OPINION
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Facing the Challenge of Patient Transfers: Using Ceiling Lifts in Healthcare Facilities

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Abstract

Objective: The objective was to review the literature on the use of ceiling lifts to perform patient transfers in healthcare settings.
Background: Manual patient transfers present a high risk of injury. Ceiling lifts are increasingly used in healthcare facilities. Despite this, little is known about the effects of this new technology.
Methods: Research and review articles were searched on five databases using specific key words and phrases. Literature citations in the articles and gray literature (e.g., technical reports, conference proceedings, magazine articles, Web sites) were also evaluated when relevant for this review. Experts in this area were contacted regarding information on the topic, potential literature, and for their suggestions.
Results: Few studies evaluated the use of ceiling lifts in healthcare. The studies available and the experiences of the experts contacted support the use of ceiling lifts. The musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts. Having lifts available, organizing the workflow, and reducing the steps required during transfers and handling tasks can significantly lessen the risk of musculoskeletal injuries.
Conclusions: Evidence supports the installation of ceiling lifts in patient rooms and recommends their use in bathrooms. However, additional studies are needed because the use of ceiling lifts in healthcare is relatively new.
Key Words: *Patient safety, risk management, design for safety, falls and injuries, prevention, ergonomics*

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Introduction

Manual patient transfers present a high risk of injury (Vieira, 2007a). A shortage of staff, a high incidence of adverse events in healthcare, an increase in the elderly and obese populations with an associated increase in the numbers of elderly and obese patients in healthcare facilities, and a high incidence of musculoskeletal disorders in healthcare workers justify and demonstrate the need for preventative interventions in healthcare facilities to reduce the risk of musculoskeletal disorders among direct care staff and patients.

Musculoskeletal safety can be improved by controlling for risk factors (Bos, Krol, Van der Star, & Groothoff, 2006). Stressful postures, forceful movements, and heavy manual handling are often performed in healthcare (Baptiste, Leffard, Vieira, Rowen, & Tyler, 2007). The problems in

preventing musculoskeletal disorders in healthcare include the lack of guidance based on ergonomic standards, the lack of construction standards and technical aids, and the lack of adequate patient-handling methods and equipment (Hignett et al., 2007). To address this problem, ceiling lifts increasingly are being used in healthcare facilities. Nonetheless, little is known about the effects of this new technology. For this reason, this article reviews and integrates currently available literature on the use of ceiling lifts to perform patient transfers in healthcare settings.

When compared to traditional manual techniques, using mechanical assist devices for patient transfers reduced the physical load of healthcare workers and their risk of injury.

Background

Musculoskeletal Disorders in Healthcare Workers

Bending, twisting, lifting heavy weights, and forceful movements increase the risk of low-back disorders in caregivers (Brulin et al., 1998; Lagerstrom, Wenemark, Hagberg, & Hjelm, 1995; Smedley, Egger, Cooper, & Coggon, 1995). The prevalence of low-back disorders is higher among healthcare workers than in the general population (Josephson, Lagerstrom, Hagberg, & Hjelm, 1997; Lagerstrom, Hansson, & Hagberg, 1998). Nurses are among the professionals with the highest rates of low-back disorders (Bejia et al., 2005; Buckle, 1987; Kumar, 2004).

Healthcare workers have a high incidence of injuries in general. For example, the number of time-loss claims/100 full-time healthcare workers accepted by the Workers Compensation Board of British Columbia, Canada, in 2000 was 7.4%, while the BC average for all employment sectors was 4.8% (WCB-BC, 2000). Back problems account for more than 40% of all lost-time claims among hospital nurses (Venning, Walter, & Stitt, 1987). Similarly, nurses have the highest incidence of disabling low-back disorders among all professionals in the United States (Jensen, 1987). The rates of low-back disorders in nurses are also high in Australia, Brazil, Canada, China, England, France, Italy, Japan, Korea, Sweden, and other countries (Ando et al., 2000; Gurgueira, Alexandre, & Correa Filho, 2003; Kee & Seo, 2007; Lagerstrom, et al.,1995; Larese & Fiorito, 1994; Niedhammer, Lert, & Marne, 1994; Smith, Wei, Kang, & Wang, 2004; Smith et al., 2005a and 2005b; Vieira, Kumar, Coury, & Narayan, 2006). Female nursing aides had low-back disorders six times more often than all other female workers in Sweden (Engkvist, Hagberg, Linden, & Malker, 1992).

