Physical Therapist–Established Intensive Care Unit Early Mobilization Program: Quality Improvement Project for Critical Care at the University of California San Francisco Medical Center

Heidi J. Engel, Shintaro Tatebe, Philip B. Alonzo, Rebecca L. Mustille, Monica J. Rivera

**Background.** Long-term weakness and disability are common after an intensive care unit (ICU) stay. Usual care in the ICU prevents most patients from receiving preventative early mobilization.

**Objective.** The study objective was to describe a quality improvement project established by a physical therapist at the University of California San Francisco Medical Center from 2009 to 2011. The goal of the program was to reduce patients’ ICU length of stay by increasing the number of patients in the ICU receiving physical therapy and decreasing the time from ICU admission to physical therapy initiation.

**Design.** This study was a 9-month retrospective analysis of a quality improvement project.

**Methods.** An interprofessional ICU Early Mobilization Group established and promoted guidelines for mobilizing patients in the ICU. A physical therapist was dedicated to a 16-bed medical-surgical ICU to provide physical therapy to selected patients within 48 hours of ICU admission. Patients receiving early physical therapy intervention in the ICU in 2010 were compared with patients receiving physical therapy under usual care practice in the same ICU in 2009.

**Results.** From 2009 to 2010, the number of patients receiving physical therapy in the ICU increased from 179 to 294. The median times (interquartile ranges) from ICU admission to physical therapy evaluation were 3 days (9 days) in 2009 and 1 day (2 days) in 2010. The ICU length of stay decreased by 2 days, on average, and the percentage of ambulatory patients discharged to home increased from 55% to 77%.

**Limitations.** This study relied upon the retrospective analysis of data from 6 collectors, and the intervention lacked physical therapy coverage for 7 days per week.

**Conclusions.** The improvements in outcomes demonstrated the value and feasibility of a physical therapist–led early mobilization program.
A

lthough rates of survival from critical illness have improved, questions about a survivor’s ability to return to his or her premorbid lifestyle remain. The long-term detrimental side effects of an intensive care unit (ICU) stay have been well documented in follow-up studies conducted after discharge from medical, surgical, and trauma ICUs, with half of the patients in an ICU being unable to return to work because of weakness and fatigue 1 year after discharge from the hospital. Numerous factors affecting patients who are critically ill cause weakness and disability. One of the most detrimental is prolonged bed rest, yet bed rest is the most prevalent patient activity during an ICU stay. A recent survey demonstrated that patients’ participation in activities other than bed rest accounted for just 11% of their time spent in the ICU. An additional observational ICU study recorded that passive turning of patients was the therapeutic activity most consistently performed in the ICU. Recognizing how immobility and weakness associated with critical illness often persist for years beyond hospital discharge, hospital personnel in the United Kingdom and Australia instituted postdischarge, nurse-led follow-up clinics but found no significant improvements in physical functioning with their postdischarge rehabilitation programs.

A more promising avenue for the prevention of disability and weakness is an ICU early mobilization program. Morris and colleagues, Needham and Korupolu, Bailey et al, and Schweickert et al showed that early mobilization of patients who are critically ill in the ICU is a safe and effective preventative treatment for the long-term weakness and disability experienced by patients after discharge from the ICU. In a randomized controlled trial, Schweickert et al demonstrated that an ICU early mobilization intervention led to a decrease in the number of days patients received mechanical ventilation and to a higher percentage of patients returning to functional independence at hospital discharge (59%) versus the control group patients who received usual care (35%). The most prominent difference in care between the 2 groups was the time at which physical therapy was initiated, with the intervention group starting physical therapy, on average, 6 days sooner than the control group. All 4 of these successful early mobilization programs were physician-led efforts to change patient care practice patterns and initiate earlier mobility of patients in the ICU, within 48 hours of admission to the ICU, in a medical ICU, with dedicated mobility staff.

Early mobility timed closer to ICU admission than to discharge requires a shift in practice patterns. While physicians, nurses, and respiratory therapists medically stabilize patients in the ICU, physical therapists are consulted to provide functional rehabilitation interventions concurrently. Physical therapists offer the best professional skills for achieving earlier mobility of patients in the ICU. However, a recent survey completed by 482 physical therapists representing hospitals from 49 of the 50 states indicated that only 10% had established criteria for initiating physical therapy in the ICU.

