Crit Care Nurs Q
Vol. 41, No. 3, pp. 226–239

Changing the Perceptions of a Culture of Safety for the Patient and the Caregiver

Integrating Improvement Initiatives to Create Sustainable Change

Joyce M. Black, PhD, RN, CWCN, FAAN; Susan Salsbury, BS, OTR/L, CDMS, CSPHP; Kathleen M. Vollman, MSN, RN, CCNS, FCCM, FAAN

Evidence indicates that chances for a successful patient mobility program, prevention of pressure injury and falls, and safe patient handling are enhanced when an organization possesses an appropriate culture for safety. Frequently, these improvement initiatives are managed within silos often creating a solution for one and a problem for the others. A model of prevention integrating early patient mobility, preventing pressure injuries and falls while ensuring caregiver safety, is introduced. The journey begins by understanding why early mobility and safe patient handling are critical to improving overall patient outcomes. Measuring current culture and understanding the gaps in practice as well as strategies for overcoming some of the major challenges for success in each of these areas will result in sustainable change. **Key words:** *falls*, *immobility*, *mobility*, *pressure ulcer prevention*, *safe patient handling*

IN TODAY'S health care environment, we face a difficult but essential task: to provide comprehensive, compassionate, complex, technological care without causing harm to our patients. To foster a safe patient environment, it is our mission to examine care practices and processes to identify and attenuate potential for error. However, the concept of do no harm or safety culture has largely been focused on the patient and has not made the important link to the safety of the health care worker. When we examine the definition of safety, it is about avoiding both short- and long-term harm to people resulting from unsafe acts and preventable adverse events.[1]

An organization's principal methods and tools for creating a safety culture are the same regardless of the population focus. A true culture of safety and the organizational leaders who create and sustain it will not be considered legitimate and genuine if the culture excludes some groups within the organization.[2] Therefore, it is critical to change the paradigm of a culture of safety for patients and a separate culture of safety for health workers and place them together as a safety culture for both the patient and health care worker as a core organizational value. Without these forces fusing together, we end

Author Affiliations: *University of Nebraska, Lincoln (Dr Black); Safe Patient Handling and Mobility, OhioHealth, Columbus (Ms Salsbury); and Advancing Nursing LLC, Northville, Michigan (Ms Vollman).*

The authors have disclosed that they have no significant relationships with, or financial interest in, any commercial companies pertaining to this article.

Correspondence: *Kathleen M. Vollman, MSN, RN, CCNS, FCCM, FAAN, Advancing Nursing LLC, 21092 Boulder Circle, Northville MI 48167 (kvollman@comcast.net).*

DOI: 10.1097/CNQ.0000000000000203

up with significant silo safety programs all with the intention of improving either patient or health care worker safety outcomes.

In hospitals, many of the individual improvement programs might include healthy work environment, fall prevention program, pressure injury prevention program, early progressive mobility program, and safe patient-handling program. With each of these in their own silos, designed solutions may improve one outcome while causing harm or creating a challenge to achieve the care practice with another.[3] For example, a pressure injury improvement team might suggest the use of a supportive cushion in the chair of the patient. While this cushion may reduce the incidence of pressure injury, it may have no benefit in the ability to safely move the patient preventing friction or shear of the skin as well as reducing any potential injury to the health care worker during the mobility activity itself. A careful assessment of the current organizational culture and the ability to design any program from a systems perspective are essential to ensure the sustained favorable impact of quality care for the patient and the caregiver.[2] Characteristics of organizations where a culture of safety exists include those with workers who feel a sense of responsibility and willingness to report adverse events, injuries, and near misses, and expect consistent, effective responses to such reports.[1]

A different direction in health care improvement is occurring with the use of a crosscutting approach. The goal is to develop strategies or tactics that will cut across several improvement focus areas, impacting one or more.[4] Crosscutting approach links traditionally separate independent parties or interests to achieve multiple goals. For example, a crosscutting strategy would be hand hygiene, which when performed effectively can impact reduction in surgical site infections, catheter-associated blood stream infections, urinary catheter–associated infections, and ventilator-associated events. The Hospital Improvement Initiative Program from the Hospital Research and Education Trust arm of the American Hospital Association has launched a nationwide crosscutting improvement strategy called the "UP campaign."[4] The 3 improvement components of Wake Up, Get Up, and Soap Up impact at least 7 different quality outcomes in each of the areas. For example, the "Get Up" component of the campaign shows that through mobilization of patients early in their hospital stay, we can reduce falls and prevent urinary catheter–associated infections, delirium, ventilator-associated events, pressure injuries, and venous thromboembolism, with the potential of reducing readmissions. Previously, the focus was on each of the initiatives separately requiring team resources and silo solutions that often overwhelmed the frontline caregiver with new tasks and responsibilities. Errors can occur by just trying to adhere to all the practices, demands, and expectations placed upon the caregiver. The caregiver is shaped by the work system but should have influence on how the rest of the system works.[5]

The mobility movement, pressure injury prevention, fall prevention, and safe patient handling are similarly challenged. When each initiative is handled separately within its own discipline, solutions are launched that are one directional. This can have either a positive or negative impact on the other initiatives. The Joint Commission published a monograph in 2012 with the purpose of generating awareness of the potential synergies around patient safety and health care worker safety.[6] The time has come to unite under the umbrella of a single improvement initiative that encompasses early progressive mobility, while preventing patient skin injury and falls and ensuring that all interventions are performed with the right people and resources to prevent caregiver injury (Figure).

Leadership is critical to the success of moving from a silo method to a crosscutting improvement approach.[2] Clinical and administrative leaders can operationalize this integrative approach through recognition of silos, removal of barriers, and bringing the right talent and expertise to the table. Various disciplines, teams, and staff will need to work

Figure. Culture of safety for the patient and health care work.

together differently while measuring process and outcomes that reach beyond the standards of each group. Part of leadership's role is to provide feedback to teams, leaders, and staff to encourage the new way of doing business. What will a change in the safety culture look like when focused on both the patient and the worker? Improvement initiatives will transcend discipline and departmental walls. Measurements will be created that integrate both patient safety and health care worker safety. Organizational processes and infrastructures will be designed to support the crosscutting improvement approach.[6] To start the journey, it is important to understand why early mobility (EM), pressure injury prevention, fall prevention, and safe patient handling are critical to improving overall patient outcomes.

