Spring 4-2014

Reduction of Intensive Care Unit Length of Stay: The Case of Early Mobilization

Alex Hunter

Leslie Johnson

Alberto Coustasse
coustassehen@marshall.edu

Recommended Citation
Hunter, A., Johnson, L., & Coustasse, A. (2014). Reduction of intensive care unit length of stay: The case of early mobilization. The Health Care Manager, 33(2), 128-135.

REDUCTION OF ICU LENGTH OF STAY: THE CASE OF EARLY MOBILIZATION

Alex Hunter
Lewis College of Business
Marshall University Graduate College
100 Angus E. Peyton Drive
South Charleston, WV 25303

Leslie Johnson PT, DPT
Lewis College of Business
Marshall University Graduate College
100 Angus E. Peyton Drive
South Charleston, WV 25303

Alberto Coustasse, DrPH, MD, MBA – **CONTACT AUTHOR**
Associate Professor
Lewis College of Business
Marshall University Graduate College
100 Angus E. Peyton Drive
South Charleston, WV 25303
(304) 746-1968
(304) 746-2063 FAX
coustassehen@marshall.edu

REDUCTION OF ICU LENGTH OF STAY: THE CASE OF EARLY MOBILIZATION

Abstract

Bed rest or immobilization is frequently part of treatment for patients in the Intensive Care Unit (ICU) with critical illness. The average ICU Length Of Stay (LOS) is 3.3 days and for every day spent in an ICU bed, the average patient spent an additional 1.5 LOS days in a non- ICU bed. The purpose of this research study was to analyze the effects of early mobilization for patients in the ICU to determine if it has an impact on the LOS, cost of care and medical complications. The methodology for this study was a literature review. Five electronic data bases were utilized with a total of 26 articles were referenced for this research. Early mobilization suggested a decrease in delirium by two days, reduced risk of readmission or death, and reduced ventilator assisted pneumonia, central line and catheter infections. ICU LOS was reduced with statistical significance in several studies examining early mobilization. Limited research on cost of ICU LOS indicated savings potential with early mobilization. When implementing early mobilization in the ICU, total costs were likely to decrease and reduce fewer medical complications. Early mobilization should become a standard of care for critically ill, but stable patients in the ICU.

Key Words: Intensive Care Unit, Length of Stay, early mobilization, costs, complications, Mechanical Ventilation

Introduction

Critically ill patients often survive because of the care received in the Intensive Care Unit (ICU), but are often plagued with costly physical and psychological sequelae that may be worsened with immobility. Bed rest or immobilization is frequently part of treatment, due to pharmacologically induced sedation and/or Mechanical Ventilation (MV).[1] Hippocrates may have implied that pain is relieved by bed rest, but modern day researchers have found that bed rest is potentially

harmful with complications of pulmonary edema, atelectasis, bone demineralization, muscle wasting, vasomotor instability, constipation, back pain, pressure ulcers, contractures and blood clots.[2]

Length of Stay (LOS) in the ICU has been used as a measure of resource utilization because it is surprisingly consistent among most diagnoses.[3] LOS has been documented as short as 24 hours, and as long as 132 days.[3] Weaning from MV has been correlated with increased ICU and hospital LOS. The ICU houses less than ten percent of total hospital beds, yet ICU care represents one third of total health care costs.[4] Daily costs have increased more than 30% from 2000-2005 with an average daily cost of $3,518.[5] Neuromuscular weakness, or ICU Acquired Weakness (ICU-AW), as well as, impaired physical function are two long term complications that ICU survivors often face.[6]

ICU-AW has been defined as bilateral weakness, ranging from severe to paralysis, with or without a loss in deep tendon reflexes.[7] Developing ICU-AW has been attributed to sepsis, immobility, multiple organ failure, hyperglycemia, and corticosteroid use.[7] In patients mechanically ventilated for greater than seven days, evidence has shown up to 58% suffer with ICU-AW.[8]

The most frequent primary admission diagnoses to the ICU include acute myocardial infarction, respiratory distress, coronary artery bypass grafting, congestive heart failure, cerebrovascular accident or intracranial hemorrhage, other cardiovascular dysfunction, pneumonia, sepsis, diabetic ketoacidosis, and gastrointestinal bleeding between other diagnoses.[9] Lilly, et al.,[9] attempted to provide benchmarks for critical care practice in the United States (US) by examining 243,553 adult admissions in 271 ICUs, and found that the average ICU LOS was

3.3 days and that for every day spent in an ICU bed, the average patient spent an additional 1.5 days in a non-ICU bed.