To demonstrate that a practice pattern of early mobility can be replicated, the University of California San Francisco (UCSF) Medical Center initiated an ICU early mobilization program. In March 2010, the program was initiated in a mixed medical-surgical ICU and led by a physical therapist following criteria established by a UCSF Medical Center interprofessional committee, with the aim of achieving the same benefits as physician-led programs outlined in earlier patient mobility studies.

The UCSF Medical Center is a 687-bed tertiary care academic teaching hospital with 6 adult ICUs. The ICUs are open units with physician and respiratory therapy coverage rotating weekly as part of the teaching mission of the medical center. The UCSF Medical Center is one of the oldest and largest transplant centers in the United States, with surgeons performing an average of 130 liver transplants each year. Before institution of the ICU early mobilization program in 2010, the UCSF Medical Center had no written criteria for initiating physical therapy in the ICU and no physical therapist dedicated exclusively to the ICU. Before 2010, an average of 20% of the ICU population had active orders for physical therapy, with the majority of the physical therapy orders having been written near the end of the patients’ stays in the ICU. This infrequent and late provision of rehabilitation contributed to long-term weakness and poor functional outcomes.

The purposes of the quality improvement project were to prevent deconditioning of patients by implementing a program established by a full-time physical therapist in the ICU and to demonstrate that a population of patients with complex medical-surgical issues can tolerate and benefit from early mobility interventions. Two aims of the physical
established quality improvement project were to initiate physical therapy earlier than with standard care and then to assess whether the early mobility program promoted improvements in function and discharge status along with reductions in length of stay. Specifically, the quality improvement project measured the following variables in both 2009 and 2010: average distance (in feet) patients ambulated, number of days in the ICU, number of days in the hospital, and percentage of patients discharged to home.

Method

Patients in the medical-surgical ICU at the UCSF Medical Center come from a variety of hospital services and typically have complicating comorbid conditions. This level of complexity in itself was a barrier to early mobility, with no precedence to follow. Furthermore, staff expressed concerns that mobilizing patients early could be harmful, potentially dislodging critical lines, increasing the risk of patients falling, and stressing or fatiguing patients who are critically ill. An ICU Early Mobilization Group was established to address these concerns. The ninth-floor medical-surgical ICU at the UCSF Medical Center was chosen as the ICU for the early mobilization program because of the consistent presence of critical care nurse practitioners working with the weekly rotating physician staff. Selecting patients for physical therapy treatment changed from a strictly physician-driven process to an interprofessional process, with nurse practitioners participating in rounds for all patients in the ICU for 15 minutes with the physical therapist daily. The nurse practitioners reviewed information for all of the patients in the ICU with the physical therapist, collaborated to determine whether any patients met the criteria to begin physical therapy, and wrote orders or referrals as needed. In addition, the nurse practitioners assisted with educating rotating staff on the aims of the program.

Establishing the Collaborative ICU Early Mobilization Group

From October 2008 to March 2010, the physical therapist worked to recruit personnel from a cross-section of UCSF Medical Center ICU patient care professions to form an interprofessional group dedicated to creating and promoting the new practice of early mobility. Successful improvements in patient outcomes, as described in published articles, gave the physical therapist evidence to cite during the recruiting process. The physical therapist made a site visit to an ICU with an established early mobilization program to discuss how to overcome barriers and ensure patient safety. The physical therapist spent 1 year, from March 2009 to March 2010, promoting a “mobility as medicine” message to all health care professionals working in the ICU. An educational PowerPoint (Microsoft Corp, Redmond, Washington) presentation on mobility as medicine was given at staff meetings and conferences by the physical therapist, who tailored the message for the specific interests of each group. When speaking to physicians, the physical therapist cited supportive research, emphasizing randomized controlled trials when possible, and when speaking to nursing or respiratory therapy staff members, the physical therapist found it helpful to add compelling familiar case studies to the educational seminar.