IMPACT OF IMMOBILITY ON CRITICALLY ILL PATIENTS

The short-term negative outcomes of immobility for critically ill patients include ventilator-associated events, delayed weaning related to muscle weakness, increased days in delirium, loss of muscle mass, and the development of pressure ulcers.[7] The major long-term complication of immobility is the impact on quality of life after discharge due to intensive care unit (ICU)-acquired weakness and delirium that frequently occur during an ICU stay.[8-13] Intensive care unit–acquired weakness is defined as a syndrome of generalized limb weakness that develops while the patient is critically ill and for which there is no alternative explanation other than the critical illness itself.[11] The generalized weakness is defined as a Medical Research Council Scale score averages of less than 4 across all muscles tested. Twenty-five percent of patients with prolonged mechanical ventilation will develop intensive care unit–acquired weakness. It is caused by critical illness polyneuropathy and myopathy, or a combination of both. The major risk factors include severe sepsis, duration of mechanical ventilation, length of ICU stay, systemic inflammatory response syndrome, multiple organ failure, immobility, and use of corticosteroids/neuromuscular blockers.[11,12] Intensive care unit–acquired weakness results in prolonged mechanical ventilation, reoccurring respiratory failure, ventilator-associated pneumonia, increased ICU and hospital length of stay, and increased mortality.[12] Up to 78% of ICU survivors experience neurocognitive impairments. A recent multicenter randomized controlled trial in medical-surgical ICUs examined 821 patients with acute respiratory failure and/or shock for the presence of delirium while in the hospital and cognitive impact 3 and 12 months postdischarge. They found that 72% of patients developed delirium during their hospital stay. The cognitive impact was significant at both 3 and 12 months. One out of every 4 patients had cognitive impairment at 12 months.[13] Herridge et al[14] looked at outcomes of acute respiratory distress syndrome survivors and found that they lost 18% of their body weight at discharge from the ICU and experienced significant functional limitations at 1 year due to muscle wasting and fatigue. In a systematic review (SR) of quality-of-life data on critically ill survivors when compared with population norms matched to sex and age, evidence of challenges in physical activity and physical role functions was significant and persistent. The factors contributing to negative quality of life outcomes included impaired pulmonary function, loss of muscle, proximal weakness, and fatigue.[15]

Impact of immobility on organs

During bed rest or immobility, adverse effects are seen on many of the major organ systems.[16-20] The major consequences to the respiratory system include development of compression atelectasis from the dependent edema formation in the supine position, impaired ability to clear the tracheal bronchial tree due to position-dependent changes in the mucociliary escalator, cough reflex, and drainage, thus placing the immobilized patient at greater risk for ventilator associated pneumonia.[16,20] The changes in the cardiovascular system related to bed rest are significant. The act of lying down shifts 11% of the total blood volume away from the legs, with the majority going to the chest. Within the first 3 days of bed rest, there is an 8% to 10% reduction in plasma volume with the loss stabilizing to 15% to 20% by the fourth week.[16-19,21,22] These changes result in increased cardiovascular workload, elevated resting heart rate, and a decrease in stroke volume with a reduction in cardiac output. Orthostatic tolerance deteriorates rapidly with immobility, with the maximum effect seen at 3 weeks. Baroreceptor dysfunction, changes in autonomic tone, and fluid shifts are thought to be the cause.[16,23,24] The heart muscle itself becomes deconditioned with bed rest. In healthy individuals on 5 days of bed rest, insulin resistance and microvascular dysfunction are seen.[25]

The musculoskeletal system is severely affected by immobility and bed rest as described previously. Immobility in the critically ill patient leads to decreased muscle protein synthesis, increased catabolism of the muscle, and decreased muscle mass that is more pronounced in the lower limbs.[24,26-28] The muscle groups that lose the most strength are those involved in maintaining posture, transferring activities, and ambulation.[11] Skeletal muscle strength may decline 1% to 1.5% per day of strict bed rest.[24] The deconditioning patient's experience from lying in bed may contribute to falls within the acute care setting.[29] In one study, researchers found that more than one-third of patients with stays in the ICU greater than 2 week had at least 2 functionally significant joint contractures.[30] Contractures during the ICU stay were associated with higher mortality and limited function more than 3 years post-ICU stay.[31]

The skin does not normally bear weight, so with bed rest, skin breakdown and delayed wound healing are frequently seen.[32] Pressure injuries are the fourth leading preventable medical error in the United States. Pressure injuries cause extreme discomfort and often lead to serious life-threatening infections. In addition to pain and suffering, 1 pressure injury results in adding 4 days to the length of stay independent of other risk factors.[33] They increase a patient's risk of developing a hospital-acquired infection by 25%. Inhospital death occurred in 11.6% of hospital stays, with pressure injuries noted as a secondary diagnosis, as compared with 4.2% of stays with a principal diagnosis of pressure injuries and 2.6% of stays for all other conditions. Based on a recent SR of the literature, hospital-acquired pressure injuries for critically ill patients worldwide range from 3.3% to 53.4%.[32] Interruptions in the skin barrier place the critically ill patient at greater risk for healthcare acquired infections. Since the consequences of immobility/bed rest are so severe, mobilizing critically ill patients early has significant merit.

Overcoming challenges to early mobilization

The benefits of exercise result in improved muscle strength, evidence of reduced oxidative stress, and inflammation in addition to positive mood changes, shorter days in delirium, less fatigue, and a greater ability to resume activities of daily living.[34-36] However, the importance of in-bed mobility and out of bed mobility as a priority of practice can be a challenge in the ICU. Studies have demonstrated that we are not successful in achieving in-bed mobility with the frequency required.[37,38] If there are challenges with repositioning in bed, what will it take to routinely achieve walking of ventilator patients? In one study, directors of medical and mixed medical-surgical ICUs in 4 countries were randomly selected to be surveyed about EM practices. A total of 833 ICUs (United States: 396; France: 151, United Kingdom: 138, Germany: 148) provided results. Twenty-seven percent reported having a formal EM protocol, while 21% had adopted EM practices without a protocol. More than 52% of the ICUs surveyed had not adopted any EM practices. Factors associated with EM practices included presence of multidisciplinary rounds (United States), written daily goals (United States and Europe), and sedation protocols (United States and Europe). Sites with protocols reported seeing reductions in length of stay and improved patient satisfaction.[39] In a recent 1-day point prevalence study on early mobilization of mechanically ventilated patients with acute respiratory failure, 42 ICUs across the United States exhibited overall prevalence of mobility activities of about 32%, with only 16% of patients mobilized out of bed. Mobility activities were directed more toward patients not on a mechanical ventilator.[40] The major barriers to preforming mobility activities included cardiovascular instability, presence of an endotracheal tube, human and technological resources (PT/OT, mobility aids), staff buy in, lack of a protocol, and deep sedation.[40,41]

