Safe-Patient-Handling Equipment in Therapy Practice: Implications for Rehabilitation

Amy R. Darragh, Marc A. Campo, Lenore Frost, Melissa Miller, Marissa Pentico, Heather Margulis

MeSH TERMS
- equipment safety
- moving and lifting patients
- occupational therapy
- physical therapy modalities
- rehabilitation

OBJECTIVE. To determine how safe-patient-handling (SPH) equipment is used in rehabilitation and how it affects therapists, patients, and therapy practice.

METHOD. We used a qualitative, instrumental case study design. Thirty-five occupational and physical therapist practitioners from three facilities participated in the study.

RESULTS. Therapists reported a broad range of applications for equipment (e.g., functional mobility and neuromusculoskeletal function). They reported that SPH equipment increased treatment options for therapists and increased participation options for patients, although equipment limitations exist. Three themes emerged from the analysis: choice, potential, and safety.

CONCLUSION. SPH equipment has therapeutic applications in rehabilitation, especially for medically complex or bariatric patients. Therapists in this study engaged in a highly individualized, complex process of decision making when selecting and using SPH devices in rehabilitation. More research to refine and test therapeutic uses is necessary.

Darragh, A. R., Campo, M. A., Frost, L., Miller, M., Pentico, M., & Margulis, H. (2013). Safe-patient-handling equipment in therapy practice: Implications for rehabilitation. *American Journal of Occupational Therapy, 67,* 45–53. http://dx.doi.org/10.5014/ajot.2013.005389

Amy R. Darragh, PhD, OTR/L, is Assistant Professor, Occupational Therapy Division, School of Health and Rehabilitation Sciences The Ohio State University, 453 West 10th Avenue, Columbus, OH 43210; Darragh.6@osu.edu

Marc A. Campo, PhD, PT, is Professor, Physical Therapy Program, Division of Health Professions, Mercy College, Dobbs Ferry, NY.

Lenore Frost, PhD, OTR/L, CHT, is Clinical Assistant Professor, Occupational Therapy Department, Sacred Heart University, Fairfield, CT.

Melissa Miller, MOT, is Occupational Therapist, Miami Valley Hospital, Dayton, OH.

Marissa Pentico, MS, OT/L, is Ergonomics Coordinator, Duke Occupational and Environmental Safety Office, Duke University and Health System, Durham, NC.

Heather Margulis, MSPT, is Associate Director of Rehabilitation Services, Hebrew Senior Life, Boston.

Work-related musculoskeletal disorders (WMSDs), including moderate to severe work-related pain or injury, constitute 29% of occupational injuries and illnesses in the United States (Bureau of Labor Statistics, 2011) and are a threat to the health of occupational therapists and physical therapists (Campo, Weiser, Koenig, & Nordin, 2008; Darragh, Huddleston, & King, 2009; Rice, Dusseau, & Kopp Miller, 2011). As many as 27% of occupational and physical therapists report work-related injuries or moderate to severe work-related musculoskeletal symptoms each year (Campo et al., 2008; Darragh, Huddleston, & King, 2009).

Many of the WMSDs among therapists result from manual patient handling and related activities (Alnaser, 2009; Campo et al., 2008; Hignett, 2001). Similarly, nurses are most commonly injured while repositioning, lifting, and transferring patients (Nelson et al., 2006). In response to high injury rates in nursing, safe-patient-handling (SPH) programs have been implemented in health care facilities across the country and have successfully decreased injury incidence, severity, and costs to both nurses and patients (Bos, Krol, Van Der Star, & Groothoff, 2006; Collins, Wolf, Bell, & Evanoff, 2004; Evanoff, Wolf, Aton, Canos, & Collins, 2003; Nelson et al., 2006).

Justification for SPH programs is derived from two key areas of research. First, proper body mechanics when transferring, lifting, repositioning, or otherwise moving patients do not prevent WMSDs (Hignett et al., 2003; Marras, Davis, Kirking, & Bertsche, 1999). Second, ergonomic approaches, such as policies that limit the weight that staff can lift, use of SPH equipment (e.g., ceiling lifts, floor-based lifts, sit-to-stand devices, lateral transfer aids, and adjustable hospital beds), patient assessment, and use of algorithms to guide

equipment selection do reduce WMSDs among health care workers (Collins et al., 2004; Evanoff et al., 2003; Nelson, Motacki, & Menzel, 2009).

Given that occupational and physical therapists routinely move, handle, and transfer patients, SPH programs could be an option to reduce the risk of WMSDs. However, therapists have expressed concern that the use of SPH equipment may impede their patients' recovery (Darragh, Campo, & Olson, 2009; Waters & Rockefeller, 2010). This worry is legitimate; SPH equipment was designed to reduce physical effort during handling tasks but not necessarily to enhance rehabilitation (Waters & Rockefeller, 2010). A study of stand-assist devices, for example, found that they are preferable to a poorly executed manual transfer but may prevent patients from moving with normal movement patterns and may promote passive participation in the transfer (Ruszala & Musa, 2005).

