact Clinical Engineering by calling 502-629-3590

In the event your study will utilize personal and/or sponsor provided equipment, please ensure that you comply with the procedures outlined above.

We look forward to the successful completion of your study. If you have any further questions or need assistance, please contact the NHORA at 502-629-3500.

Please let us know how we are doing. Follow the link http://www.mynursemaker.com/NHORASatisfaction, to complete the NHORA Satisfaction Survey in less than two minutes. Your feedback helps NHORA improve the services we provide and meet the needs of the research community.

Sincerely,

[Signature]

Rhonda Hoffmna
System Director Research

Norton Hospital • Kosair Children’s Hospital • Norton Audubon Hospital
Norton Suburban Hospital • Norton Immediate Care Centers • Norton Brownsboro Hospital

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Appendix D

Letter of Support from Vice President for the Institute of Nursing and Workforce Outreach at the Study Site

November 23, 2015

To whom it may concern:

I am writing to express my support of Katherine Crush Stewart’s capstone project. Her project seeks to evaluate our current mobility practices as well as to determine the association between these practices and specific patient characteristics in our mechanically ventilated patient population in the cardiothoracic intensive care unit at Norton Audubon Hospital. Beginning January 01, 2016, this study will use a retrospective descriptive design to analyze electronic health records of mechanically ventilated patients who received care in the cardiothoracic intensive care unit between January 01, 2015 and October 01, 2015 to meet the objectives as previously stated.

I believe this project will offer this unit valuable information that will improve not only the quality by which we provide care to our patient population but will also provide guidance to our providers and team members in enhancing patient outcomes. Therefore, I fully support Katherine Crush Stewart’s efforts to conduct this study in the cardiothoracic intensive care unit at Norton Audubon Hospital.

Sincerely,

Kim Tharp-Barrie, DNP, RN, SANE
Vice President
Institute for Nursing & Workforce Outreach
Norton Healthcare
Appendix E

Proposed Early Mobility Protocol

STOP and follow unit specific mobility protocol for non-ventilated patients

Is the patient mechanically ventilated?
- No
- Yes

Does the patient meet any of the following criteria?
- Comfort care only
- Non-English speaking patient or family
- Spinal fracture or spinal instability
- Intraventricular draining device present
- Extremity instability
- Any femoral access
- Open abdomen or chest wounds
- Cardiogenic shock: MAP <55mmHg or CI <2.0L/min
- VA or VAV ECMO
- Neuromuscular Blockade

STOP. The patient does not meet criteria for mobility

Does the patient meet the following criteria?
- FIO2 <60%
- PEEP <8
- MD/HCP approval for mobility

STOP. The patient does not meet criteria for mobility

Does the patient meet the following criteria?
- Richmond Agitation Sedation Scale is -1 to +1
- Able to follow commands
- Vital signs stable (MAP>55; HR 60-120; RR<26)

STOP. The patient does not meet criteria for mobility

Inform advanced HCP and start with Level 1
Capstone Report References


Taito, S., Shime, N., Ota, K., & Yasuda, H. (2016). Early mobilization of mechanically

respiratory failure increase ambulation after transfer to an intensive care unit
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doi:10.1097/CCM.0b013e318168f986.

Titsworth, W. L., Hester, J., Correia, T., Reed, R., Guin, P., Archibald, L.,...Mocco, J.
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