A multitude of life sustaining measures such as catheters, monitors, and sedative medications mixed with unstable vital signs, electrolyte imbalances, unusual sleeping patterns, and even abnormal behaviors, make early mobilization intimidating.[10] Avoidance of bed rest with early mobilization is a potential option to reduce weakness acquired during ICU stay, but intensive Physical Therapy (PT), including ambulation, is often avoided in mechanically ventilated patients.[11] Low level of patient mobility is a common practice in the ICU, with 27% of ICU patients receiving PT, and only 6% of mechanically ventilated patients receiving PT.[12] A systematic review by Adler and Malone[10] concluded that mobilization can safely occur within two to four days of intubation in critically ill, but stable ICU patients. Early mobilization has recently been associated with improvements in respiratory function, level of consciousness, functional independence, cardiovascular fitness and psychological well-being.[1]

Respiratory failure has been the most common reason patients are admitted to the ICU, because of the need for MV. According to Ely, et al.,[13] specific medical complications, including delirium, have been associated with an increased ICU stay and with MV. Delirium is an acute mental status change with inattention, and either disorganized thinking or an alerted level of consciousness.[14] Delirium has been found in up to 32% of ICU patients, rising to 77% in mechanically ventilated patients.[15] Ely, et al.,[13] demonstrated an increased hospital LOS of ten days in those patients who developed delirium.

The purpose of this research was to analyze the effects of early mobilization for patients in the ICU to determine if it has an impact in the LOS, cost of care, and medical complications.

Methodology

The methodology for this study was a literature review. The West Virginia University library on the Charleston Area Medical Center Memorial Campus in Charleston, West Virginia was used for full text articles, utilizing the PubMed, EbscoHost, ProQuest and CINHAL databases. Google was used when articles could not be located through the above data bases. Key terms used in the search included 'ICU' AND 'early mobilization', AND 'cost', OR 'length of stay', OR 'acquired weakness' OR 'complications'. The Physical Therapy Journal was also explored. The inclusion criteria included: the search was limited to articles published 2003 through April 2013. Articles were limited to the English language. Primary and secondary data were included from original articles, research studies and reviews. Relevant articles were selected after review of abstracts was performed. Twenty-six peer review articles were chosen for this research following the inclusion criteria.

The conceptual framework for this research is illustrated in Figure 1. The authors reasoning is that early mobilization in the ICU can decrease ICU LOS thus decreasing the patient's overall hospital LOS and medical complications contributing to an overall decrease in cost of care. Without early mobilization, patient will stay sicker for longer periods and the cost to patients, hospitals and insurance companies will be greater.

INSERT FIGURE 1 ABOUT HERE

Results

ICU LOS with Early Mobilization

One of the first studies investigating early mobilization in ICU patients with Acute Respiratory Failure (ARF) was a prospective cohort study in a university Medical ICU (MICU).[16] The protocol group was initiated into the protocol within 48 hours of MV with the mobility team, while the usual care group received Passive Range Of Motion (PROM) daily by the bedside nurse. Both ICU and hospital LOS were significantly different between the protocol and usual care group (Table 1).[16]

INSERT TABLE 1 ABOUT HERE

A randomized controlled trial of 90 critically ill patients examined the effects of bedside cycling and demonstrated no significant difference between control and experimental groups in ICU or hospital LOS.[17] Of importance to note with this study, is that both groups received strengthening and functional training, but the treatment group received an extra 20 minutes of cycling per day in a supine or semi-recumbent position (Table 1).

The impact of PT in ICU LOS in a preeminent Turkish Hospital was examined in ventilator dependent patients.[18] The control group received only standard nursing care, and the experimental group participated twice per day five days per week in the chest physiotherapy program individualized to each patient, and included activities ranging from postural drainage to exercise and mobilization (Table 1).