Global suggestions for improvement

Mobilizing the critically ill patient must be viewed along a progressive continuum based on readiness, specific pathology, strategies to prevent complications, and ability to tolerate the activity/movement and driven by a protocol.[7,16,40] Progressive mobility is defined as a series of planned movements in a sequential manner beginning at a patient's current mobility status with a goal of returning to his or her baseline.[42] It encompasses a variety of positioning and mobility techniques including head of the bed elevation, passive and active range of motion, continuous lateral rotation therapy and prone positioning if indicated on the basis of protocol criteria, movement against gravity, physiologic adaptation to an upright/leg down position, chair position, dangling, and ambulation.[42] Physical deconditioning that occurs with bed rest can be combatted by using a stepwise mobility progression program. However, such efforts will not be successful unless there is a safe way to prevent skin injury, prevent falls, and make it easy and safe for the health care worker to perform the activity.

IMPACT OF MOBILITY ON SKIN IN THE CRITICALLY ILL PATIENT

Patients at highest risk for pressure injury development are those who are unconscious and/or immobile requiring complete assistance of the staff. The critically ill patient exemplifies this risk and, when combined with a myriad of lines, tubes, monitors, and a risk of hemodynamic instability when moved, critically ill patients are seldom moved enough. Some of the highest rates of hospital-acquired pressure injury occur in the critically ill patient. The development of these pressure injuries is due to a combination of high-intensity pressures prior to admission (found down at the scene, long stays in operating room, interventional radiology, emergency room) and long durations of pressure while in ICU. The routine turning of immobilized critically ill patients at a minimum of every 2 hours has become the accepted standard of care; however, there has been almost no study on the need for this frequency with advanced pressure redistribution support surfaces commonly in use. The modest research in the area points to less frequent turning in the critically ill. In 2002, Krishnagopalan and colleagues[37] performed a prospective observational study of patient position in the ICUs of 3 hospitals. Only patients who had an expected length of stay of more than

18 hours and who were unable to turn themselves were included. Patients were observed at 15-minute intervals for a minimum of 5 hours. Only 3% of patients were repositioned every 2 hours with about half the patients remaining supine for 4 to 8 hours. Nearly one-quarter of patients were not repositioned by staff for more than 8 hours. Only 2 of the 74 patients were moved every 2 hours and staff did not reposition nearly 25% of patients for more than 8 hours.[37] Goldhill et al[38] examined patients in 39 ICUs every hour for more than 2 separate days in the United Kingdom and analyzed 393 sets of observation for 7664 hours. Five patients were prone at any time and 3.8% (day 1) and 5% (day 2) were on rotating beds. Patients were on their back for 46.1% of observations, turned left for 28.4% and right for 25.5%, and head up for 97.4%. A turn was defined as a change between on back, turned left, or turned right. The average time (SD) between turns was 4.85 hours (SD: 3.3 hours). There was no significant association between the average time between turns and age, weight, height, gender, respiratory diagnosis, intubated and ventilated, sedation score, day of week, or nurse: patient ratio.[38]

Attempting to change the frequency of turning critically ill patients was studied by Pickham and colleagues.[43] This study used a wearable patient sensor that cued the staff about turning. The sensor was applied to the upper chest in all patients; in the treatment group, data about duration of the patient's position in bed were relayed to a point-of-care dashboard that indicated the time to the next turn. The device did not cue the nurses caring for the control group. Outcomes measured included incidence of pressure injury and compliance with turning comparing the group with the sensor to traditional turn reminders. At the start of the study, 1312 patients were enrolled; after eliminating unusable cases, 555 control patients were compared with 671 treatment patients. Pressure injuries developed in 2.3% of the control patients compared with 0.76% in the treatment group. The majority of pressure injuries were a deep tissue injury. Compliance with turning was higher in the treatment group, 67% versus 54% ($P < .001$).

Another method of signaling the staff to turn or move the patient is the use of a continuous bedside pressure maps. The pad is placed under the patient and displays a real-time image on a small computer screen that is designed to aid the staff in positioning the patient to redistribute pressure. Gunningberg and colleagues[44] studied 190 patients randomly assigned to the pressure map. Pressure injury development in patients who were pressure ulcer free at the onset of the study was compared. Seven patients in each group developed pressure injury, with pressure injury present within 3 days in each group.[44] The researchers believed that the Hawthorne effect may have been present, reducing the risk of pressure injury in both groups from a prevalence rate of 45%.

While the 2-hour turning schedule may be the target time frame, the angle of the body in the bed (eg, 30° lateral vs 45° lateral) is also an important component. Since 1992, the recommended angle for turning is 30°. However, as patients have become more obese, it is difficult to determine whether a 30° angle exists in the pelvis following a turn. In addition, when the head of the bed is elevated, the pelvis becomes a fulcrum to the pivot, further reducing the ability to obtain a turn. In the study by Pickham et al[43] in 2017, a turn was defined as a turn angle of 20° for at least 15 minutes. The study found that only 35% to 36% of the turns in both the treatment and control groups could be classified as a "turn." In 2016, Powers[45] compared the incidence of pressure ulcers between a group of critically ill patients turned with pillows (N = 30) and a group turned with a patient-positioning system that included wedges and a glide sheet (N = 29). Nurses were instructed not to place the wedges against the sacrum. Patients turned with pillows achieved on average an initial 20° position. This is compared with those turning with the positioning system who achieved an initial 30° turn. Furthermore, turning the patients with pillows required more nurses (1.97 compared with

1.35, $P < .0001$). Six ulcers developed in the group turned with pillows compared with 1 in the treatment group ($P = .04$).[45]

Practical approaches

Turning the critically ill patient presents challenges. Transient changes in heart rate, blood pressure, and mixed venous oxygen levels are to be expected, especially if the patient has not been moved for quite a while. Patients must be permitted to recover from being moved to the side in bed before labeling them "hemodynamically unstable." Suspending patient movement further delays recovery.