In contrast, two recent pilot studies have suggested that these devices may benefit rehabilitation practice. Arnold, Radawiec, Campo, and Wright (2011) reported that patients who underwent rehabilitation with an SPH program in place showed greater improvements in FIM™ mobility scores than patients who underwent rehabilitation without an SPH program. Darragh, Campo, and Olson (2009) found that therapists using SPH equipment during intervention identified SPH devices as particularly helpful for bariatric, dependent, or debilitated patients. However, the way in which SPH equipment was integrated into therapy practice has not been fully defined, and clinical experts' perceptions of the effect of the equipment on rehabilitation practice has not been systematically examined. Given occupational and physical therapists' vulnerability to WMSDs and the potential of SPH programs both to protect therapists and to preserve their patients' functional recovery, research into the use of SPH equipment in rehabilitation must be conducted.

The purpose of this project was to determine how therapists who have integrated SPH equipment into rehabilitation use these devices and how this use affects therapy practice. The project addressed the following questions: (1) How is SPH equipment used by occupational and physical therapy personnel in rehabilitation, and (2) how does the use of equipment affect rehabilitation practice?

Method

Research Design

This study had a qualitative, instrumental case study design (Baxter & Jack, 2008; Stake, 1995). The research was approved by the Office of Responsible Research at The Ohio State University, the Institutional Review Board at Mercy College, and the Institutional Review Board at Sacred Heart University. Participants received, reviewed, and signed informed consent documents before participation in the study. Therapists each received a $50.00 gift card for their participation.

Study Participants

Occupational and physical therapy professionals were recruited for the study from three health care facilities located in the eastern United States. We used purposeful sampling of facilities to ensure recruitment of therapists experienced in the use of SPH equipment. The facilities were chosen because they provided inpatient rehabilitation services; had SPH policies in place; had installed SPH equipment in patient rooms, rehabilitation areas, or both; and had active participation from therapists. They were identified through word of mouth as well as through contacts at a national SPH conference. Participants met the following inclusion criteria: licensed occupational therapist, certified occupational therapy assistant, licensed physical therapist, or licensed physical therapist assistant; working in inpatient rehabilitation; and using SPH equipment as part of therapeutic intervention for ≥1 yr.

Procedure

Focus groups occurred at the facilities and lasted between 1 and 2 hr. Six to 10 participants attended each group. Using a preestablished interview guide, investigators asked participants to address four primary questions about their use of the equipment in therapy (Figure 1). Darragh and Campo developed the interview guide questions on the basis of their prior research in this area (Darragh, Campo, & Olson, 2009) and of a review of the literature. To ensure uniformity during the focus groups, either Campo or Darragh served as lead facilitator for each group, and the other served as scribe and backup facilitator. The discussions were audiotaped, transcribed, and checked against the recordings for accuracy. In addition, the investigators toured each facility, viewed the SPH policy, and viewed the equipment used by rehabilitation staff.

- How are physical therapists and occupational therapists using safe-patient-handling equipment in rehabilitation and acute care settings?
- In what ways, if any, does the use of safe-patient-handling equipment affect your patient care?
- Is there an effect on your time?
- In what ways, if any, does the use of safe-patient-handling equipment affect you, the therapist?

Figure 1. Interview guide questions.

Data Analysis

We used a qualitative approach to analyze the participants' discussions using NVivo, Version 8 (QSR International, Burlington, MA) to organize and categorize the data. Specifically, we used a cross-case analysis, in which participant responses to interview topics are grouped together and coded (Patton, 1990). Three members of the research team independently read and coded the transcripts. Using a method of constant comparison, data were compared with codes and categories emerging throughout the analysis (Glazer & Strauss, 1967). We used this method to systematically identify codes, aggregate them into larger categories, and identify the larger framework encompassing the intersection of equipment use, patient characteristics, and overall effects on therapist and patient. The final coding scheme and thematic layers were established through multiple consensus meetings.

Strategies for Achieving Trustworthiness

Multiple verification procedures were used throughout the study to improve the trustworthiness of the data and results. Initially, we reflected on and bracketed personal and professional biases that could affect the interviews and the analysis. We examined focus group questions and interpretations of the data for undue influence of these biases throughout the analytic process (Creswell, 1998).

Two forms of triangulation, triangulation of observers and analysts, were used to strengthen the analysis (Patton, 1990). To triangulate the observers, at least two investigators experienced with group facilitation were present at all interviews. Triangulation of analysts was also used (Patton, 1990). Multiple team members analyzed the data using a systematic process of independent coding and consensus meetings until the final thematic model was complete.

Data were checked for representativeness (Miles & Huberman, 1994) to be sure that themes were supported by quotes from all groups and both professional disciplines. We checked that high-impact stories (e.g., the ones we tended to remember) were supported by similar examples from across groups and were not overweighted in the analysis. Negative evidence was coded and included in the analyses (Miles & Huberman, 1994).