The UCSF Medical Center ICU Early Mobilization Group formed in 2009 consisted of volunteer representatives of registered nurses, physical therapists, nurse practitioners, respiratory therapists, and physicians. This interprofessional group examined barriers to mobility in the ICU cited in research articles and presented at the American Thoracic Society Annual Conference in 2009, noting a lack of patient availability to physical therapy and a lack of physical therapy staffing as primary problems in the ICU at the UCSF Medical Center. The group determined that a new full-time physical therapist position in the ICU would ensure that windows of time when patients were awake, medically stabilized, and procedure free would be available for early mobility sessions. The physical therapist manager did not agree that increased staffing was necessary. However, the timing of each mobility activity for patients in the ICU is challenging. Patients in the ICU must be hemodynamically stable and alert enough to participate; in addition, pain must be controlled, tests and procedures (such as hemodialysis) must be completed or pending, and all involved health care providers (such as respiratory therapists for walking a patient receiving ventilation) must be available. A physical therapist would need to be in the ICU for the entire day to find the best window of time for a patient and the team members. These conditions would ensure the optimal intensity of early mobility activities. To validate the request for a new physical therapist position with which to staff the medical-surgical ICU, the Executive Director for Service Lines at the UCSF Medical Center created a formula based on financial figures shared by Johns Hopkins Hospital when it added ICU physical therapy staff. This formula demonstrated potential financial savings for the UCSF Medical Center that would offset the cost of a new full-time physical therapist’s salary.

The ICU Early Mobilization Group met monthly from January 2010 to June 2011 to develop safety guidelines, educate each other across professions, develop inclusion and exclusion criteria for selecting patients in the ICU for mobilization,
identifying barriers to early mobility, and assess how to overcome those barriers. Given the complexity of the ICU population, the group decided upon the guidelines shown in Figure 1, with the provision that the team could collaborate and assess patients on an individual basis, making exceptions to the guidelines when appropriate. For example, a patient with end-stage liver disease may have a long-standing tendency toward hypotension, with a mean arterial pressure of less than 60 mm Hg, but would still benefit from early mobilization. In this situation, because the hypotension is chronic and the patient must remain strong enough for a future life-saving transplant, providing monitored mobility is more important than following a specific guideline. The flow chart shown in Figure 1 guides physicians, registered nurses, and physical therapists through the process of safely assessing and increasing all mobility activities for a patient in the ICU.

The ICU Early Mobilization Group created guidelines for the interprofessional practices necessary for the safe mobilization of patients (eFigure, available at ptjournal.apta.org). Representatives of each profession were responsible for providing the information regarding their individual roles in this collaborative process to their colleagues via e-mail notices and updates in staff meetings. Members of the ICU Early Mobilization Group were responsible for identifying barriers to early mobility and addressing those barriers during monthly meetings as well as during monthly hospital-wide critical care meetings. Figure 2 outlines all identified and addressed barriers to executing early mobility in the ICU.

Once the professional roles and individual mobility guidelines were established, the group decided that the safety and effectiveness of the program (its primary aims being to prevent patient deconditioning and improve overall outcomes) would be assessed retrospectively by comparing patients’ demographic characteristics and outcomes during the intervention period (March 2010–December 2010) with those during the same period in the same ICU in the preceding year (March 2009–December 2009). For assessment of the safety of the intervention, the established hospital incident reporting system was used as the primary source. Any increase in the number of incident reports filed would be followed by a re-examination of the intervention and its guidelines. Incident reports were filed for falls or dislodging of centrally located lines but not for transient changes in vital signs. Changes in patients’ vital signs during early mobility sessions were expected and would need to be judged by all of the presiding clinicians together (respiratory therapists, nurses, physicians, and physical therapists [eFigure]) on an individual patient basis. As outlined in Figure 1, mobility activities were limited or stopped when a patient’s vital signs fluctuated beyond pre-determined parameters for that patient; however, this scenario is true for all ICU activities, from changing linens to turning for skin protection. Fluctuation of vital signs is a normal part of critical care and is not necessarily an adverse event.

**Early Intervention Program**

On March 1, 2010, a full-time physical therapist was added to the chosen 16-bed medical-surgical ICU at the UCSF Medical Center for 8 hours per day, 5 days per week. Additional equipment purchased for the new program included a bilateral heavy-duty platform walker (often referred to as a cardiac or ICU walker) and waffle cushions for skin protection during sitting. The physical therapist leading the quality improvement project had the following responsibilities: responding to referrals for physical therapy within 24 hours on weekdays; scheduling physical therapy sessions on the basis of a patient’s condition; coordinating nurse, respiratory therapist, and physician involvement with each session, as outlined in the eFigure; leading the monthly interprofessional ICU Early Mobilization Group meetings; and providing to group members weekly updates about progress or barriers. The physical therapist also wrote a policy document outlining practice standards for all ICU staff to reference and submitted this, along with exclusion guidelines, for approval by the Director of the Department of Critical Care at the UCSF Medical Center. These were approved, along with the addition to physician ICU admitting forms of prompts for writing physical therapy referrals. The Director of the Department of Critical Care and the ICU Early Mobilization Group approved the following per-patient daily policy roles.