Patient Transfer-Related Risks

Manual patient transfers present a high risk of injury. "Patient handling, transfers and repositioning tasks are extremely hazardous and require ergonomic intervention to reduce this risk" (Marras, Davis, Kirking, & Bertsche, 1999, p. 924). When

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compared to traditional manual techniques, using mechanical assist devices for patient transfers reduced the physical load of healthcare workers and their risk of injury (Vieira, 2007a). Lifting patients is a major risk factor; it was found to be related to 84% of the low-back disorders in nurses (Engkvist et al., 1992). Another study found that working in higher lifting frequency areas (OR = 4.26) was a significant predictor ($p < 0.01$) of low-back disorders (Venning et al., 1987).

In a previous study, approximately 70% of the recorded low-back disorders in nurses happened while manually transferring or handling patients (Vieira, 2007a). Orthopedic nurses and intensive care unit nurses considered patient transfers and turning and repositioning patients in bed the most physically demanding tasks of their jobs (Vieira et al., 2006). The simulated nursing job force [79% (SD = 16) of maximum] was higher than the preferred level [56% (SD = 21) of maximum, $p < 0.01$]; the compression forces at the lumbosacral joint [4,754 N (SD = 437)] and the percentage of the population without sufficient torso strength [37% (SD = 9)] were highest during the pushing phase of manual bed-to-stretcher transfers (Vieira, 2007a).

Aggravating Factors in the Changing Healthcare Environment

Patient handling and transfers impose significant loads on and consequent risks to the musculoskeletal system of healthcare workers even when patients are not obese (Vieira, 2007a). For these reasons it is important to use appropriate equipment to perform patient transfers. Considering the increasing number of obese, older, and more dependent patients in healthcare, the need for assistive devices becomes ever more evident. "The increase in overweight, obesity and severe obesity prevalence is evident in adults (aged 20 to 74) of both genders over the last decade" (American Obesity Association, 2005). The highest prevalence of overweight and obesity is among men 65 to 74 years old, and women 55 to 64 years old (American Obesity Association, 2005). Obesity is currently one of the most important health, medical, social, and financial problems in North America. According to the American Obesity Association (2005), from 1999 to 2000, 127 million Americans (65% of the U.S. adult population) were overweight with a body mass index (BMI) $\geq 25 < 30$ kg/m2 or heavier; 60 million (31% of the U.S. adult population) were obese (BMI $\geq 30 < 40$ kg/m2) or heavier; and 9 million (5% of the U.S. adult population) were severely obese /bariatric (BMI ≥ 40 kg/m2).

Obesity rates are increasing alarmingly, and consequently so is the number of obese patients. Treating obese patients is a major challenge for hospitals and healthcare professionals (DeJohn, 2005). Providing care for obese patients is difficult (Zuzelo, 2005): "…basic activities demand careful planning in order to prevent accidents and injuries to either staff members or the patient" (Fox & Spence-Jones, 2003, p. 81). Nurses have a positive attitude toward caring for bariatric patients, but they have serious concerns with regard to their safety and increased workload (Zuzelo & Seminara, 2006). The increased

weight of the patient population results in a significant increase in the physical workload of the healthcare professionals responsible for transferring and handling these patients (Baptiste et al., 2007).

The elderly population and the prevalence of chronic conditions have also increased significantly over past decades (e.g., Naughton, Bennett, & Feely, 2006; Vladeck & Firman, 1983). These factors have presented challenges for the nursing and rehabilitation staff in terms of repetitive patient transfers and other patient handling activities, because of the increase in the number of residents in long-term-care facilities. Elderly patients usually suffer from one or more chronic conditions, illness, and reduced functional capacity related to the normal aging process. Elderly and obese patients often have difficulty bearing weight, repositioning themselves in bed, and performing activities of daily living such as showering and toileting; therefore, additional assistance and equipment frequently are required (DeJohn, 2005). These patients often have low functional status and increased weight associated with decreased weight-bearing tolerance and balance issues. These factors—in conjunction with a lack of standardized procedures to manage these populations and a lack of and/or the technical limitations of equipment used to perform patient transfers—are related to the high rates of caregiver and patient injuries in healthcare.

Risk Reduction Strategies

Previous studies have demonstrated that, even though lack of training may be related to musculoskeletal disorders in healthcare, "training in lifting and handling techniques alone has been shown to be of little, or no, long-term benefit" (Hignett, 1996, p. 1238). This information is corroborated by a recent systematic literature review (Martimo et al., 2008). On the other hand, ergonomic design and interventions—combined with the use of mechanical lifts, staff training and education, and regular exercise—were found to be effective in reducing musculoskeletal disorders such as the rate of low-back disorders related to patient-handling tasks performed by healthcare professionals (Bos et al., 2006; Engst, Chhokar, Miller, Tate, & Yassi, 2005; Garg & Owen, 1992; Garg, Owen, Beller, & Banaag, 1991; Joseph & Fritz, 2006; Li, Wolf, & Evanoff, 2004; Miller, Engst, Tate, & Yassi, 2006; Skargren & Oberg, 1996).