Results

Thirty-five therapists participated in the study: 14 physical therapists, 4 physical therapy assistants, 14 occupational therapists, and 1 certified occupational therapy assistant (2 did not supply their professional affiliation). Thirty-one women and 4 men with a mean age of 34 yr and an average of 10 yr experience participated in the study. The SPH programs had been in place for 5 yr in two of the facilities and 3 yr in another. Each facility provided guidelines to help therapists determine which patients required SPH equipment. One program, for example, required equipment for any patient needing more than minimal (25%) assist with bed mobility, sitting, standing, transferring, or ambulating. Another program used the National Institute for Occupational Safety and Health recommendation that therapists avoid lifting >35 lb of patient weight.

Across facilities, therapists used the equipment with 10%–25% of their caseload. In general, they used equipment with patients who were low level, dependent, and bariatric who had diagnoses such as stroke, amputation, spinal cord injury, cancer, multiple sclerosis, and general debilitation. They used a wide range of equipment, including mechanical devices (e.g., ceiling lift, floor-based lift, sit-to-stand device), nonmechanized devices (e.g., friction-reducing sheets), and standard therapy equipment that is typically included as part of SPH (e.g., gait belt). The data analysis revealed three major themes related to the question of how the equipment is used in and affects rehabilitation: choice, potential, and safety.

Choice

Choice involves how therapists decided to use equipment, appropriately and effectively, with patients. Integrating equipment into therapy with those patients who required it was a highly individualized and complex process. Equipment selection was based on the physical, behavioral, and cognitive–perceptual characteristics of each patient; features of each device; time and environmental demands; and potential uses of each device. Although each facility had algorithms, guidelines, or both, selecting and using equipment required consideration of multiple factors.

Patient Considerations. The therapists included physical characteristics (e.g., patient weight, level of functioning, weight-bearing status) and the patient's physical status (e.g., fatigue, balance, tone, joint issues, posture, and strength) in their decision making. The presence of wounds or lines also affected the choice of equipment or sling. For example, abdominal drains or incisions precluded the use of slings that attached around the waist.

Behaviors such as agitation and anxiety affected equipment use and selection. Some patients had a fear of equipment—for example, the way it looked or sounded or merely the idea of being suspended in a sling. In other cases, characteristics of certain devices helped patients feel safer—for example, "That something big is in front of her and it's sturdy is helpful anxiety-wise."

Cognitive and perceptual skills were also considered. For example, therapists took into account a patient's ability to follow commands and understand directions. Perceptual deficits such as spatial inattention and visual–perceptual deficits influenced which device might be used.

Equipment Considerations. The therapists weighed the equipment's potential uses. They used the equipment to promote patient activity and participation and to passively move patients (Table 1). Functional mobility was the most commonly reported therapeutic use for SPH equipment (Table 2) and included transfer training, functional ambulation, and facilitation of bed mobility. Other therapeutic uses included gait training and, less frequently, activities such as dressing and bathing. Therapists also used equipment when focusing on neuromusculoskeletal and mental functions that affected performance. The equipment served as external support during balance, weight-shift, weight-bearing, and posture activities. Therapists also used it when addressing attention, divided attention, unilateral neglect, visual perception, and visual discrimination. Therapists had some disagreement over use of equipment with patients with perceptual deficits, such as spatial inattention, and whether slings provided inappropriate feedback.

Passive mobility was the second most common use of SPH equipment. Both occupational therapy practitioners and physical therapy practitioners moved patients passively because, for example, the patient was too fatigued to participate, the transfer was not part of the treatment plan, or the patient required repositioning in a wheelchair.

The therapists considered the limitations of the SPH devices. Some limitations were by design—for example, weight requirements, level of independence, lower-extremity weight bearing, or upper-extremity range of motion. Other limitations included difficulty with maneuverability, difficulty adjusting slings, and poor fit. When comparing floor-based and ceiling lifts, therapists reported a preference for ceiling lifts because they were easier to maneuver in the environment and with patients in them.

Some patients refused to use lifts, expressed fear of the lifts, found them uncomfortable, or just did not like them. A minority of therapists expressed concerns that lifts promoted passivity or deemphasized transfer training and that a patient's ability to participate while in the equipment should be considered.

Time and Environmental Considerations. The time demands associated with SPH equipment varied among therapists, facilities, and even devices. Therapists who were

Table 1. Equipment Descriptions and Uses (U.S. Department of Veterans Affairs, VISN8 Patient Safety Center of Inquiry, 2012)

