Abstract: This article reviews the literature on the use of ceiling lifts in healthcare to perform patient transfers. Research and review articles were searched on Pubmed, Medline, Science Direct, Scirus, and Google Scholar using the following keywords and phrases: "ceiling lift" "patient transfer"; "prevention AND musculoskeletal AND injuries AND healthcare". Literature cited in the articles identified and gray literature were also evaluated when relevant for this review. Experts in this area were contacted regarding information on the topic, potential literature to be reviewed and other suggestions. There were few studies evaluating the use of ceiling lifts in healthcare. The studies available and the experiences of contacted experts support the use of ceiling lifts in healthcare and encourage connecting bedrooms and bathrooms by ceiling lifts. Musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts. Having lifts available, organizing the workflow, reducing the steps required during transfers and handling tasks can significantly reduce the risk of musculoskeletal injuries. There is some supporting evidence for the installation of ceiling lifts in patient rooms and the extension of this into bathrooms. However, future studies are necessary because the use of ceiling lifts in healthcare is relatively new.
Suggested Reviewers: Anjali Joseph
The Center for Health Design
ajoseph@healthdesign.org
Expertise

Opposed Reviewers:
Facing the challenge of patient transfers: using ceiling lifts in healthcare facilities

Edgar Ramos Vieira* (PT, MSc, PhD)
Post Doctoral Fellow and Instructor
University of Alberta

Linda Miller (BSC, OT, MEDes)
President
EWI Works International Inc.
http://ewiworks.com/index.htm

*Corresponding Author
Work address: 6-10, University Terrace, University of Alberta 8303 112 Street,
Edmonton, Alberta, Canada T6G 2T4.

E-mail address: evieira@ualberta.ca. Web: http://myprofile.cos.com/evieira.

Phone +1(780) 492-2068; Fax +1(780) 492-9040.

Key words: Patient safety; Risk management; Design for safety; Falls and injuries; Prevention; Ergonomics.

Running head: Ceiling Lifts in Healthcare
Facing the challenge of patient transfers: using ceiling lifts in healthcare facilities

Abstract

This article reviews the literature on the use of ceiling lifts in healthcare to perform patient transfers. Research and review articles were searched on Pubmed, Medline, Science Direct, Scirus, and Google Scholar using the following keywords and phrases: “ceiling lift” “patient transfer”; “prevention AND musculoskeletal AND injuries AND healthcare”. Literature cited in the articles identified and gray literature were also evaluated when relevant for this review. Experts in this area were contacted regarding information on the topic, potential literature to be reviewed and other suggestions. There were few studies evaluating the use of ceiling lifts in healthcare. The studies available and the experiences of contacted experts support the use of ceiling lifts in healthcare and encourage connecting bedrooms and bathrooms by ceiling lifts. Musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts. Having lifts available, organizing the workflow, reducing the steps required during transfers and handling tasks can significantly reduce the risk of musculoskeletal injuries. There is some supporting evidence for the installation of ceiling lifts in patient rooms and the extension of this into bathrooms. However, future studies are necessary 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.
Introduction

Bending, twisting, lifting heavy weights and making forceful movements increase risk of low back disorders in caregivers (Brulin et al., 1998; Smedley et al., 1995; Lagerstrom et al., 1998). The prevalence of low back disorders is higher among healthcare workers then in the general population (Lagerstrom et al., 1998; Josephson et al., 1997). Nurses are among the professionals with the highest rates of low back disorder (Bejia et al., 1995; 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 (WCB-BC, 2000), Canada in 2000 was 7.4%, while the BC average for all employment sectors was 4.8%. Back problems account for more than 40% of all lost-time claims among hospital nurses (Venning et al., 1987). Similarly, nurses have the highest incidence of disabling low back disorders among all professionals in the USA (Jensen, 1987). Similarly, 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 et al., 2003; Kee and Seo, 2007; Lagerstrom et al., 1995; Larese and Fiorito, 1994; Niedhammer et al., 1994; Smith et al., 2004, 2005a and 2005b; Vieira et al., 2006). Female nursing aides had low back disorders six times more often than all other female workers in Sweden (Engkvist et al., 1992).

Manual patient transfers represent high risk of injuries. “Patient handling, transfers and repositioning tasks are extremely hazardous and require ergonomic intervention to reduce this risk” (Marras et al., 1999, p.924). In comparison to using traditional manual techniques, using mechanical assist devices for patient transfers
Ceiling Lifts in Healthcare

reduces the physical load of healthcare workers and risk of injuries (Vieira, 2007a). Lifting patients is a major risk factor and 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 ICU nurses considered patient transfers, turning and repositioning patients in bed the most physically demanding tasks of their jobs (Vieira et al., 2006). The simulated nursing job force [79 (16) % of maximum] was higher than the preferred level [56 (21) % of maximum, $p < 0.01$]; the compression forces at the lumbosacral joint [4754 N (437)] and the percentage of the population without sufficient torso strength [37% (9)] were highest during the pushing phase of manual bed to stretcher transfers (Vieira, 2007a).