Purpose and Potential Contribution of This Article

The factors presented in this review are related to the increased installation and use of ceiling lifts for patient transfers in healthcare facilities. Support, encouragement, and even policies for the use of ceiling lifts and other devices to assist in patient transfers are evident in formal agreements such as the Memorandum of Understanding between the Association of Unions and the Health Employers Association of British Columbia, with regard to Manual Lifting (OHSAH, 2001). The memorandum focuses on eliminating all unsafe manual patient transfers by using mechanical equipment, unless it represents a risk to the patients. The possibility of extending the

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ceiling lift rails into bathrooms has also been discussed. However, little is known about how these lifts are being used and how effective they are in reducing the rates of patient transfer-related injuries in healthcare. The objective of this article is to review the current literature on the use of ceiling lifts to perform patient transfers in healthcare settings. The specific questions were:

- How effective is the use of ceiling lifts for preventing patient-transfer related risks and injuries?
- Are the costs of installing this equipment justified by the benefits?
- What are the benefits and drawbacks of connecting bedrooms and bathrooms by ceiling lifts?
- What are the issues to be considered when using ceiling lifts?

Data Sources, Study Selection, and Data Extraction

Research and review articles were searched on Pubmed, Medline, Science Direct, Scirus, and Google Scholar. The following key words and phrases were searched in different combinations: ceiling lift, patient transfer, prevention AND musculoskeletal AND injuries AND healthcare. The literature cited in the identified articles was also evaluated in relation to its relevance for this review. The gray literature (e.g., books, conference proceedings, industry reports) was reviewed when it was regarded as relevant to the topic. In addition to reviewing the literature, experts in this area were contacted by e-mail regarding information on the topic, potential literature to be reviewed, and for their recommendations.

Results of Data Synthesis

Outcome of Literature Search and Article Limitations

A limited number (n = 12) of studies dealing specifically with ceiling lifts was found. Most of them were cross-sectional or descriptive and had methodological limitations. A systematic review was not feasible given the small number of high-quality case-control and cohort studies in this area and the fact that the use of ceiling lifts is only now becoming more common. These facts limited our ability to perform a systematic review of the literature. For this reason, this exploratory narrative review is limited in its ability to reach definite conclusions. There is some information regarding staff injuries, but little is known about patient injuries. One reason for the scarcity of information on the effectiveness of ceiling lifts for preventing patient injuries is that patient drops and skin tears during transfers are relatively rare events. This limits the ability to address such questions in studies. However, the number of publications on this topic is growing rapidly. Future reviews should be able to provide more definitive conclusions.

Risk Reduction by Using Lifts for Patient Transfers

Previous studies using floor-mounted mechanical hoists provide some evidence of the impact of using assistive devices for patient transfers. For example, one study evaluated the effectiveness of an ergonomic evaluation and intervention to reduce the incidence of back disorders among nursing assistants in a nursing home (Garg & Owen, 1992). The most stressful patient-handling tasks

In addition to the benefits demonstrated for floor-mounted devices, it appears that ceiling lifts may further reduce the risks of patient transfers.

were determined and the most effective methods of performing the tasks using patient-transfer devices were evaluated in a laboratory study. Based on the results of these tests, patient-transfer devices were made available for the staff (e.g., floor-mounted mechanical hoists), the staff received training, and the environment (toilets and shower rooms) was redesigned. Evaluation of the intervention showed a significant reduction in the physical demands of work, including a 59% reduction of the mean compressive force on the L5/S1 intervertebral disc—from 4,751 N before to 1,964 N after; a 61% reduction in the mean hand force required to make transfers—from 312 N to 122 N; and a 102% increase in the percentage of the female population capable of performing the tasks—from 41% before to 83% after the intervention. The intervention resulted in a 43% reduction in back disorders among nursing assistants in the nursing home—from 83/200,000 work-hours before to 47/200,000 work-hours after the intervention.