Equipment Type and Definition[a]	Equipment Uses	Therapist Examples
Ceiling lift: Lift device mounted on tracks on the ceiling or walls; can be used as dependent lift and transfer device	Bathing; dressing; functional mobility; gait training; mental functions; neuromusculoskeletal functions; passively move, transfer, or reposition	"If they're pushing or leaning to one side, you can get a mirror in front of them and standing fully upright. You can allow the lift to pick them up so their legs can be straight and they aren't slumped, and you can align their posture better, too."
Floor lift: floor-based, portable lift device with a frame; can be used as dependent lift and transfer device	Dressing; functional mobility; neuromusculoskeletal functions; passively move, transfer, or reposition; therapeutic exercise	"I have used the [floor] lift more for the reason of finding the best way, especially if I'm doing bed mobility and we come to [the] edge of bed and we come to supine sit and it was [moderate–maximum] assist and now the expectation is I'm going to have that person dress. They need to stand to do lower body dressing to pull up their pants; I am probably not going to try and do that without a lift."
Sit-to-stand lift: floor-based lift device for transferring patient between surfaces, sit-to-stand, and ambulation	Dressing, functional mobility, gait training, grooming, mental functions, neuromusculoskeletal functions, passive transfer	"In acute care, we co-treat a lot with more heavy duty or complicated patients. . . . The [physical therapist] is behind them doing midline shifting cues, the [occupational therapist] is in front of them engaging their upper body so they multitask. They try to keep their balance, maintain their midline, follow through with commands, and track all at the same time."
Lateral Transfer Aids		
Friction-reducing sheets: Sheet, tube, or other shape designed to reduce the physical demand of lateral transfers or repositioning	Dressing, functional mobility, therapeutic exercise, passively move or reposition	"You can . . . put them over a slide board and have less friction." "Then when you try to do therapeutic exercise with a patient who doesn't have the lower extremity strength to resist gravity without assist, you can put our tubes underneath. Have them do abduction, hip slide."
Air assisted: Portable air supply is attached to transfer aid, mattress inflates.	Functional mobility; passively move, reposition, or transfer	"We can use it for assisting with rolling by deflating one side with the therapist's upper body and the patient can assist by pulling to that side."

[a]Equipment types and definitions are standard definitions developed by the Patient Safety Center of Inquiry in Tampa, FL. See the center's *Technology Resource Guide* at www.visn8.va.gov/VISN8/PatientSafetyCenter/safePtHandling/TechnologyResourceGuide_041612.doc for more information

Table 2. Commonly Identified Uses of Safe-Patient-Handling (SPH) Equipment in Therapy

Treatment Goal	Use of SPH
Functional mobility	Transfer training, ambulation, repositioning and bed mobility
Passive mobility	Passive transfer, lift, reposition, move
Neuromusculoskeletal function Gait training	Postural alignment, weight shift, strength, balance, oculomotor exercise, therapeutic exercise
Mental function	Cognitive and perceptual activities
Activities of daily living	Other than functional mobility

Note. Treatment goals are listed in descending frequency of use of SPH equipment.

using ceiling lifts stated that ceiling lifts improved their efficiency, especially compared with the floor-based lifts, as did having equipment available in both patient rooms and treatment areas.

Others reported that using equipment decreased their efficiency and that manual transfers were faster. Issues such as set-up time and initial comfort with the device affected overall efficiency. Retrieving equipment from another location added time and required preplanning.

Environmental factors played a role in equipment use. Some lifts did not fit under the beds or were difficult to manage when patients had multiple tubes and drains. Crowded or limited space had an impact on the use of equipment, as did availability.

Potential

A recurring theme throughout our analysis was that of *potential,* a term referring to the possibilities and options for rehabilitation. Therapists using SPH equipment experienced increased options in therapy, accomplished more, and mobilized patients earlier in their recovery. Patients increased their participation and activity. Equipment had particular benefits for those who were bariatric, had medically complex conditions, or were dependent. One therapist voiced a reality of current practice: "Well, the trends of our patients are they are much bigger, much acutely sicker, and they still want us getting them up every day."

Patients with whom SPH equipment was used participated more and were more active during their rehabilitation: "Actually, she felt so much better standing and she was able to walk. It improved her mood and she was able to participate more." Patients also increased their activity. They spent more time out of bed, were up more frequently, and participated in more strenuous activities: "They are better able to do therapeutic activities more frequently." The more complex or bariatric patients participated in activities previously unavailable to them:

> I had a patient, too, who was heavier, and we would not have been able to stand him up. He loved the overhead sling because we were able to work on sit to stand where physically there was no way that even with two or three therapists that we could get him up.

For therapists, the equipment provided new treatment options and increased their creativity. As one therapist asserted, "We have been limited in what we can do in this profession. Now there is something for everybody."

Therapists mobilized patients earlier in the rehabilitation process—"It [equipment] definitely gets us moving them sooner in their stage of recovery"—which was especially important for the lower-level or bariatric patients: "I think it [lift equipment] opens huge possibilities for our bariatric population." Patients with obesity or medically complex conditions were able to do more in therapy. Having SPH equipment increased therapist treatment options: "Without the machine, we would have a PT and OT getting them [heavy or medically complex patients] to stand, and that's all we would be able to do." Also, patients were able to participate sooner:

> As far as mobilizing patients earlier, even patients weighing 600 pounds, we are able to mobilize fairly quickly, whereas previous jobs I have seen, bariatric patients are left in bed because they just don't have the equipment to get them out of bed.