There are patients who are too unstable to turn. They include patients who when moved develop life-threatening changes in heart rhythm, oxygenation, mixed venous subtraction levels, or blood pressure. Clinical situations that are volatile include an unstable airway, periods of massive fluid resuscitation for hemorrhage or during early stages of sepsis, and patients with unstable spinal or pelvic fractures. If these conditions do not stabilize within 10 minutes following a position change, the patient can be labeled "hemodynamically unstable." When too unstable to turn, the nurse should reposition the body areas that can be moved, such as the heels and the occiput. However, once the resuscitation is complete, turning should be attempted, starting with slow turns and positioning with wedges to control the lateral angle of the body. Incremental weight shifting, also known as "microturns," does not have evidence to support its use.[46]

The ICU should be outfitted with the highest-grade support surface the hospital can provide for the typical ICU patient. The patients in ICU are complex to turn and often ischemic or hypoxic, further increasing their risk for pressure injury and for these patients, an even higher-grade support surface may be needed. Mechanical lifts or turn and position systems should be used to move the patient up in bed to reduce shear forces on the sacrum caused from being dragged by draw sheets. The heels must be floated from the bed by using a heel off-loading device. Pillows may be employed to lift the heel for a short time, but they collapse under the weight of the leg.[47] It is recommended that a preventive 5-layer dressing be used beneath the sacrum and buttocks to help in reducing shear and pressure impact.[48,49]

A turning program should be designed that can be safely implemented using the fewest staff as possible. Long waits for staff to arrive to move a patient further extends the time tissues are exposed to pressure and shear. Turning and positioning systems should be used to move the patient with fewer staff into lateral positions. The patient can be held in place with wedges to keep them at a 30° angle. Patients with complex lines, monitors, and medical devices will require innovation to develop ways to inspect the skin under the device, move the device, or to place pads under the device.

Use a care bundle to standardize care

Care bundles have become common in health care practice. A pressure injury prevention care bundle usually includes 5 elements, each of which is supported by evidence from randomized controlled trials or SRs. All the interventions in the care bundle must be performed in patients continuously, and the bundle is being incorrectly applied if the health care practitioner is selecting only 1 or 2 measures from the bundle to perform. Care bundles are thought of as systems that are greater than the sum of their parts; only when the interventions are performed simultaneously can the care bundle achieve its maximum effect. The components of care bundles include skin assessment, risk assessment, nutritional support, which are beyond the scope of this article, support surfaces, and repositioning/turning.[49] Using the proper support surface and turning schedule are addressed later.

IMPACT OF PATIENT FALLS

Falls are defined as a sudden, unintentional descent, with or without injury to the patient, which resulted in the patient coming to rest on the floor, on or against some other surface, another person, or an object.[50] Falls are the leading cause of hospital-acquired injury and can frequently prolong or complicate hospital stays.[51] Between 700 000 and 1 million patients suffer a fall in US hospitals each year.[52] Of the patients who fall, 30% to 35% sustain an injury and approximately 11 000 falls are fatal.[50] Injuries can range from a minor bruise or abrasion to death. Falls with injury can extend the hospitalization and associated costs. The average cost for a fall with serious injury is $14 000 per patient.[53,54] The Centers for Medicare & Medicaid Services will no longer pay for inhospital falls with trauma.

Falls can result from intrinsic factors specific to the patient and extrinsic risks from the environment.[55] Intrinsic patient risk factors may include age, deconditioning from lack of mobility, dementia or cognitive dysfunction, impaired hearing and vision, and certain medications. History of a fall can be predictive of a future fall.[55] Extrinsic fall risk factors are related to the environment. Environmental risks can include poor lighting, unlocked beds, slippery floors, or trip hazards from tubes and medical equipment. Fall prevention programs must address both the patient-specific risk factors and the environmental risks.

Fall prevention is an essential part of a hospital's safety culture. Organizational support for falls prevention programs should include leadership involvement, frontline staff, and a multidisciplinary approach for best success.[51,56] There is no magic formula for fall prevention; however, the literature supports a multifactorial approach.[56,57] Components of a fall prevention intervention may include a fall risk assessment, fall alert signs, patient and family education, purposeful rounding, bed exit alarms, post–fall evaluations, low beds, ID bands, nonskid foot wear, medication review, sitters, and/or room placement close to the nurses' station. Recently, the science on early mobilization of hospitalized patients beginning at the time of admission based on the patient condition has shown promise in reducing falls.[4] There are many different fall risk assessments; however, a 2015 SR found that no one tool can be recommended for fall detection in patients older than 65 years admitted to acute care hospitals because none demonstrated high enough predictive value.[58] Patient-centered interventions and personalized care plans based on patient's fall risk demonstrated reduced fall rates in 3 studies.[59] Visual identification of patients at high risk for falls is another piece of a comprehensive falls prevention program. Yellow socks and yellow armbands signs outside patient rooms are examples of visual identification. Interdisciplinary communication and collaboration are crucial to prevent patient falls.[51]

The Joint Commission Center for Transforming Healthcare recently published a report from its preventing patient falls project. It included 7 US hospitals that participated in a robust process improvement methodology to address their falls. They identified 6 categories that contributed to patient falls. These included fall risk assessment issues, hands-off communication issues, toileting issues, call light issues, education and organizational culture issues, and medication issues. For each issue, they broke down the contributing factors and then generated solutions for each. Their keys for success were measuring and analyzing contributing factors and addressing culture change. With their interventions, the organizations saw a 62% reduction in falls with injury and a 35% reduction in their falls rate.[50] Fall prevention is a complex problem and requires a collaboration across disciplines, with support from leadership to frontline staff to create a culture of safety to increase mobilization, while preventing falls and caregiver injury.

HEALTH CARE WORKER INJURIES RELATED TO PATIENT MOBILITY

To understand the importance of safe patient handling programs for both patients and health care workers, it is necessary to review statistics and current data about the problem. Health care workers are one of the most at-risk occupations for work-related musculoskeletal injuries.[60] Registered nurses are ranked fifth in the incidence of work-related musculoskeletal injuries and nurse aides are ranked second compared with all other occupations.[61] Work-related musculoskeletal disorders (WMSDs) are injuries to muscles, nerves, tendons, joints, cartilage, and intervertebral disc where the work environment contributes to the condition, or the condition is made worse or persists because of the work condition.[62] Examples of WMSDs include cervical strain/sprain, rotator cuff tendonitis, lateral epicondylitis, lumbar strain/sprain, and wrist strain/sprain and knee sprain. Most health care musculoskeletal injuries are cumulative in nature. Patient-handling injuries are defined as injuries to a health care worker from health care recipient handling and mobility activities.[63] Patient-handling tasks include both in-bed mobility and out-of-bed mobility. In-bed patient mobility includes tasks such as boosting/turning/repositioning, providing personal care, bathing, and wound care. Examples of out-of-bed-mobility tasks are transfers from bed to chair/wheelchair/commode or similar seated items, transfers from bed to cart or examination table from a lying position to a lying position, transporting a patient by stretcher, or ambulating a patient.