The efficacy of combining early sedation interruption with PT and Occupational Therapy (OT) was investigated in a randomized controlled trial with the intention to treat all 104

mechanically ventilated patients.[19] This two center study used computer randomization and blinding of therapists, with initiation of early exercise and progressive mobilization in patients who had been on the ventilator less than 72 hours, but were expected to remain on the ventilator at least 24 more hours. The control group received sedation interruption with therapy as ordered by the primary team, typically not initiated until patients were mechanically ventilated for 14 days or more. ICU LOS and hospital LOS were not significantly different in this study (Table 1).

A 7 month prospective before and after quality improvement project was conducted in a 16 bed MICU in an academic setting which studied early rehabilitation in patients with acute respiratory failure.[20] This single center study targeted patients who had been ventilated four or more days. Interventions were not specific to a protocol, but instead, consisted of creating positions for therapists and a rehabilitation aide, establishing guidelines for safe and early mobilization, and altering standards for sedatives from continuous to as needed and changing activity orders from bed rest to as tolerated (Table 1).

A systematic review investigating outcomes of mobilization in patients requiring MV was conducted using many of the already mentioned studies.[21] Using 17 eligible studies, the authors found that active mobilization may positively impact the ability to wean from the ventilator and may decrease both ICU and hospital LOS.[21]

Ronnebaum, Weir, & Hilsabeck[22] completed a retrospective chart review study using patients with a diagnosis of respiratory distress at the ICU comparing the effectiveness of a Mobility Protocol (MP) utilizing daily meetings with an interdisciplinary team to safely initiate early mobilization when stable with Standard Physical Therapy (SPT) .The authors found a statically significant reduction of the ICU LOS of more than 10 days from 13.3 in the MP group

compared to 24.9 days of SPT patients. Also Mean Ventilator (MV) time was reduced by 16 days by MP patients with 14.5 days compared to 30.9 days of the SPT patients which was also statistically significant (Table 1).

An early mobility program, titled PUMP Plus, was initiated in the neurointensive care unit at Shands Hospital at the University of Florida from April 1, 2010 through July 31, 2010.[23] Unless it was clinically contraindicated, the study population of 3291 patients was automatically enrolled in the early mobility program of progressive mobility. Results of the PUMP Plus study showed a statistically significant decrease in hospital LOS from 12 days before the mobility protocol implementation to 8.6 days after, a decrease in neurointensive care LOS by 13% from 4.0 days before mobility implementation to 3.4 days after and a correlation between LOS and mobility score (Table 1).

A financial model was developed using data from existing studies and from the actual implementation of early mobilization in the MICU at Johns Hopkins Hospital.[24] Data from this study of early mobilization in the ICU indicated a 22% reduction in stay with an average of 5.4 days before intervention and 3.9 days post intervention.[24]

Cost of Care with early mobilization in ICU

According to Dasta, McLaughlin, Mody, & Piech,[25] patients requiring MV in the last quarter of 2002 accrued higher hospital costs with an average of $47,158 compared to those patients not requiring MV with an average of $23,707. Average daily ICU cost studied in 2002 were highest day one and day two, stabilizing on day three as evidenced by $7,728 +/- 8,509 day one, $3,872 +/- 4,223 day two and $3,436 +/- 3,550 day three.[25]

In 2008, Morris, et al.,[16] examined early ICU mobilization in the treatment of Acute Renal Failure (ARF), finding the total direct inpatient cost for patients in the protocol group to be $6,805,082 with an average patient cost of $41,142, while the total cost for the usual care group was $7,309,871, with an average patient cost of $44,302 (Table 1).

Ronnenbaum, et al.,[22] performed a retrospective chart review in 2008 compared the effectiveness of a MP with SPT demonstrated an average difference of 11.6 LOS fewer in the ICU in the MP protocol, as well as a $22,000 savings per patient in the MP.

The financial model created using data from the Johns Hopkins Hospital early mobilization implementation identified three areas of costs associated with early ICU mobilization which included personnel, training, and equipment[24] (Table 2).