Therapists accomplished more in therapy sessions—"Before, we would have done what we could in the bed and probably not done nearly as much, but now we do a lot more"—which gave them more choices: "We do more tasks and activities."

Therapists, therefore, were no longer the limiting factor, and patients were working to their potential, not the therapist's. Many therapists credited the equipment with freeing up their hands, which meant that treatment was not limited by their physical ability to hold someone. The lift provided external stability, allowing therapists to use their hands for other aspects of treatment: "I also feel that it helps us. It frees our hands to give facilitation cues so you're not holding them. You can cue them for their posture and weight shifts, and things like that."

Safety and Security

Safety refers to specific statements that therapists made regarding prevention of injury to therapists and patients

and about patient falls, skin breakdown, or debilitation. *Security* refers to therapists' perceptions of how patients viewed safety when using the lifts. Related to safety and security were perceptions of fatigue, pain, and strain.

Safety. Therapists reported that, overall, patients were safer with the devices. The general consensus was that "falls have definitely gone down." Lifts offered protection when therapists were concerned someone might fall during ambulation, transfer training, or activities of daily living (ADL) training:

> In rehab, I have used [sit-to-stand device] for walking with a patient who would go good distances, but his knee could buckle at any time without warning. Having [sit-to-stand device] in the room was much more assuring for both of us. He was a big guy, so if he buckled, there was no way I could hold him.

Skin protection was a benefit of SPH equipment. Using friction-reducing devices preserved skin integrity:

> Going back to the [friction-reducing devices], . . . the Stage 4 ulcers, whatever skin integrity issues they have, they work 10 times better than using a Chuck. You can reposition them and have significantly less friction on somebody who has skin integrity issues.

Equipment in general prevented consequences of too much time in bed: "I think it's a good prevention tool, preventing them from overshearing the skin or preventing them from laying in bed not doing much, getting pneumonias." However, when equipment was not used properly, it reduced patient safety: "A lot of times they [health care workers] don't buckle that [sit-to-stand device]. They [patients] just go right through that sling.

The consensus was that the devices improved staff safety. The SPH equipment contributed to overall safety at work and decreased the risk of injury: "It just makes you feel so much safer and less chance of injury." Many referred to their patients' size and dependency and how the lifts assisted with this particular population: "I just feel much safer using the lifts for people that are going to be max assist or that are way bigger than me and very weak."

Security. Most patients experienced a greater sense of security when their therapists used equipment:

> They're also more willing to do things that are a little riskier because they do have that sense of security, they're willing to go a little out of their comfort zone as opposed to when we're holding them up, they're really not—they stand there and don't do anything.

They felt comfortable and safe with the equipment, which allowed them to work harder in rehabilitation. For some patients, however, an adverse event in a lift left them scared or distrustful of the lift, and this fear had to be considered: "I had one who refused for a short period because something had gone funny with the lift and they were trying to transfer her and it froze midway. After that she said, 'I'm not using that.'"

Fatigue, Pain, and Strain. Therapists experienced less fatigue at work—"I'm not as tired [when using ceiling lift]"—and outside of work—"You have more energy outside of work to do things you would like to do." Work-related pain also decreased: "My back doesn't hurt quite as much from having to do so much heavy lifting." SPH equipment was designed to reduce the physical strain associated with patient-handling activities, and for the most part, therapists reported decreased physical demand at work:

> It promotes overall safety, and when we talk about the safety of everyone, I think there's less strain on the therapist, and we can use our energy in assisting the patient in supported sitting or whatever the task might be, so it conserves our energy.

Again, the benefits of the equipment were pronounced with dependent and bariatric patients: "If I was walking someone who was a max assist, it would take everything in me to walk them 5 feet. Now I can walk them 30 feet, and it isn't nearly as taxing on the patient or myself."

Many therapists reported that the ceiling lifts, in particular, reduced physical demand compared with both manual transfers and floor-based lifts. Floor lifts and sit-to-stand devices were harder to move, particularly between floors or units, and could actually increase physical demand:

> With the portable lift, you're twisting and tweaking your back just moving it, depending on the size of the patient and if there's any knee involvement. Trying to get their legs split between that bar is very difficult on the regular floor lift.

Confined environments and patient equipment (e.g., drains, IV poles) contributed to difficulties with using the equipment:

> Sometimes it is an issue on our floor because [of] whatever you're contending with—the commode, the bed, the wheelchair, and the four IV poles that they have. It's terrible. It can be difficult to move patients in the [sit-to-stand device] with all that stuff.

Discussion

The purpose of this study was to identify how SPH equipment is used in rehabilitation and to describe how this equipment affects therapy practice. Therapists reported that they were able to do more for their patients, particularly dependent or bariatric patients for whom they had limited

options before the equipment was introduced. This finding is consistent with our pilot work, in which therapists reported that the devices were useful with debilitated or low-level patients (Darragh, Campo, & Olson, 2009), and with Arnold et al. (2011), who found that implementation of an SPH program in rehabilitation improved the functional mobility FIM scores among adults with stroke.