In a direct link to the frequency of WMSDs, accompanying health care costs are rising. Costs associated with health care WMSD in 2010 were $20 billion in direct costs and up to 5 times that for indirect costs.[61] The 2016 Aon Health Care Benchmarking and Safe Patient Handling Data from analysis of more than 1600 employers identified that the most common patient-handling injuries were backs 51.3% and shoulders 20.1%. The most severe patient-handling injury costs were shoulders at an average of $13 400, followed by neck injuries at an average cost of $12 7000.[64] The rate of patient-handling injuries was 11.3 per 10 000 worker months, and the most frequent injury task was positioning and repositioning in bed, followed by lifting/transferring to bed or chair.[65]

Health care workers are exposed to unique ergonomic risks as compared with other industries. Ergonomic risk factors for patient-handling injuries include exertion, frequency, posture, and duration of exposure.[66] Exertion is the force or effort required for task performance. In one study, nurses and patient care assistants were reported to have lifted 1.8 tons in an 8-hour shift, which is similar to lifting a small truck.[67] Patients are heavier, with 67% to 80% of people in the United States overweight, obese, or morbidly obese.[68] Obesity is a health care epidemic with additional comorbidities and complications increasing the exertion required for patient-handling tasks. Forces generated when manually lifting or repositioning patients can exceed safe workloads and put health care workers at risk for musculoskeletal injury.[69,70] Frequency is the number of times a task is performed. Boosting/turning and repositioning patients occur repetitively throughout a nurse's shift. Postural risks for patient-handling injuries include both awkward and static postures. Health care workers often must bend, reach, and twist to provide direct patient care. Working around medical equipment in limited space or statically holding awkward postures for patient care also contributes to patient-handling injuries. Duration of exposure includes the cumulative effect of exertion, repetition, and posture. Additional risk factors that contribute to patient-handling injuries in nurses are prolonged work hours, an older workforce, and increasing numbers of critically ill patients.[66]

Nurses and health care workers do an exceptional job taking care of their patients; however, they are not as diligent in their own self-care. The American Nurses Association completed a health risk appraisal from October 2013 to October 2016. Almost 11 000 nurses were included in the analysis. Results of the survey showed that the health of a registered nurse is worse than the average American's health when considering body mass index, sleep, nutrition, and levels of stress.[71] Nurses also tend to underreport their work injuries accepting that it is a part of their job.[72,73] In a recent American Nurses

Association survey, 8 out of 10 nurses reported working with musculoskeletal pain.[74] In that same survey, 62% of nurses reported concern of developing a musculoskeletal injury. Fifty-six percent of nurses reported that their musculoskeletal pain is made worse by their job.

Health care is the only industry that believes that 100 lb is light weight. Other industries use mechanical assistance to move their products, such as rollers, dollies, forklifts, and power jacks, yet health care workers frequently manual boost/turn and reposition their patients using only fabric incontinence pads. Manually moving patients puts both health care workers and patients at risk for injury.[6] The National Institute for Occupational Safety and Health has researched and documented the maximum weight limit for safe patient handling and a pushing and pulling.[75] Proper body mechanics alone will not prevent a patient-handling injury.[76] Although it is well documented that it is not safe to manually move patients (Marras et al[69] and Waters[70]), nurses continue to do so. They have not embraced a culture of safety for themselves.

What to do to achieve patient mobility and health care worker safety: big ideas

Safe patient-handling technologies for both in-bed mobility (friction-reducing slide sheets, bed in chair position) and out-of-bed mobility (ceiling and floor-based lifts, powered stand-assist devices, and nonpowered stand aids) must be viewed and utilized as personal protective equipment to keep the health care worker safe. Safe patient-handling technologies need to be readily available. A nurse will not take the time to retrieve technologies if they are not easily accessible. Multicomponent safe patient-handling programs have demonstrated positive effects on musculoskeletal health and are recommended as a practice to consider.[77,78]

Health care workers must move forward embracing a culture of safety for both their patients and themselves. With evidence-based practice when it is discovered that a practice is unsafe, the practice is changed. Nurses no longer recap needles for the risk of incurring a needle stick injury. Health care workers gown, glove, and mask before entering a room with respiratory exposures. The American Nurses Association collaborated with other health care professionals to develop Eight Interprofessional Standards of Care for Safe Patient Handling and Mobility.[63] The very first standard is establishing a culture of safety. A comprehensive safe patient-handling program is multifaceted requiring administrative, engineering, and behavioral controls.[79,80] Administrative controls include leadership support, policy, and budget. Engineering controls include safe patient-handling technologies, maintenance, and storage. Behavioral controls include education, communication, and peer coaching and creating and fostering a culture of safety. The safe patient handling and mobility (SPHM) peer coaches are frontline health care workers who have received additional education regarding the risks for WMSDs, superuser training on how to operate the SPHM technologies, and crucial conversation strategies to encourage their peers to use technologies.[81] Barriers to implementing a safe patient handling include perceptions that there is not enough time to get SPHM technology, there is not enough space to use it, and lack of understanding of the inherent risks from manual patient handling.[82] Peer coaches can be instrumental in facilitating culture change role modeling utilization of safe patient-handling behaviors.

Promoting culture change is not easy. It requires commitment and involvement with key stakeholders from the "C" suite to frontline direct patient care providers. A positive organizational safety climate, a people-oriented culture, and ergonomic practices have been identified as significant factors to promote safe patient-handling behaviors with hospital nurses.[83] Health care workers have to be educated and have confidence that using SPHM technologies is better for themselves and their patients.[84] Barriers that include interpersonal, situational, and organizational and environment issues must be overcome to increase the utilization of SPHM technologies.[82] Technologies must be readily available and easy to use and fit solutions to prevent falls and protect the skin and caregiver while achieving the mobility activity. Outcomes should be monitored and measured to reinforce program sustainability, both positive patient outcomes and reduction of health care worker injuries. Research has shown that comprehensive SPHM programs can reduce the number and severity of injuries to health care workers, lost time, and restricted duty days and associated costs.[84] When implementing comprehensive solutions, positive patient outcomes from SPHM programs include improved mobility, reduced risk of falls, reduced risk of pressure injury, and increased satisfaction with care.[82,85,86] The time to change is now for the safety of our health care workers and our patients.