INSERT TABLE 2 ABOUT HERE

The Impact of Early Mobilization in ICU on Medical Complications

The randomized controlled trial by Schweickert, et al.,[19] found a significant difference in reduction of days of ICU delirium, two days in the treatment group compared to four days in the control group, and in ICU acquired paresis at hospital discharge, 31% treatment group compared to 49% control group (Table 1).

In a cohort study of 280 acute respiratory failure survivors, using parent data from a prior study, Morris, et al.,[16] found that patients who did not participate in an early mobilization group were statistically significant with 1.77 times more likely to be readmitted or being dead (Table 1).

The PUMP Plus study exhibited a 60% decrease in hospital acquired infections (such as Ventilator Associated Pneumonia, central line infections and catheter associated UTI's) with increased mobility scores, but no significant difference was noted in pressure ulcer development.[23]

Discussion

Early mobilization for decreased LOS in the ICU exhibited some mixed results. When implementing early mobilization in the ICU costs were shown to decrease. Fewer medical complications occurred with the implementation of early mobilization in the ICU.

While the sample size for the PUMP Plus study was large (n= 3291), data was only collected for 2 weeks prior to the initiative and for 2 weeks after the initiative, with pre sample size of 77 and post sample size of 93.[23] The PUMP Plus study used the iMOVE mobility assessment tool, which was noted to be both valid and sensitive. This study hypothesized that increased mobility would be correlated with decreased pressure sore incidence, as had been shown in other studies, but it did not, likely due to low prevalence of pressures in this unit. While the PUMP Plus study was conducted in a neurointensive care, it provided external validity to the study regarding progressive mobilization with ventilated and non-ventilated patients.

ICU-AW is common following critical illness and often the recovery is incomplete, as demonstrated in a five year post illness study of survivors of acute respiratory distress syndrome, which showed normal pulmonary function, but reduced 6 Minute Walk Distance (6MWD) compared to normal averages, representing long lasting physical impairment. Muscle wasting and fatigue have been documented as functional limitations at one year post ICU discharge, with 6MWD results being 66% of predicted values, with only 49% of survivors able to return to

work.[23] So, while this research indicates possible immediate cost savings with early mobilization in the ICU, the total cost of ICU illness to full recovery is still unknown.

It has been suggested that total ICU costs are related to LOS, but frequently ICU costs are fixed, representing overhead costs of running a hospital, and these costs do not change regardless of LOS.[26] For example, in a retrospective cohort study of all patients undergoing MV for at least 48 hours in the ICU at the Hospital of the University of Pennsylvania in Philadelphia fiscal year 2006, reducing ICU and hospital stay for all patients would save $673,941 in variable costs, which was only 0.9% of total hospital costs.[26]

While the earlier mobilization study by Ronnebaum, et al.,[22] sounds convincing with shorter LOS and $22,000 per patient savings, this study is a retrospective chart review study with a small sample size. This study demonstrated shorter MV days with earlier mobilization, and inferred reduced ventilator assisted pneumonia and decreased blood stream infections with its supporting literature.

Burtin, et al.,[17] found no difference in ICU or hospital LOS with the cycling intervention. It can be argued that both groups received strengthening exercise and functional mobility training so while supine or semi-recumbent cycling had an impact on 6MWD and the functional task of improving sit to stand, no change in LOS was noted (Table 1).

Morris, et al.,[16] used survey follow up to determine results regarding readmission rates and death rates. This method provided questionable reliability, as it could not be certain the survey was filled out by the appropriate person, or that the survey was filled out accurately. Only eight percent were lost to follow up according to the research.

Li, et al.,[21] performed a systematic review of mobilization in ventilated patients in the ICU and may have noted some success with ventilator weaning and LOS, but the study limitations were significant due to considerable heterogeneity and limited methodological quality. Researcher bias may have impacted results in the work by Needham, et al., (2010), as these researchers have produced much research regarding the success of early mobilization in the ICU. Other study limitations included small sample sizes with high numbers lost to follow up, as well as, high rate of mortality in the population studied.