Therapists used SPH equipment to facilitate therapeutic activity, primarily when addressing functional mobility and neuromusculoskeletal functions, as well as for passive transfers, lifts, or repositioning. They identified applications for mental functions and ADLs, but these applications were mentioned much less frequently. They moved beyond facility guidelines to make decisions about how and for what purpose a device should be used in treatment. To appropriately integrate equipment, therapists accounted for patients' physical, behavioral, and cognitive–perceptual characteristics; the environment, limitations, and potential uses of the equipment; and the therapeutic potential and safety improvements resulting from equipment use (Figure 2). This process of clinical reasoning follows the model created by Mattingly and Fleming (1994) in that therapists used *procedural* reasoning (consideration of patients' mental and physical status), *interactive* reasoning (individual characteristics; e.g., personal background, values, context), and *conditional* reasoning (future potential; e.g., the patient's prognosis and potential) to decide which equipment to select. Their knowledge about the therapeutic potential of devices influenced their decisions, as did their understanding of the safety benefits to themselves and their patients.

Therapists reported mobilizing heavier and dependent patients more often, earlier, and more safely than they could without the equipment, thus increasing the range of patients amenable to therapy and rehabilitation. Approximately one-third (33.8%) of U.S. adults are obese, and two-thirds (68%) are overweight or obese (Flegal, Carroll, Ogden, & Curtin, 2010). Adults with obesity are at risk of developing medical conditions that are commonly addressed by rehabilitation personnel, such as coronary heart disease, stroke, type 2 diabetes, or osteoarthritis (Centers for Disease Control & Prevention, 2011). Of course, they may also require therapy services for conditions unrelated to their weight status, such as traumatic injury. SPH equipment provides a way for therapists to mobilize these individuals safely and offer opportunities for increased activity and effort. By providing external support, these devices have the potential to allow patients to practice tasks, increase ambulation and mobility, improve endurance, and participate in activities meaningful to them.

Therapists experienced decreased pain and fatigue, decreased risk of injury, and less physical demand at work. SPH equipment was specifically designed to reduce physical demands associated with moving patients, so this outcome was not unexpected. This effect persisted even when therapists used the equipment in nontypical ways. However, the therapists commented on instances in which the equipment did not reduce demands, usually in relation to moving the equipment during an activity, sometimes in relation to environmental demands (e.g., limited clearance under hospital beds). This finding speaks to the importance of therapist participation in the selection and trial of equipment for purchase and therapist involvement in the design and fabrication of SPH devices for therapeutic use.

Therapists used multiple types of equipment with patients, including friction-reducing devices, slide boards, gait belts, sit-to-stand devices, floor-based lifts, and ceiling lifts. All these devices were used in therapy, but therapists did seem to have a preference for ceiling lifts over floor-based lifts, especially therapists whose facility had transitioned from floor lifts to ceiling lifts. Therapists' preference for ceiling lifts over floor lifts was based on ease of maneuverability, flexibility of use, and time savings. This

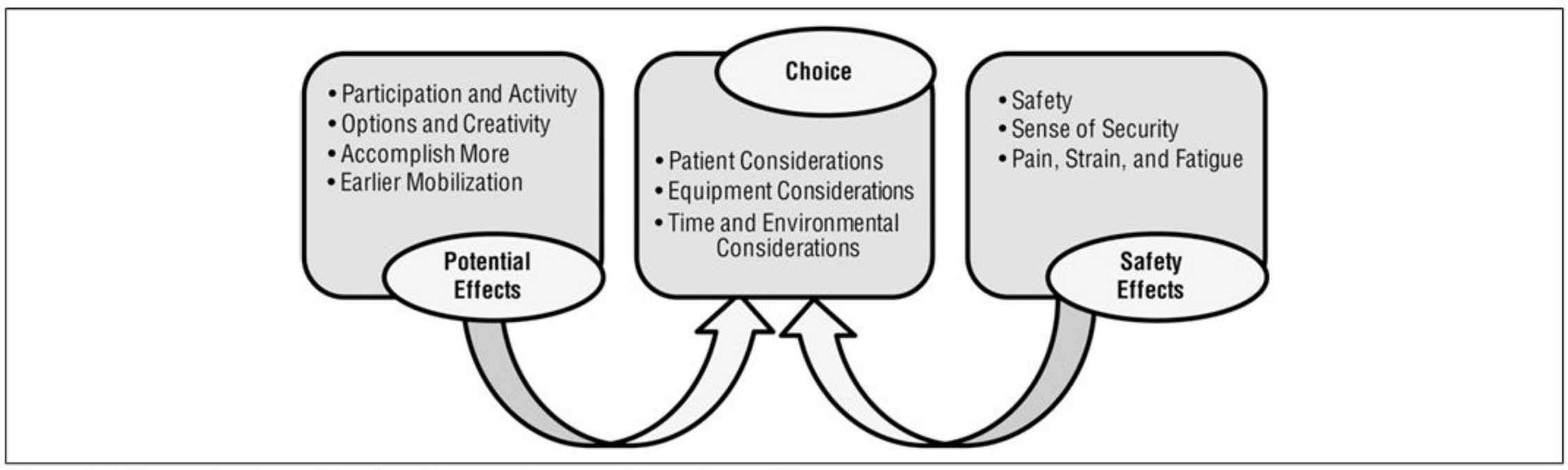

Figure 2. Effects of safe-patient-handling equipment: Thematic model.