SUMMARY

To achieve success in patient mobility, we must breakdown the silo improvement initiatives around patient safety and health-care worker safety. We must ensure that the front-line caregiver has integrative solutions that facilitate patient mobility while protecting the patient's skin from shear and pressure, preventing falls through improving conditioning, and providing the caregiver with the safe patient-handling tools to achieve in-bed and out-of-bed mobility. With comprehensive solutions, we will successfully achieve safe mobility for the acute and critically ill patient to impact ICU length of stay, hospital length of stay, time in delirium, reduced pressure injuries, and shorter time on mechanical ventilation.[87-92] The following series of articles will provide evidence-based strategies for mobility programs while ensuring safe patient handling.

REFERENCES

1. Ammouri AA, Tailakh AK, Muliira JK, Geethakrishnan R, Al Kindi SN. Patient safety culture among nurses. *Int Nurs Rev*. 2015;62:102-110.
2. Oster CA, Deakins S. Practical application of high reliability principles in healthcare to optimize quality and safety outcomes. *J Nurs Adm*. 2018;48(1):50-55.
3. Berwick DM, Feeley D, Loehrer S. Change from the inside out, healthcare leaders taking the helm. *JAMA*. 2015;313(17):1707-1708
4. Health Education and Research Trust Hospital Innovation Improvement Network. The UP campaign. www.HERT-HIIN.org. Published 2017. Accessed January 13, 2018.
5. Carayon P, Wetterneck TB, Rivera-Rodriguez AJ, et al. Human factor systems approach to healthcare quality and patient safety. *Appl Ergon*. 2014;45:14-25.
6. The Joint Commission. *Improving Patient and Worker Safety: Opportunities for Synergy, Collaboration and Innovation*. Oakbrook Terrace, IL: The Joint Commission; 2012. http://www.jointcommission.org/. Accessed January 13, 2018..
7. Morris PE. Moving our critically ill patients: mobility barriers and benefits. *Crit Care Clin*. 2007;23(1):1-20.
8. Hermans G, Mechelen HV, Clerckx B, et al. Acute outcomes and one-year mortality of intensive care unit acquired weakness: a cohort study and propensity matched analysis. *Am J Respir Crit Care Med*. 2014;190(4):410-420.
9. Herridge MS, Tansey CM, Matte A, et al. Functional disability 5 years after acute respiratory distress syndrome. *N Engl J Med*. 2011;364(14):1293-1304.
10. Hopkins RO, Weaver LK, Collingridge D, Parkinson RB, Chan KJ, Orme JF Jr. Two-year cognitive, emotional, and quality-of-life outcomes in acute respiratory distress syndrome. *Am J Respir Crit Care Med*. 2005;171(4):340-347.
11. Kress JP, Hall JB. ICU-acquire weakness and recovery from critical illness. *N Engl J Med*. 2014;370(17):1626-1634.
12. Fan E, Cheek F, Chlan L, et al.; ATS Committee on ICU-acquired Weakness in Adults. An official American Thoracic Society Clinical Practice guideline: the diagnosis of intensive care unit-acquired weakness in adults. *Am J Respir Crit Care Med*. 2014;190(12):1437-1446.
13. Pandharipande PP, Girard TD, Jackson JC, et al. Long-term cognitive impairment after critical illness. *N Engl J Med*. 2013;369(14):1306-1316.
14. Herridge MS, Cheung AM, Tansey CM, et al. One year outcomes in survivors of the acute respiratory distress syndrome. *N Engl J Med*. 2003;348(8):683-693.
15. Dowdy DW, Eid MP, Dennison CR, et al. Quality of life after acute respiratory distress syndrome: a meta-analysis. *Intensive Care Med*. 2006;32(8):1115-1124.