**Respiratory therapist.** The respiratory therapist will administer mechanical ventilation to patients needing such ventilation through either an Ambu-Bag (Vital Signs Inc, Totowa, New Jersey) or a transport ventilator, with the choice of device to be determined by the respiratory therapist covering the ICU that day. When patients appear to not have the strength for both reconditioning and weaning, support will be given first to reconditioning and then to weaning. Patients on high-flow oxygen therapy may be able to walk by using a non-rebreather mask and a portable tank in accordance with the respiratory therapist’s recommendations for those patients.

**Registered nurse and physicians.** Registered nurses and physicians will facilitate timely physical therapy referrals for all patients meeting established criteria and admit patients to the ICU with orders for activity as
Does the patient present with any of the exclusion criteria? (See the chart* below)

- Significant dose of vasopressors for hemodynamic stability (maintain MAP > 60)
- Mechanically ventilated with FiO₂ > 0.8 and/or PEEP > 12, or acutely worsening respiratory failure
- Neuromuscular paralytics
- Currently in an acute neurological event (CVA, SAH, ICH)
- Unstable spine or extremity fractures
- Grave prognosis, transitioning to comfort care
- Open abdomen, at risk for dehiscence
- Active bleeding process
- Bed rest order

Does the patient appropriately attend to the tasks?

Limit PT treatment to edge of bed or standing at bedside

Bed-level assessment
1. Orient the patient and perform CAM-ICU
2. Assess baseline vital signs
3. Bed exercises (passive, active, active assisted, resisted range of motion exercises to all extremities)

Does the patient meet all of the following?
- Remaining alert and oriented
- Demonstrating trunk control
- Vital signs within acceptable parameters

Standing assessment
5. Perform sit-to-stand and static standing at the bedside

Does the patient meet all of the following?
- Remaining alert and oriented
- Demonstrating trunk control
- Vital signs within acceptable parameters

6. Proceed with standing activities, transferring to chair, and gait training

Sedation-related medication
- Interrupting continuous infusion
- Changing from continuous infusion to “as needed” bolus doses
- Using antipsychotic medication for treatment of hyperactive delirium

Primary CNS etiology
Reassess after 24 hours

Figure 1.
Guidelines for daily mobility assessment and treatment. MD=medical doctor, NP=nurse practitioner, PT=physical therapist, RASS=Richmond Agitation Sedation Scale, CAM-ICU=confusion assessment method for the intensive care unit, FiO₂=fraction of inspired oxygen, PEEP=positive end-expiratory pressure (cm H₂O), MAP=mean arterial pressure (mm Hg), CVA=cerebrovascular accident, SAH=subarachnoid hemorrhage, ICH=intracerebral hemorrhage, CNS=central nervous system. Vital sign parameters: case-by-case basis.
Nurses and physicians will prepare patients for successful mobilization through physical therapy by supporting the work of breathing, minimizing pain, temporarily disconnecting feeding tubes, and facilitating patients’ alertness. Discussions regarding patients’ mobility achievements will be presented during daily rounds.

Physical therapist. The physical therapist will coordinate mobility sessions for a patient with nurses daily to find an optimal window of time for the patient. Mobilization will be increased intensively, with each patient doing the most that he or she can do at any given time. Physical therapy will consist of active therapy for patients with Richmond Agitation and Sedation Scale scores of +1 to −2. Physical therapy will consist of passive range of motion that can be performed by a physical therapist assistant under the supervision of a physical therapist for patients with Richmond Agitation and Sedation Scale scores of −3 to −5. Daily mobility screening and assessment of each patient referred for physical therapy will follow the algorithm outlined in Figure 1.

During monthly meetings of the ICU Early Mobilization Group, barriers to the delivery of physical therapy in the ICU were identified and compared with barriers described at other institutions during site visits and conferences as well as published articles.19,20,26,28–32 The barriers and resolutions implemented after group deliberation and consensus are outlined in Figure 2.