finding is supported by research demonstrating that ceiling lifts are easier to maneuver than floor-based lifts (Marras, Knapik, & Ferguson, 2009; Rice, Woolley, & Waters, 2009; Zhuang, Stobbe, Hsiao, Collins, & Hobbs, 1999). Ceiling lifts require less force to push and pull than floor-based lifts and motorized sit-to-stand devices (Zhuang et al., 1999). Rice et al. (2009) reported that ceiling lifts require 50%–75% less force to push or pull than floor-based lifts and that during rotational movement, the torque required to move floor-based lifts is 10 times that required to operate ceiling lifts. Marras et al. (2009) found that anterior–posterior shear forces on the lumbar spine while operating floor-based lifts were of sufficient magnitude to produce damage to spinal discs, especially when pushing and turning the floor lift, as opposed to operating ceiling lifts, in which forces were generally within safe limits. Given this evidence, it is not a surprise that therapists viewed ceiling lifts favorably, particularly those therapists whose floor-based lifts were replaced by ceiling lifts.

Implications for Occupational Therapy Practice

This study suggests that SPH equipment, when used in rehabilitation, may

- Promote early and more mobilization of patients,
- Provide more options for activities and therapeutic interventions among therapists with bariatric and dependent patients, and
- Allow patients and therapists to more safely participate in therapy sessions.

In addition, this study indicates that SPH equipment

- Requires therapists to engage in complex clinical reasoning skills for appropriate and effective integration of the equipment into rehabilitation;
- Has important limitations when used in therapy practice, such as maneuverability, patient positioning, and sling fit and adjustability, that require careful consideration before use; and
- Should be used by therapists who have received training in how to use the equipment properly and safely, as was the case for the therapists included in this study.

Study Limitations

This study has several important limitations. Generalization is limited because of the qualitative methodology. The use of multiple settings, with diverse programs, assists with generalization, but larger studies are needed. Therapists in the study were either required or strongly encouraged to use equipment. Given these cultural and policy expectations, they may have been motivated to find ways to make it work in rehabilitation, which may not be true for all settings. In our pilot study (Darragh, Campo, & Olson, 2009), therapists were not required to use equipment, and although they identified applications for lower functioning patients, they expressed more reservations than did the current participants. This study was not intended to present objective measures of usefulness or effect but instead to emphasize the perceptions and experiences of therapists who are using the equipment on a daily basis. Quantitative studies are needed, particularly experimental and quasi-experimental studies comparing patient outcomes when SPH equipment is and is not used.

Research Implications

This study is a small step toward developing and testing SPH equipment in rehabilitation. This area of inquiry is in its infancy, and quantitative studies are needed for further exploration and to complement this study. Studies to test the usefulness of these devices during discrete therapeutic activities such as functional mobility, bathing, dressing, and gait training, as well as their impact on patient participation and activity level, are critical. We must also examine the effects of SPH equipment on rehabilitation outcomes to verify that it does not interfere with patient recovery. Additionally, research and development of SPH equipment specifically designed for therapeutic activity will be critical to therapist safety and patient recovery. SPH equipment has the potential to profoundly change rehabilitation practice, but devices, methods, and applications must be firmly established. ▲

Acknowledgments

This project was supported in part by a Mercy College faculty development grant. Study findings were presented at the Safe Patient Handling and Movement Conference, Orlando, FL, in March 2012 and at the AOTA Annual Conference & Expo in Indianapolis, IN, in April 2012.

References

Alnaser, M. Z. (2009). Psychosocial issues of work-related musculoskeletal injuries and adaptation: A phenomenological study. *Work, 32,* 123–132.

Arnold, M., Radawiec, S., Campo, M., & Wright, L. R. (2011). Changes in Functional Independence Measure ratings associated with a safe patient handling and movement program. *Rehabilitation Nursing, 36,* 138–144. http://dx.doi.org/10.1002/j.2048-7940.2011.tb00081.x

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *Qualitative Report, 13,* 544–559.