16. Truong AD, Fan E, Brower RG, Needham DM. Bench to bedside review: mobilizing patients in the intensive care unit-from pathophysiology to clinical trials. *Crit Care*. 2009;13:1-8.
17. Allen C, Glasziou P, Del Mar C. Bed rest: a potentially harmful treatment needing more careful evaluation. *Lancet*. 1999;354:1229-1233.
18. Fortney SM, Schneider VS, Greenleaf JE. *The Physiology of Bedrest*. Vol 2. New York, NY: Oxford University Press; 1996.
19. Greenleaf JE, Kozlowski S. Physiological consequences of reduced activity during bed rest. *Exerc Sport Sci Rev*. 1982;10:84-119.
20. Stevens RD, Dowdy DW, Michaels RK, Mendez-Tellez PA, Pronovost PJ, Needham DM. Neuromuscular dysfunction acquired in critical illness: a systematic review. *Intensive Care Med*. 2007;33(11):1876-1891.
21. Gosselink R, Bott J, Johnson M, et al. Physiotherapy for adults with critical illness: recommendations of the European Respiratory Society and European Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients. *Intensive Care Med*. 2008;34:1188-1199.
22. Convertino VA. Cardiovascular consequences of bed rest: effect on maximal oxygen uptake. *Med Sci Sports Exerc*. 1997,29:191-196.
23. Convertino V, Hung J, Goldwater D, DeBusk RF. Cardiovascular responses to exercise in middle-aged men after 10 days of bedrest. *Circulation*. 1982;65:134-140.
24. De Jonghe B, Sharshar T, Lefaucheur JP, et al. Paresis acquired in the intensive care unit: a prospective multicenter study. *JAMA*. 2002;288:2859-2867.
25. Hamburg NM, McMackin CJ, Huang AL, et al. Physical inactivity rapidly induces insulin resistance and microvascular dysfunction in healthy volunteers. *Arterioscler Thromb Vasc Biol*. 2007;27(12):2650-2656.
26. Pavy-LeTraon A, Heer M, Narici MV, Rittweger J, Vernikos J. From space to earth: advances in human physiology for 20 years of bed rest studies (1986-2006). *Eur J Appl Physiol*. 2007;101(2):143-194.
27. Ferrando AA, Lane HW, Stuart CA, Davis-Street J, Wolfe RR. Prolonged bed rest decreases skeletal muscle and whole body protein synthesis. *Am J Physiol*. 1996;270:E627-E633.
28. De Jonnghe B, Bastuji-Garin S, Durand MC, et al. Respiratory weakness is associated with limb weakness and delayed weaning in critical illness. *Crit Care Med*. 2007;39:2007-2015.
29. Kleinpell RM, Fletcher K, Jennings BM. Reducing functional decline in hospitalized elderly. In: Hughes RG, ed. *Patient Safety and Quality: An Evidence-Based Handbook for Nurses*. Rockville, MD: Agency for Healthcare Research and Quality; 2008:251-265. http://www.ncbi.nlm.nih.gov/books/NBK2629/. Accessed February 3, 2018.
30. Clavet H, Hébert PC, Fergusson D, Doucette S, Trudel G. Joint contracture following prolonged stays in the intensive care unit. *CMAJ*. 2008;178:691-697.
31. Clavet H, Doucette S, Trudel G. Joint contractures in the intensive care unit: quality of life and function 3.3 years after hospital discharge. *Disabil Rehabil*. 2015;37(3):207-213.
32. National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. In: Emily H, ed. *Prevention and Treatment of Pressure Ulcers: Clinical Practice Guideline*. Osborne Park, Western Australia: Cambridge Media; 2014.
33. Reddy M, Gill SS, Rochon PA. Preventing pressure ulcers: a systematic review. *JAMA*. 2006;296(8):974-983.
34. Gomez-Cabrera MC, Domenech E, Viña J. Moderate exercise is an antioxidant: upregulation of antioxidant genes by training. *Free Radic Biol Med*. 2008;44:126-131.
35. Winkelman C, Higgins PA, Chen YJK, Levine AD. Cytokines in chronically critically ill patients after activity and rest. *Biol Res Nurs*. 2007;8: 261-271.
36. Herridge MS, Batt J, Hopkins RO. The pathophysiology of long-term outcomes following critical illness. *Crit Care Clin*. 2008;24:179-199.
37. Krishnagopalan S, Johnson W, Low LL, Kaufman LJ. Body position of intensive care patients: clinical practice versus standards. *Crit Care Med*. 2002;30:2588-2592.
38. Goldhill DR, Badacsonyi A, Goldhill AA, Waldmann C. A prospective observational study of ICU patient position and frequency of turning. *Anaesthesia*. 2008;63:509-515.
39. Bakhru RN, McWilliams DJ, Wiebe DJ, Spuhler VJ, Schweickert WD. Intensive care unit structure variation and implications for early mobilization practices. An international survey. *Ann Am Thorac Soc*. 2016;13(9):1527-1537.
40. Jolley SE, Moss M, Needham DM, et al. Point prevalence study of mobilization practices for acute respiratory failure patients in the United States. *Crit Care Med*. 2017;45:205-215.
41. Jolley SE, Regan-Baggs J, Dickson RP, Hough CL. Medical intensive care unit clinician's attitudes and perceived barriers towards early mobilization of critically ill patients: a cross-sectional survey study. *BMC Anesthesiol*. 2014;14:84.
42. Vollman KM. Introduction to progressive mobility. *Crit Care Nurse*. 2010;30(2):S3-S5.
43. Pickham D, Berte N, Pihulic M, Valdez A, Mayer B, Desai M. Effect of a wearable patient sensor on care delivery for preventing pressure injuries in acutely ill adults: a pragmatic randomized clinical trial (LS-HAPI study). *Int J Nurs Stud*. 2017;80:12-19.
44. Gunningberg L, Sedin I, Andersson S, Pingel R. Pressure mapping to prevent pressure ulcers in a hospital setting: a pragmatic randomized controlled trial. *Int J Nurs Stud*. 2017;72:53-59.
45. Powers J. Two methods for turning and positioning and the effect on pressure ulcer development: a

comparison cohort study. *J Wound Ostomy Continence Nurs*. 2016;43(1):46-50.
46. Krapfl L, Langin J, Pike C, Pezzella P. Does incremental positioning (weight shifts) reduce pressure injuries in critical care patients? *J Wound Ostomy Continence Nurs*. 2017;44(4):319-323.
47. Kalowes P, Messina V, Li M. Five-layered soft silicone foam dressing to prevent pressure ulcers in the intensive care unit. *Am J Crit Care*. 2016;25(6):108-119.
48. Santamaria N, Gerdtz MF, Sage S, et al. A randomised controlled trial of the effectiveness of soft silicone foam multi-layered dressings in the prevention of sacral and heel pressure ulcers in trauma and critically ill patients: the border trial. *Int Wound J*. 2015;12(3):302-308.
49. Tayyib N, Coyer F, Lewis PA. Implementing a pressure ulcer prevention bundle in an adult intensive care. *Int Crit Care Nurs*. 2016;37:27-36.
50. Health Research & Educational Trust. *Preventing Patient Falls: A Systematic Approach From the Joint Commission Center for Transforming Healthcare Project*. Chicago, IL: Health Research & Educational Trust; 2016. www.hpoe.org. Accessed January 13, 2018.
51. Degelau J, Belz M, Bungum L, et al. Institute for clinical systems improvement. Prevention of falls acute care. Updated April 2012. https://www.icsi.org/guidelines__more/catalog_guidelines_and_more/catalog_guidelines/catalog_patient_safetyreliability_guidelines/falls/ Accessed January 3, 2018.
52. Dupree E, Fritz-Campiz A, Mushen D. A new approach to preventing falls with injury. *J Nurs Care Qual*. 2014;29(2):99-102.
53. Galbraith J, Butler JS, Memon AR, Dolan MA, Harty JA. Cost analysis of a falls prevention program in an orthopaedic setting. *Clin Orthop Relat Res*. 2011; 469(12):3462-3468.
54. Haines T, Hill AM, Hill KD, et al. Cost effectiveness of patient education for the prevention of fall in hospital: economic evaluation from a randomized controlled trial. *BMC Med*. 2013;11:135. doi:10.1186/1741-7015-11-135.
55. Flanders SA, Harrington L, Fowler RJ. Falls and patient mobility in critical care keeping patients and staff safe. *AACN Adv Crit Care*. 2009;20(3):267-276.
56. Hempel S, Newberry S, Wang Z, et al. Hospital fall prevention: a systematic review of implementation, components, adherence, and effectiveness. *J Am Geriatr Soc*. 2013;61(4):483-494. doi:10.1111/jgs.12169.
57. Cameron ID, Gillespie LD, Robertson MC, et al. Interventions for preventing falls in older people in care facilities and hospitals. *Cochrane Database Syst Rev*. 2012;12:CD005465. doi:10.1002/14651858.CD005465.pub3.
58. Matarese M, Ivziku D, Bartolozzi F, Piredda M, Demarinis MG. Systematic review of fall risk screening tools for older patients in acute hospitals. *J Adv Nurs*. 2015;71(6):1198-1209.
59. Avanecean D, Calliste D, Contreras T, Lim Y, Fitzpatrick A. Effectiveness of patient-centered interventions on falls in the acute care setting compared to usual care: a systematic review. *JBI Database System Rev Implement Rep*. 2017;15(12):3006-3048.
60. US Bureau of Labor Statistics, Department of Labor. *Survey of Occupational Injuries and Illnesses*. Washington, DC: US Bureau of Labor Statistics; 2014.
61. OSHA. Safe patient handling programs: effectiveness and cost savings. https://www.osha.gov/dsg/hospitals/documents/3.5_SPH_effectiveness_508.pdf. Published 2014. Accessed January 3, 2018.
62. Centers for Disease Control and Prevention. Safe patient handling. http://www.cdc.gov/niosh/topics/safepatient/. Published 2013. Accessed January 20, 2018.
63. American Nurses Association. *Safe Patient Handling and Mobility: Interprofessional National Standards*. Silver Spring, MD: American Nurses Association; 2013.
64. Aon Risk Solutions. Aon health care benchmarking and safe patient handling data. www.aon.comwcbarometer. Published 2016. Accessed February 20, 2018.
65. Gomma A, Tapp L, Luckhaupt S, et al. Occupational traumatic injuries among workers in health care facilities—United States, 2012-2014. *MMWR Morb-Mortal WklyRep*. 2015;64:405-410.
66. Fragala G, Boynton T, Conti M, et al. Patient-handling injuries: risk factors and risk-reduction strategies. *Am Nurse Today*. 2016;11(5):40-44.
67. Tuohy-Main K. Why manual handling should be eliminated for resident and carer safety. *Geriatrician*. 1997;15:10-14.
68. Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among US adults, 1999-2008. *J Am Med Assoc*. 2010;303(3):235-241.
69. Marras WS, Davis KG, Kirking BC, Bertsche PK. A comprehensive analysis of low-back disorder risk and spinal loading during transferring and repositioning of patients using different techniques. *Ergonomics*. 1999;42:904-926.
70. Waters TR. When is it safe to manually lift a patient? *Am J Nurs*. 2007;107(8):53-58.
71. American Nurses Association. Executive summary: American nurses association health risk appraisal. https://www.nursingworld.org/~4aeeeb/globalassets/practiceandpolicy/work-environment/health-safety/ana-healthriskappraisalsummary_2013-2016.pdf. Published 2017. Accessed April 20, 2018.
72. Gropelli TM, Corkle K. Nurses' and therapists' experiences with occupational musculoskeletal injuries. *AAOHN J*. 2010;58:159-166.