Data Collection
Data about the quality improvement project were collected from patients receiving physical therapy services in the UCSF Medical Center medical-surgical ICU from March 2009 to December 2009 and from March 2010 to December 2010. The data were gathered from January 2011 through July 2012 by several collectors; the data gathered retrospectively included standard physical therapy notes, patients’ medical records, and nursing administrative records. The total number of patients receiving physical therapy during each data period was recorded. The following patient demographic characteristics were recorded: age, sex, initial diagnosis, comorbidities, and World Health Organization International Classification of Functioning, Disability and Health33 rating of the level of assistance required to assist patients with mobility. Additional data collected were number of days from ICU admission to physical therapy evaluation, average distance (in feet) patients ambulated, number of days in the ICU, number of days

Figure 2.
Barriers identified and addressed (resolutions) during the establishment of the early mobilization program in the intensive care unit (ICU). PT=physical therapist, Rehab=rehabilitation.
in the hospital, and percentage of patients discharged to home.

**Data Analysis**

IBM SPSS Statistics version 20 (SPSS Inc, Chicago, Illinois) and Microsoft Excel 2010 data analysis were used to perform data analysis. The mean for age and the median and interquartile range (IQR) for number of days, comorbidities, and distance (in feet) ambulated were collected. To determine whether patient demographic characteristics in 2009 and 2010 were similar, the variables age, sex, and comorbidities were analyzed. Age was analyzed with an independent t test, sex was analyzed with a chi-square test, and the number of comorbidities was investigated with a Wilcoxon rank sum test. To determine whether there were differences between the period in 2010 when the early mobilization program was used and the corresponding period in 2009, the number of days from ICU admission to physical therapy evaluation, number of days in the ICU, number of days in the hospital, and average distance (in feet) ambulated were analyzed with a Wilcoxon rank sum test. The discharge data from 2009 and 2010 were analyzed with a chi-square test.

**Results**

As shown in Table 1, the demographic characteristics age, sex, comorbidities, and surgical interventions for the patients receiving physical therapy in 2009 and 2010 were not significantly different. Overall census figures for the ICU, taken from nursing administrative records by an independent auditor, showed a 10% decrease in patient population from 2009 to 2010. For March 2009 to December 2009, nursing administrative records showed a census of 3,740 patient days in the ninth-floor ICU, and for March 2010 to December 2010, they showed 3,467 patient days. The largest increase in the number of patients receiving physical therapy was noted for patients cared for primarily by the medical service. The diagnostic categories and comorbidities for patients receiving physical therapy during 2009 and 2010 were gathered from patients’ medical history admitting notes as a means of assessing the complexity of the patient population and to demonstrate whether changes noted during the quality improvement project were attributable to a shift in patient demographic characteristics rather than to the early mobility intervention.

The first purpose for establishing an ICU early mobilization program was to shorten the time between a patient’s admission to the ICU and physical therapy evaluation. Institution of this measure also should increase the overall number of patients receiving physical therapy in the ICU. The second purpose was to demonstrate that patients from a wide range of hospital services and with complex medical histories, as indicated by the average numbers and types of comorbidities (Tab. 2), can safely tolerate early mobility interventions in the ICU. Table 3 shows a comparison of patients seen by physical therapists in the ICU, broken down by hospital service. Among patients receiving physical therapy, the number of patients from the medical service increased significantly, and the number of patients from the liver transplant service more than doubled. Overall, physical therapists in the ninth-floor ICU treated patients from 17 different admitting hospital services.

**Table 1.** Demographic Characteristics of Patients Receiving Physical Therapist Services in 2009 and 2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>2009 (n=179)</th>
<th>2010 (n=294)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y, X (SD)</td>
<td>64.4 (15.4)</td>
<td>62.0 (16.6)</td>
<td>.07*</td>
</tr>
<tr>
<td>No. (%) of men</td>
<td>99 (55.3)</td>
<td>149 (50.7)</td>
<td>.38*</td>
</tr>
<tr>
<td>No. of comorbidities</td>
<td>5</td>
<td>5</td>
<td>.93*</td>
</tr>
</tbody>
</table>

* Determined with an independent t test.
* Determined with a chi-square test.
* Determined with a Wilcoxon rank sum test.