Bos, E. H., Krol, B., Van Der Star, A., & Groothoff, J. W. (2006). The effects of occupational interventions on reduction of musculoskeletal symptoms in the nursing profession. *Ergonomics, 49,* 706–723. http://dx.doi.org/10.1080/00140130600578005

Bureau of Labor Statistics. (2011). *Nonfatal occupational injuries and illnesses requiring days away from work, 2010* [Press release]. Retrieved January 9, 2012, from www.bls.gov/news.release/archives/osh2_11092011.pdf

Campo, M., Weiser, S., Koenig, K. L., & Nordin, M. (2008). Work-related musculoskeletal disorders in physical therapists: A prospective cohort study with 1-year follow-up. *Physical Therapy, 88,* 608–619. http://dx.doi.org/10.2522/ptj.20070127

Centers for Disease Control and Prevention. (2011). *Adult obesity facts.* Retrieved July 19, 2011, from www.cdc.gov/obesity/data/adult.html

Collins, J. W., Wolf, L., Bell, J., & Evanoff, B. (2004). An evaluation of a "best practices" musculoskeletal injury prevention program in nursing homes. *Injury Prevention, 10,* 206–211. http://dx.doi.org/10.1136/ip.2004.005595

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage.

Darragh, A. R., Campo, M., & Olson, D. (2009). Therapy practice in a minimal lift environment: Perceptions of therapy staff. *Work,* 33, 241–253.

Darragh, A. R., Huddleston, W., & King, P. (2009). Work-related musculoskeletal injuries and disorders among occupational and physical therapists. *American Journal of Occupational Therapy, 63,* 351–362. http://dx.doi.org/10.5014/ajot.63.3.351

Evanoff, B., Wolf, L., Aton, E., Canos, J., & Collins, J. (2003). Reduction in injury rates in nursing personnel through introduction of mechanical lifts in the workplace. *American Journal of Industrial Medicine, 44,* 451–457. http://dx.doi.org/10.1002/ajim.10294

Flegal, K. M., Carroll, M. D., Ogden, C. L., & Curtin, L. R. (2010). Prevalence and trends in obesity among U.S. adults, 1999–2008. *JAMA, 303,* 235–241. http://dx.doi.org/10.1001/jama.2009.2014

Glazer, B., & Strauss, A. (1967). *Discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine Press.

Hignett, S. (2001). Manual handling risk assessments in occupational therapy. *British Journal of Occupational Therapy, 64,* 81–86.

Hignett, S., Crumpton, E., Ruszala, S., Alexander, P., Fray, M., & Fletcher, B. (2003). Evidence-based patient handling: Systematic review. *Nursing Standard, 17,* 33–36.

Marras, W. S., Davis, K. G., Kirking, B. C., & Bertsche, P. K. (1999). A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques. *Ergonomics, 42,* 904–926. http://dx.doi.org/10.1080/001401399185207

Marras, W. S., Knapik, G. G., & Ferguson, S. (2009). Lumbar spine forces during manoeuvering of ceiling-based and floor-based patient transfer devices. *Ergonomics, 52,* 384–397. http://dx.doi.org/10.1080/00140130802376075

Mattingly, C., & Fleming, M. (1994). *Clinical reasoning: Forms of inquiry in a therapeutic practice.* Philadelphia: F. A. Davis.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Newbury Park, CA: Sage.

Nelson, A., Matz, M., Chen, F., Siddharthan, K., Lloyd, J., & Fragala, G. (2006). Development and evaluation of a multifaceted ergonomics program to prevent injuries associated with patient handling tasks. *International Journal of Nursing Studies, 43,* 717–733. http://dx.doi.org/10.1016/j.ijnurstu.2005.09.004

Nelson, A. L., Motacki, K., & Menzel, N. (2009). *The illustrated guide to safe patient handling and movement.* New York: Springer.

Patton, M. (1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: Sage.

Rice, M. S., Dusseau, J. M., & Kopp Miller, B. (2011). A questionnaire of musculoskeletal injuries associated with manual patient lifting in occupational therapy practitioners in the State of Ohio. *Occupational Therapy in Health Care, 25,* 95–107. http://dx.doi.org/10.3109/07380577.2011.566308

Rice, M. S., Woolley, S. M., & Waters, T. R. (2009). Comparison of required operating forces between floor-based and overhead-mounted patient lifting devices. *Ergonomics, 52,* 112–120. http://dx.doi.org/10.1080/00140130802481123

Ruszala, S., & Musa, I. (2005). An evaluation of equipment to assist patient sit-to-stand activities in physiotherapy. *Physiotherapy, 91,* 35–41. http://dx.doi.org/10.1016/j.physio.2004.06.010

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks, CA: Sage.

U.S. Department of Veterans Affairs, VISN8 Patient Safety Center of Inquiry. (2012). *Technology resource guide.* Retrieved September 7, 2012, from www.visn8.va.gov/VISN8/PatientSafetyCenter/safePtHandling/TechnologyResourceGuide_041612.doc

Waters, T. R., & Rockefeller, K. (2010). Safe patient handling for rehabilitation professionals. *Rehabilitation Nursing, 35,* 216–222. http://dx.doi.org/10.1002/j.2048-7940.2010.tb00050.x

Zhuang, Z., Stobbe, T. J., Hsiao, H., Collins, J. W., & Hobbs, G. R. (1999). Biomechanical evaluation of assistive devices for transferring residents. *Applied Ergonomics, 30,* 285–294. http://dx.doi.org/10.1016/S0003-6870(98)00035-0