In addition to the benefits demonstrated for floor-mounted devices, it appears that ceiling lifts may further reduce the risks of patient transfers. For example, by using ceiling lifts, the number of steps required during patient transfers is lessened, which can further reduce risks significantly. A previous study compared bariatric patient transfers from bed to wheelchair and back using portable lifts with the same transfers using newly installed ceiling lifts (Vieira, 2007b). Ceiling lifts, as opposed to the portable sling suspension lifts used for bariatric patient transfers, eliminated the need to move the lift device with the patient. This was a significant improvement, because that aspect was deemed the most demanding and risky part of the transfer. In addition, the risk of equipment failure (breakdown during transfer) was reduced because of the higher load capacity afforded by the ceiling lifts. Ceiling lifts were also preferable because they reduced the amount of storage space required and the need to "search, gather" and move equipment, reducing noncompliance by having the equipment always available for use.

The study classified potential incidents as having high, moderate, or low detectability, effect, and probability. Incident detectability is how likely it is that a system failure or hazard will be detected by staff before it causes harm or interrupts the completion of required tasks or procedures. Incident effect represents the seriousness of the most likely worst-case outcome for patient, visitor, staff, or property damage. Incident probability refers to how often a system failure or hazard has occurred in the past. Incident ratings were based on personal experience and the history of a particular type of event at the facilities studied. The intervention resulted in a 28% reduction in low-detectability incidents (53 vs. 38); a 26% reduc-

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tion in moderate-effect incidents (54 vs. 40); and a decrease in both high- and moderate-probability incidents [a 22% (37 vs. 29) and 30% (27 vs. 19) reduction, respectively]. Finally, it resulted in an approximate 25% reduction in the sum of risk scores for failure modes and causes requiring action (1,006 vs. 763) (Vieira, 2007b).

Reduction of Injury Rates and Costs

Studies have shown that the provision of ceiling lifts and other supports in long-term-care facilities results in fewer work-related injuries, greater work satisfaction, and improved morale (Joseph, 2006). Another study evaluated the effectiveness of using ceiling lifts in a new long-term-care facility (Miller et al., 2006). In the facility evaluated there was one ceiling lift for every six beds. The intervention resulted in decreased numbers of injuries and a reduction in costs related to patient-handling injuries in the long-term-care facility where the intervention was implemented, as compared to a control (no intervention) facility. Another study found that using lifting devices could reduce up to 84% of the time loss and costs associated with healthcare workers' lifting injuries (Yassi, Ostry, Hatter, & De Boer, 2005). This finding was corroborated by Joseph and Fritz (2006), who compared the number of staff injuries related to patient handling two years before the installation of ceiling lifts in patient rooms in the ICU and neurology departments of the PeaceHealth facility in Eugene, Oregon, with the number of injuries three years after lift installation. This intervention resulted in an 80% reduction in the number of injuries related to patient handling and an 83% reduction in injury-related costs. "Applying this data house wide, PeaceHealth estimate that the $1.64 million cost that they will spend making all 306 patient rooms in their new facility lift ready will be paid back in approximately 1.88 years" (The Center for Health Design, 2006). In the article "The Business Case for Better Buildings," it was stated that: "The one-time incremental costs of designing and building optimum facilities can be quickly repaid… A better building is one that facilitates physical, mental, and social well-being and productive behavior in its occupants… A better building is a safer building" (Berry, Parker, Jr., Hamilton, O'Neill, & Sadler, 2004, p. 10).

The use of ceiling lifts should be directed by rules and procedures, training programs, and appropriate equipment maintenance.

The Occupational Health and Safety Agency for Healthcare in British Columbia (OHSAH, 2002) developed programs to reduce the high rate of musculoskeletal injuries sustained by healthcare workers as a result of lifting and/or patient/resident transfers. They prepared a patient/resident ceiling lift program guide. The use of ceiling lifts should be directed by rules and procedures, training programs, and appropriate equipment maintenance. According to OHSAH, "ceiling lifts, or some other form of assistance and intervention,

should be implemented in every room where there is a significant risk of musculoskeletal injuries due to patient handling" (OHSAH, 2002, p. 19). Costs of up to $7,500 CAN/bed were considered justifiable for the installation of ceiling lifts to eliminate unsafe manual lifts (OHSAH, 2002). This figure was based on an approximate 67% expected reduction in overexertion injuries sustained while lifting patients/residents. Costs of up to $4,000 CAN/bed would be justifiable when an approximate 33% reduction is anticipated. OHSAH reported a 58% reduction in musculoskeletal injury claims at St. Joseph's Hospital, Comox, British Columbia, Canada, following the installation of ceiling lifts.