**Table 2.** Comorbid Conditions in 2009 and 2010

<table>
<thead>
<tr>
<th>2009 Top 10 Most Common</th>
<th>Count*</th>
<th>2010 Top 10 Most Common</th>
<th>Count*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>22</td>
<td>Hypertension</td>
<td>36</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>13</td>
<td>End-stage liver disease</td>
<td>23</td>
</tr>
<tr>
<td>Chronic joint pain/neuropathy</td>
<td>13</td>
<td>Diabetes</td>
<td>22</td>
</tr>
<tr>
<td>Hematologic oncology</td>
<td>10</td>
<td>Hematologic oncology</td>
<td>18</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>9</td>
<td>End-stage renal disease</td>
<td>17</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>8</td>
<td>Chronic joint pain/neuropathy</td>
<td>17</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>8</td>
<td>(Poly)substance abuse/alcohol abuse</td>
<td>16</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>6</td>
<td>Hyperlipidemia</td>
<td>15</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>6</td>
<td>Atrial fibrillation</td>
<td>12</td>
</tr>
<tr>
<td>End-stage liver disease</td>
<td>6</td>
<td>Gastroesophageal reflux disease</td>
<td>12</td>
</tr>
</tbody>
</table>

* Count refers to number of patients with this condition in addition to their primary diagnosis.
Physical Therapist–Established Intensive Care Unit Early Mobilization Program

Table 3.
Number of Patients Receiving Physical Therapy in the Intensive Care Unit, by Hospital Servicea

<table>
<thead>
<tr>
<th>Year</th>
<th>MED</th>
<th>LXT</th>
<th>AGS</th>
<th>ORT</th>
<th>OS</th>
<th>NSX</th>
<th>NSP</th>
<th>NEU</th>
<th>KXT</th>
<th>CAR</th>
<th>VAS</th>
<th>CTS</th>
<th>CRI</th>
<th>OHN</th>
<th>OSX</th>
<th>URO</th>
<th>GYO</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>56</td>
<td>17</td>
<td>30</td>
<td>19</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>10</td>
<td>5</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>179</td>
</tr>
<tr>
<td>2010</td>
<td>121</td>
<td>45</td>
<td>28</td>
<td>9</td>
<td>19</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>7</td>
<td>18</td>
<td>8</td>
<td>0</td>
<td>7</td>
<td>5</td>
<td>294</td>
</tr>
</tbody>
</table>

a MED—medicine service, LXT—liver transplant service, AGS—adult general surgeries, ORT—orthopedics, OS—orthopedic spine surgeries, NSX—neurosurgery, NSP—neurological spine surgeries, NEU—neurological service, KXT—kidney transplant service, CAR—cardiac service, VAS—vascular surgery, CTS—cardiac and thoracic surgeries, CRI—hematological oncology service, OHN—otolaryngeal and head and neck surgeries, OSX—oral surgery, URO—urology service, GYO—gynecological and obstetrics services.

Although the patient population remained consistent from 2009 to 2010, with similar mixtures of complexities (Tab. 2) and overall admissions, the ICU early mobilization program influenced physical therapist practice. The results showed that the number of patients receiving physical therapy while still in the ICU increased from 2009 to 294 and that the number of days to physical therapy evaluation decreased from a median of 3 days in 2009 to a median of 1 day in 2010 (z = −5.97, P < .001) (Tab. 4). Furthermore, there were functional improvements in the distances that patients walked; there was a 100-ft increase from 2009 (median = 40 ft) to 2010 (median = 140 ft) (z = −3.132, P = .002).

The average ICU length of stay for patients receiving physical therapy also was statistically different, with a shorter length of stay in 2010 than in 2009. For 2009, the median ICU stay was 6 days (IQR = 8 days); for 2010, the median ICU stay was 4 days (IQR = 7 days) (z = −0.254, P = .111) (Tab. 4). Similarly, the hospital length of stay also was significantly different, with a median hospital stay of 14 days (IQR = 24.5 days) in 2009 and a median hospital stay of 12 days (IQR = 16 days) in 2010 (z = −2.45, P = .014). Finally, a chi-square test of independence to examine the percentages of patients discharged to home showed a statistical difference (χ² = 11.18, df = 1, P < .001) between the 55% of patients discharged to home in 2009 and the 77% discharged to home in 2010. The level of assistance was analyzed with the International Classification of Functioning, Disability and Health; this instrument has scores ranging from 1 to 8, with 1 representing dependence and 8 representing independence. There was a difference in these scores between 2009 (median = 3) and 2010 (median = 4). Finally, 43% of patients were ambulatory in 2009, whereas 50% of patients demonstrated upright mobility skills in 2010; this increase was significant (χ² = 8.23, df = 1, P = .004).