The current study was limited due to the restrictions in the search strategy used, such as the number of databases searched or researcher and publication bias may have limited the availability and quality of the studies identified for review.

Hospital systems are under increased pressure to produce quality outcomes and reduced costs. Utilization of early mobilization can likely reduce LOS, hospital costs and medical complications. Changing the culture of bed rest in the ICU is possible and valuable. The cost of early mobilization could be further reduced by training lower paid staff such as mobility technicians rather than higher paid therapists or nurses. Patients on MV should be mobilized as soon as they are medically stable to minimize complications.

Further research should focus on longitudinal studies to determine the entire cost of care with adequate follow up to determine functional status in the home and in the community. Other research could examine true ICU and hospital costs and how patient volumes and turnover rates impact those costs. And, because quality plays an increasing role in reimbursement, time of critical illness discharge should be investigated to ensure discharges occur at the appropriate time to avoid readmissions.

Conclusion

While the cost saving benefit is not fully realized by the research available, early mobilization has the potential to reduce LOS and medical complications. Early mobilization in the ICU would likely benefit patients, hospitals and insurance companies. Because of its benefits, early mobilization in the ICU should become a standard of care due to the potential reduction in medical complications.

REFERENCES

1. Drolet A, DeJuilio P, Harkless S, Henricks S, Waters C, Wiliams S. Move to improve: the feasibility of using an early mobility protocol to increase ambulation in the intensive and intermediate care setttings. *Phys Ther.* 2013;93(2):1-11.

2. Lipshutz A, Gropper M. Aquired neuromuscular weakness and early mobilization in the Intensive Care Unit. *Anesthesiology.* 2013;118(1):202-214.

3. Arabi Y, Venkatesh S, Haddad S, Shimemeri A, Malik S. A prospective study of prolonged stay in the intensive care unit: predictors and impact on resource utilization. *Int J Qual Health Care.* 2002;14(5):403-410.

4. Shorr A. An update on cost-effectiveness analysis in critical care. *Curr Opin Crit Care.* 2002; 8(3):337-343.

5. Halpern N, Pastores S. Critical medicine in the United States 2000-2005: An analysis of bed numbers, occupency rates, payer mix and costs. *Crit Care Med.* 2010;38(1):65-71.

6. Desai S, Law T, Needham D. Long-term complications of critical care. *Crit Care Med.* 2011;39(2):371-379.

7. Brummel N, Jackson J, Girard T, Pandharipande P, Schiro E, Work B, et al. A combined early cognitive and physical rehabilitation program for people who are critically ill: the activity and cognitive therapy in the intensive care unit (ACT-ICU) trial. *Phys Ther.* 2012;92(12):1580-1592.

8. Griffiths R, Hall J. Intensive care united-acquired weakness. *Crit Care Med.* 2010;38(3):779-787.

9. Lilly C, Zuckerman I, Badawi O, Riker R. Benchmar data from more than 240,000 adults that reflect the current practice of critical care in the United States. *Chest.* 2011;140(5):1232-1242.

10. Adler J, Malone D. Early mobilization in the Intensive Care Unit: A systematic review. *Cardiopulm Phys Ther J.* 2012;23(1):5-13.

11. Truong A, Fan E, Brower R, Needham D. Bench-to-bedside review: Mobilizing patients in the intensive care unit-from pathophysiology to clinical trials. *Crit Care.* 2009;13(4): 216-224.

12. Needham D, Wang W, Desai S, Mendez-Tellez P, Dennison C. Intensive care unit exposures for long-term outcomes research: development and description of exposures of 150 patients with acute lung injury. *J Crit Care.* 2007;22(4):275-284.

13. Ely E, Shintani A, Truman B, Speroff T, Gordon S, Harrell F, et al. Delirium as a predictor of mortality in mechanicially ventilated patients in the intensive care unit. *JAMA.* 2004;291(14):1753-1762.

14. Thomason J, Shintani A, Peterson J, Pun B, Jackson J, Ely E. Intensive care unit delirium is an independent predictor of longer hospital stay: a prospective analysis of 261 non-ventilated patients. *Crit Care.* 2005;9(5):R375-R381.