The effectiveness of ceiling lift use for reducing the number of musculoskeletal injuries among caregivers was evaluated (Engst et al., 2005). Staff preferred to use ceiling lifts for lifting and transferring patients as opposed to manual transfers or using portable lifts. Staff perceived that the risk of musculoskeletal injury was significantly lessened. In addition, for the unit where the ceiling lifts were installed, actual compensation costs due to injuries incurred while lifting and transferring patients were reduced by 68%. On the other hand, compensation costs increased by 68% on the unit where ceiling lifts were not installed (Engst et al., 2005).

Connecting Bedrooms and Bathrooms by Ceiling Lifts

Having ceiling lift rails linking bedroom with washroom would further reduce the number of steps required during toileting tasks. It also would address a common concern of healthcare professionals: having to lift a patient who has fallen in the washroom between the toilet and the wall and who is caught in a corner. OHSAH stated that the installation of "ceiling lifts should also be considered in bathing rooms where no tub lifts exist, and in treatment and diagnostic areas where the degree of patient handling required merits their use" (OHSAH, 2002, p. 9).

The James A. Haley Veterans' Hospital in Tampa, Florida, installed ceiling lifts that extend into the bathrooms in their spinal cord injury (SCI) center units. "The staff and patients love this concept (every room has its own bathroom, so there are no privacy issues)" (Nelson, Director, Patient Safety Center of Inquiry at the Tampa VA, 2007, personal communication). "Privacy curtains and transitioning into the bathroom is something that was tricky but companies have resolved this problem with modern technology" (Baptiste, Ergonomist/Biomechanist, Patient Safety Center of Inquiry at the Tampa VA, 2007, personal communication). According to Doloresco (Associate Chief of Nursing at the James A. Haley Veterans' Hospital, 2007, personal communication), the installation of ceiling lifts represented a major improvement in patient care, resulting in fewer staff injuries. "It has been a great advantage having the tracks traverse the bathroom/shower entryway, so that patients can be easily transported from bed directly to the shower." Given the observed benefits of the installation of ceiling lifts in the SCI units, ceiling lifts will be installed in the James A. Haley Veterans' Hospital new poly-trauma rehabilitation unit (Doloresco, 2007, personal communication).

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Potential Issues and Concerns

Having ceiling lifts is not enough. Ceiling lifts can reduce the risk of injury only if they are used. Adequate regulations, policies (such as no or minimal lifting), and supervision are needed in addition to staff education and training. Another consideration regarding the installation of ceiling lifts in healthcare facilities is the potential for caregivers to use the lifts all the time, even for patients who could and should transfer themselves with little or no assistance. This could result in reduced mobility, increased dependency, and prolonged hospitalization for such patients.

The excessive, inappropriate use of ceiling lifts may be counterproductive to the healing process, where patients should be rehabilitated to become independent individuals again. The inadequate use of ceiling lifts to perform a totally assisted transfer with less dependent patients could go against the work of rehabilitation professionals (physical therapists and occupational therapists). In other words, patients should be encouraged to use most of their capabilities to avoid deconditioning and to reinforce rehabilitation efforts toward independence and the ability to self-transfer. These concerns are legitimate, but they should not interfere with the decision to make ceiling lifts available for staff use with patients who require such assistance. Adequate education and training are necessary for proper decision making regarding patient transfer.

With regard to the different slings to be used with the ceiling lifts for specific tasks such as repositioning, transferring, toileting, and bathing,

…currently available literature suggests that the musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts.

OHSAH recommends that some slings be left beneath the patient/resident when not in use. They also emphasize that toileting and bathing slings should not be shared among patients/residents, and special provision should be made for patients/residents with infectious conditions to ensure that the same slings are not used by different patients, thereby increasing the risk of cross-contamination. "Sufficient reserve of slings must be provided such that slings can be regularly laundered. The heavy construction of slings can require a lengthy laundering process. The program recommendation is 2.5 slings per bed, of which 1.2 slings per bed must be commode or bathing slings" (OHSAH, 2002, p. 10). In addition, sling material and design must be carefully considered and patients continuously observed for signs of potential skin breakdown.

Final Considerations

Only a dozen specific studies were identified as of March 2008. Additional case-control and cohort studies are necessary. Nonetheless, currently available literature suggests that the musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts. Hav-

ing lifts available, organizing the workflow, and reducing the steps required during transfers and handling tasks can significantly reduce the risk of musculoskeletal injury. The cost-benefit of ceiling lift installation was shown to be favorable. There is evidence to support the installation of ceiling lifts in patient rooms and to extend their use into bathrooms. However, future studies are needed because the use of ceiling lifts in healthcare is still relatively new.

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