Safety concerns, specifically dislodging of critical lines, patients falling during mobility activities, and patients experiencing medical decompensation because of increased activity, are common rationales for limiting patient mobility in the ICU and must be addressed in the planning of and assessment for early mobilization.34 As noted for other ICU early mobilization programs, no medically detrimental events occurred in patients from March 2010 through December 2010 as a direct result of early mobilization.16,19–21,32,35,36 Adverse events that did occur included accidental removal of rectal tubes, nasogastric tubes, and peripheral intravenous lines, which were all replaced. There was no accidental dislodging of central lines, endotracheal tubes, dialysis catheters, chest tubes, or postsurgical drains during the study period. According to risk management statistics kept by the UCSF Medical Center, the same numbers of incident reports were filed for the medical-surgical ICU in 2009 and 2010, demonstrating that an emphasis on early...
mobilization does not increase harm to patients.

Discussion

Immobility combined with the catabolic process of critical illness often results in weakness, causing long-term disability for patients in the ICU.37–42 Keeping patients awake and mobile with an interprofessional early mobility program is currently considered a crucial preventative care measure to help patients recover from critical illness without the side effect of long-term disability.5,18,21,26,43–46 The quality improvement project described here demonstrated that a physical therapist–led program to initiate early mobility in an ICU population with complex issues is feasible and safe. As a result of the development of an interprofessional team of clinicians planning and providing education before the intervention, prompting physicians to write physical therapy referrals on ICU admitting forms, and dedicating a full-time physical therapist to a 16-bed ICU, patients began physical therapy 1 day after ICU admission—2 days earlier than before the quality improvement project.

In turn, early mobility contributed to a decreased length of stay and better discharge outcomes for a larger number of patients than did standard care. The ICU length of stay for patients receiving early mobility physical therapy decreased by 2 days, and overall hospital length of stay decreased by 2 days. Although other factors, such as decreased use of sedation,47,48 make a concomitant contribution to reduced length of stay, preventative early mobility plays a strong role.49–51 Finding objective outcome measures to evaluate the level of benefit (of ICU early mobilization) for patients is a challenge.52,53 The literature on already established ICU early mobilization programs used length-of-stay outcome measures as evidence of positive results for patients.17,21,55 Discharge location was improved by the early mobilization program, with a higher percentage of patients in the program being able to go home rather than to a rehabilitation facility. This result may have been due to patients who received physical therapy interventions in the ICU being more functional at their initial presentation in 2010 than those in 2009. As recorded in the physical therapy evaluation, the median level of assistance required by the patients in the ICU in 2009 was moderate, as defined by the International Classification of Functioning, Disability and Health, meaning that the patients provided 50% to 74% of the effort needed for mobility; in 2010, the median level of assistance was minimal, meaning that the patients provided 75% to 100% of the effort needed for mobility. Because of the subjective nature of this measurement of patient effort and the fact that the data were collected by multiple therapists, no statistical analysis was performed on those data. The difference likely was related to reaching a larger number of patients in 2010 and reaching them earlier in their ICU stay, before they became more deconditioned.

Forty-three percent of patients who received physical therapy in the ICU in 2009 ambulated as part of their physical therapy protocol specifying bed-level activity and passive range of motion.16 Thus, they remained in the program. Because discharge to home requires a greater level of independence and better functional mobility than does discharge to an institution, this outcome measure served as a proxy for less weakness.54,55 Distance walked was used as a similar indicator. The greater distance walked by patients who received physical therapy interventions in the ICU in 2010 was associated with the greater intensity of rehabilitation that could be provided by a physical therapist dedicated to the ICU.

The project was limited by a reliance on retrospective analysis of data from 6 collectors rather than 1 independent researcher. The project lacked the ability to control for confounding variables, such as other nursing interventions and case management, that may have contributed to a reduced length of stay during the study period. The project was further subject to bias because of the lack of masking during gathering of the data and the lack of more specific outcome measures.