15. Cavellazzi R, Sadd M, Marik P. Delirium in the ICU: an overview. *Ann Intensive Care.* 2012;49(2):1-11.

16. Morris P, Goad A, Thompson C, Taylo, K, Harry B, Passmore L, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. *Crit Care Med.* 2008; 36(8):2238-2244.

17. Burtin C, Clerckx B, Robbeets C, Ferdinande P, Langer D, Troosters T, et al. Early exercise in critically ill patients enhances short-term functional recovery. *Crit Care Med.* 2009; 37(9):2499-2505.

18. Malkoç M, Karadibak D, Yildirim Y. The effect of physiotherapy on ventilatory dependency and the length of stay in an intensive care unit. *Int J Rehabil Res.* 2009;32(1):85-88.

19. Schweickert W, Pohlman M, Nigos C, Pawlik A, Esbrook C, Spears L, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients; a randomised controlled trial. *Lancet.* 2009;373(5):1874-1882.

20. Needham D, Korupolu R, Zanni J, Pradhan P, Colantuoni E, Palmer J, et al. Early physical medicine and rehabilitation for patients with acute respiratory failure: A quality improvement project. *Arch Phys Med Rehabil.* 2010;91(4):536-542.

21. Li A, Peng X, Zhu B, Zhang Y, Xi X. Active mobilization for mechanically ventilated pateints: a systematic review. *Arch Phys Med Rehabil.* 2012;93(11):1081-1087.

22. Ronnebaum J, Weir J, Hilsabeck T. Earlier mobilization decreases the length of stay in the intensive care unit. *JACPT.* 2012;3(2):204-210.

23. Titsworth W, Hester J, Correia T, Reed R, Guin P, Archibald L, et al. The effect of increased mobility on morbidity in the neurointensive care unit. *J Neurosurg.* 2012;116(6):1379-1388.

24. Lord R, Mayhew C, Korupolu R, Mantheiy E, Friedman M, Palmer J, et al. ICU early physical rehabilitation programs: financial modeling of cost savings. *Crit Care Med.* 2013;41(3):1-8.

25. Dasta J, McLaughlin T, Mody S, Piech C. Daily cost of an intensive care unit day: The contribution of mechanical ventilation. *Crit Care Med.* 2005;33(6):1266-1271.

26. Kahn J, Rubenfeld G, Rohrbach J, Fuchs B. Cost savings attributable to reductions in intensive care unit length of stay for mechanically ventilated patients. *Med Care.* 2008; 46(12):1226-1233.