73. Menzel NN. Underreporting of musculoskeletal disorders among healthcare workers. *AAOHN J*. 2008;56:487-494.
74. American Nurses Association. ANA health and safety survey. http://www.nursingworld.org/MainMenuCategories/WorkplaceSafety/Healthy-Work-Environment/Work-Environment/2011-HealthSafetySurvey.html. Published 2013. Accessed January 20, 2018.
75. NIOSH Science Blog RSS. Preventing back injuries in health care settings. http://blogs.cdc.gov/niosh-science-blog/2008/09/22/lifting. Accessed February 20, 2018.
76. Hignett S, Crumpton E, Ruszala S, Alexander P, Fray M, Fletcher B. Evidence-based patient handling: systematic review. *Nurs Stand*. 2003;17:33-36.
77. Yassi A, Cooper J, Tate R, et al. A randomized controlled trial to prevent patient lift and transfer injuries of health care workers. *Spine*. 2001;26(16):1739-1746.
78. Tullar J, Brewer S, Amick B, et al. Occupational safety and health interventions to reduce musculoskeletal symptoms in the health care sector. *J Occup Rehabil*. 2010;20:199-219.
79. Nelson AL. Consequences of unsafe patient handling practices. In: Nelson AL, ed. *Safe Patient Handling and Movement: A Guide for Nurses and Other Health Care Providers* (pp 41-46). New York, NY: Springer; 2006.
80. Nelson A, Baptiste AS. Evidence-based practices for safe patient handling and movement. *Orthop Nurs*. 2006;25:366-378.
81. Zadvinskis I, Salsbury S. Effects of a multifaceted minimal-lift environment for nursing staff: pilot results. *West J Nurs Res*. 2010;31(1):47-63.
82. Noble N, Sweeney N. Barriers to the use of assistive devices in patient handling. *Workplace Health Saf*. 2017;66(1):41-49.
83. Lee S, Lee J. Safe patient handling behaviors and lift use among hospital nurses: a cross-sectional study. *Int J Nurs Stud*. 2017;74:53-60.
84. Olinski C, Norton C. Implementation of a safe patient handling program in a multihospital health system from inception to sustainability. *Workplace Health Saf*. 2017;65(11):546-559.
85. Facility Guidelines Institute. *Patient Handling and Movement Assessments: A White Paper*. https://www.fgiguidelines.org/resource/patient-handling-and-movement-assessments/. Published 2012. Accessed February 3, 2018.
86. Teeple E, Collins J, Shrestha S, Dennerlein J, Losina E, Katz J. Outcomes of safe patient handling and mobilization programs: a meta-analysis. *Work*. 2017;58(2):173-184.
87. Morris PE, Goad A, Thompson C, et al. Early intensive care mobility therapy in the treatment of acute respiratory failure. *Crit Care Med*. 2008;36:2238-2243.
88. Needham DM. Mobilizing patients in the intensive care unit: improving neuromuscular weakness and physical function. *JAMA*. 2008;300(14):1685-1690.
89. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. *Lancet*. 2009;373(9678):1874-1882.
90. Thomsen GE, Snow GL, Rodriguez L, Hopkins RO. Patients with respiratory failure increase ambulation after transfer to an intensive care unit where early activity is a priority. *Crit Care Med*. 2008;36:1119-1124.
91. McWilliams D, Weblin J, Atkins G, et al. Enhancing rehabilitation of mechanically ventilated patients in the intensive care unit: a quality improvement project. *J Crit Care*. 2015;30(1):13-18.
92. Meyers T. Prevention of heel pressure injuries and plantar flexion contractures with use of a heel protector in high-risk neurotrauma, medical, and surgical intensive care units: a randomized controlled trial. *J Wound Ostomy Continence Nurs*. 2017;44(5):429-433.