Staffing limitations further challenged the project. Three physical therapists provided coverage for the ICU—1 full-time clinician and 2 backup clinicians for vacation coverage as well as an additional 2 hours of physical therapist assistant support on most days. This amount of physical therapy coverage was not adequate and did not match the frequency provided in model programs, with coverage of 6 or 7 days per week.20,52 Not having a physical therapist assigned to the ICU on the weekend meant that patients referred for physical therapy on the weekend had to wait to start receiving physical therapy treatment until Monday, reducing the ability to reach patients within 48 hours after ICU admission—the aim of the early
Physical Therapist–Established Intensive Care Unit Early Mobilization Program

mobilization program. Mobilizing critically ill patients while guarding their vital lines, such as continuous dialysis catheters or endotracheal tubes, often requires a minimum of 2 people, making an assistant for the physical therapist essential. Fortunately, the UCSF/San Francisco State University Doctorate Program in Physical Therapy was able to provide current students with clinical experience and elective credit in exchange for their assistance in the program.

Still open for question is whether the program was sufficiently staffed to provide the appropriate intensity. Determining the optimal dosage and intensity of early mobilization interventions requires further study.

Intensive care unit early mobilization is a complicated process requiring interprofessional communication. This complexity remained a challenge throughout the program and created referral and treatment variations with each weekly rotation of medical resident staff. Future studies of degrees of variation in practice patterns and their impact on the care of patients in a medical center could inform institutions, as they establish programs, on optimal ways to standardize best practices.

Conclusions

The quality improvement project at the UCSF Medical Center was initiated and promoted by a physical therapist in collaboration with critical care professionals to establish the ICU Early Mobilization Group. The benefits of the early mobilization program included vitality observed in patients when they started physical therapy earlier, which allowed for patient mobility sooner and patients walking farther than with standard physical therapy care in the ICU. This early mobilization program contributed to better outcomes for patients (decreased length of hospital stay and greater likelihood of discharge to home); and cost savings. These benefits convinced the nurses, nurse practitioners, respiratory therapists, physicians, and hospital administrators at the UCSF Medical Center to continue the practice of dedicating a physical therapist to the ICU for the purpose of early mobilization beyond the quality improvement project pilot period. They have since expanded the program to other UCSF Medical Center ICUs.

Physical therapy interventions in the ICU are targeted to prevent weakness and disability. Weakness prevents half of all patients who are critically ill from returning to a pre-morbid level of function. Physical therapists are equipped to address this matter and can recognize that in a complex ICU environment, interprofessional collaboration is required to deliver beneficial interventions to patients in a timely, consistent manner. For the quality improvement project described here, the physical therapist–led program was promoted across health care professions with updates, education, and communication in ongoing monthly ICU Early Mobilization Group meetings and internal publications or newsletters. The physical therapist–led program further established improved patient care with interprofessional collaboration at every treatment opportunity. The results demonstrate the ability of a non–physician-led health care professional to facilitate institutional change and to create quality improvement in practice patterns even in a large academic medical center with frequently rotating personnel. A retrospective review of patient functional capability, as measured by distance walked in the ICU, length of stay, and discharge location as a proxy for functional outcomes, demonstrated improved patient care. However, many questions remain regarding optimal frequency, intensity, and dosage of mobility interventions and how best to allocate staffing to carry out these interventions.

Dr Engel provided concept/idea/research design and project management. Dr Engel, Mr Alonzo, and Dr Rivera provided writing. Dr Engel, Mr Tatebe, Mr Alonzo, and Ms Mustille provided data collection. All authors provided data analysis. Mr Tatebe, Mr Alonzo, and Ms Mustille provided clerical support. Mr Tatebe, Mr Alonzo, Ms Mustille, and Dr Rivera provided consultation (including review of manuscript before submission).

This article originally was an invited manuscript for the Special Series on Rehabilitation for People With Critical Illness, which was published in the December 2012 and February 2013 issues of Physical Therapy.


References


34 Stiller K. Safety issues that should be considered when mobilizing critically ill patients. Crit Care Med. 2007;35:35–53.


43 Herridge MS. Mobile, awake and critically ill. CMAJ. 2008;178:725–726.