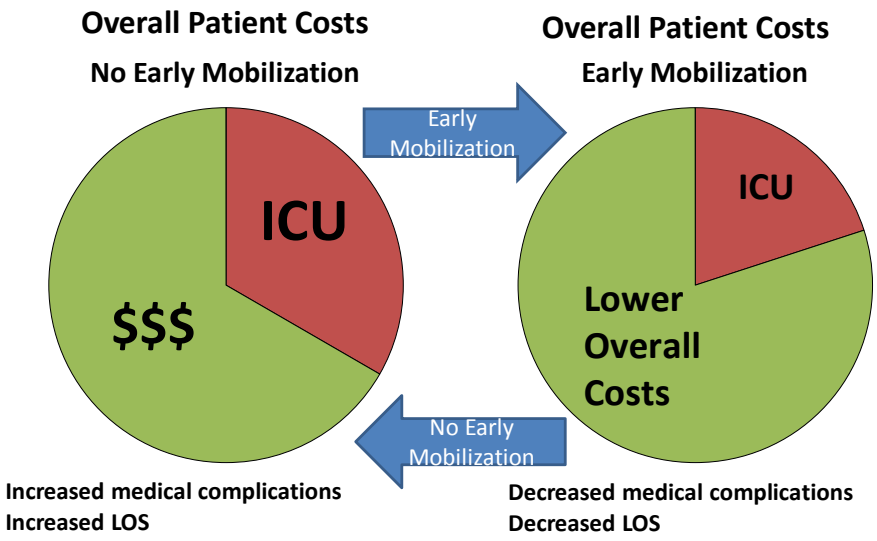

Figure 1: Conceptual Framework: Early mobilization in the ICU

Table 1: Length of Stay in Intensive Care Units with Early Mobilization

Author	Design	PT Interventions	Findings
Morris, et al., 2008[16]	• Prospective Cohort Study • ARF MV≤48 hours	• Mobilization program 7 says/week by mobility team (PT, RN, NA) • Starting with PROM and progressing with transfers and sitting vs. usual care	1. ICU LOS Protocol: 5.5 days vs. usual care 6.9 days* 2. Hospital LOS protocol 11.2 days vs. usual care 14.5 days care* More likely to be readmitted in c=group who did not do early mobilization.
Burtin, et al., 2009[17]	• Randomized controlled trial	• Treatment initiated on ICU day 5, • Both groups received UE/LE therapy exercises and functional training • Treatment group had an additional cycling session for 20 minutes total duration 5 days a week	NO statistical difference ICU or Hospital LOS or ventilation weaning time
Malkoc, et al., 2009[18]	• Retrospective case/ control chart review	• Intervention group received chest PT with individualized activities ranging from exercise to mobility twice per day 5 days/week • Control group received standard nursing care	1. Ventilator dependent days* Intervention:14.0+/-5.9* Control: 20.0+/- 6.1 2. ICU LOS Intervention: 15.8+/-8.5 Control: 25.5+/-4.5
Schweickert, et al., 2009[19]	• Prospective Randomized controlled trial • 2 Centers MV ≤ 72 hours • Expected to cont MV least 24 hours	• Treatment group ex???t mobilization day of enrollment • Sedatives interrupted o Control – PT/OT Delivered when ordered	1. LOS ICU ** • Treatment: 5.9 • Control: 7.9 2. Hospital LOS** • Treatment: 13.5 • Control: 12.9
Needham, et al., 2010	• Prospective before and after Quality I improvement case control • Patients MV 4 days or more	• Creating positions for FT PT/OT and PT Rehab Aide • Established guidelines for safe early mobility or PT/OT • PRN sedatives vs. continuous infusions • Default activity level of as tolerated instead of bed rest	1. ICU LOS reduced by 2.1 day **s Hospital LOS reduced by 3.1days **

Table 1: Length of Stay in Intensive Care Units with Early Mobilization (con't)

Author	Design	PT Interventions	Findings
Ronnebaum, et al., 2012[22]	• Retrospective chart review • Diagnosis of non-neurological respiratory failure and were put on MV upon admission	• PT evaluation to occur within 24 hours in MP group	1. Mean ICU LOS* a. SPT 24.9 +/-13.7 days b. MP 13.3 +/- 6.3 days 2. Mean MV days* a. SPT 30.9 +/- 20 days b. MP 14.5 +/- 8.7 days 3. Mean interval until the initiation of PT* a. SPT 12.9 +/- 9.7 days b. MP 6.1 +/- 4.6 day
Titsworth, et al., 2012[23]	Prospective Intervention trial	• Pump plus (progressive upright mobility program)	1. Reduction of LOS before mobility program implementation from 12 days pre intervention to 8.6 days post intervention* 2. Reduction in Neuro ICU LOS from 4.0 to 3.46 (13% difference)* 3. 0.2% reduction in LOS with each unit increase in mobility score measured*

- Key: ARF= acute respiratory failure, MV= mechanical ventilation/mechanically ventilated, QI= quality improvement, PT= Physical Therapy, OT= Occupational Therapy, FT= full time, RN= registered nurse, NA= nursing assistant, PRN= as needed UE= Upper Extremity, LE= Lower Extremity SPT=Standard Physical Therapy when deemed appropriate MP=Early Mobility protocol involving interdisciplinary team and daily meetings

* $p < 0.05$ ** Statically significant ** Non Significant $p > 0.05$

Table 2: Estimated Savings with Early Mobilization in ICU

Admissions Per Year	**Estimated Savings**
200	$34,134
600	$224,378
900	$358,475
2000	$645,951

Source: Lord, et al., (2013)[24]