Patient handling and transfers impose significant loads and consequent risks to the musculoskeletal system of healthcare workers even when the patients are not obese (Vieira, 2007a). For these reasons it is important to use appropriate equipment to perform patient transfers. These need become even more evident considering the increasing number of obese, older and more dependent patients in healthcare. “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 problem in North America. According to
Ceiling Lifts in Healthcare

the American Obesity Association (2005), from 1999 to 2000, 127 million Americans (65% of the USA adult population) were overweight (BMI $\geq 25 < 30$ kg/m$^2$) or heavier, 60 million (31% of the USA adult population) were obese (BMI $\geq 30 < 40$ kg/m$^2$) or heavier, and 9 million (5% of the USA adult population) were severely obese / bariatric (BMI $\geq 40$ kg/m$^2$).

Obesity rates are increasing at alarming rates and consequently 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 and Spence-Jones, 2003). Nurses have a positive attitude toward caring for bariatric patients, but they have serious concerns in relation to their safety and increased workload (Zuzelo et al., 2006). The increased weight of the patient population results in a significant increase to the physical workload of healthcare professionals responsible for transferring and handling these patients (Baptiste et al., 2007).

The elderly population and the prevalence of chronic conditions are also increasing significantly (Joseph, 2006b). These factors have presented challenges for the nursing and rehabilitation staff in terms of patient transfers and other patient handling activities because they are affected by the larger 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 normal aging process. Elder and obese patients often have difficulties bearing weight, repositioning themselves in bed, and performing daily living activities such as showering and toileting, additional assistance and
Ceiling Lifts in Healthcare

equipments are frequently required (DeJohn, 2005). These patients frequently have low functional status and increased weight associated with decreased weight bearing tolerance and balance issues. These factors associated with a lack of standardized procedures to deal with these populations, lack of and/or technical limitations of the equipment used to perform patient transfers are related to the high rates of caregiver and patient injuries in healthcare.

Staff shortage, high incidence of adverse events in healthcare, increasing elder and obese populations with increasing number of elder and obese patients in healthcare facilities, and high incidence of musculoskeletal disorders in healthcare workers, all these factors justify and demonstrate the need for preventative interventions for 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. Stressful postures, forceful movements, and heavy manual handling are often performed in healthcare. The problems in preventing musculoskeletal disorders in healthcare include the lack of guidance based on ergonomic standards, lack of construction standards and technical aids, and lack of adequate patient handling methods and equipment (Hignett et al., 2007).

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). On the other hand, ergonomic design and interventions, combined with the use of mechanical lifts, staff training and education and exercising regularly were found to be effective in reducing musculoskeletal disorders such as the rates low back disorders
Ceiling Lifts in Healthcare

related to patient-handling tasks performed by healthcare professionals (Bos et al., 2006; Engst et al., 2005; Garg and Owen, 1992; Garg et al., 1991; Joseph and Fritz, 2006; Li et al., 2004; Miller et al., 2006; Skargren and Oberg, 1996).

A 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 and Owen, 1992). The most stressful patient handling tasks were determined and the most effective methods of performing the tasks using patient transferring devices were evaluated in a laboratory study. Based on the results of the tests, patient transferring devices were made available for the staff, the staff received training, and the environment was redesigned (toilets and shower rooms). The evaluation of the intervention showed a significant reduction of work physical demands, including 59% reduction on the mean compressive force on the L5/S1 intervertebral disc – from 4751 N before to 1964 N after; 61% reduction on mean hand force required to make transfers – from 312 N to 122 N, and 102% increase on the percentage of the female population capable of performing the tasks – from 41% before to 83% after the intervention. The intervention resulted in 43% reduction of 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.

The factors presented in this review are related to the increased installation and use of ceiling lifts for patient transfers in health care facilities. Support, encouragement, and even policies for the use of ceiling lifts and other devices to assist in patient transfers is evident in formal agreements such as the Memorandum of Understanding between Association of Unions and the Health Employers Association of British Columbia, re Manual Lifting (2001). The memorandum focus on “...eliminating all unsafe manual lifts
Ceiling Lifts in Healthcare

of patients/residents through the use of mechanical equipment, except where the use of mechanical lifting equipment would be a risk to the well-being of the patients/residents”.

A recent issue was raised in relation to the possibility of extending the ceiling lift rails into the bathrooms. 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. There is some information regarding staff injuries but little is known about patient injuries. One of the issues related to the scarce information in relation to the effectiveness of the use of ceiling lifts for preventing patient injuries is that patient drops and skin tears during patient transfers are relatively rare events. This fact causes the studies to often be underpowered to answer the research questions. For these reasons, the objective of this article was to review the current literature on the use of ceiling lifts in healthcare to perform patient transfers. The specific questions were “how are ceiling lifts being used in health care”; “how effective is the use of ceiling lifts for preventing patient transfer related injuries”, and “what are the benefits and drawbacks of connecting bedrooms and bathrooms by 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 keywords and phrases were searched in different combinations: “ceiling lift” “patient transfer”; “prevention AND musculoskeletal AND injuries AND healthcare”. The literature cited in the articles identified was also evaluated in relation to its relevance for this review. The gray literature (e.g. books, conference proceedings, industry reports) was reviewed when
Ceiling Lifts in Healthcare

identified as been relevant to the topic. In addition to reviewing the literature, experts in this area were contacted by email regarding information on the topic, potential literature to be reviewed and other suggestions.

**Results of data synthesis**

The reduction of steps required during patient transfers can significantly reduce the risks. For example, 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). The evaluation showed that the major changes occurred in transporting the patient via the lift using the portable lift. The use of ceiling lifts as opposed to portable sling suspension lifts for bariatric patient transfers removed the need for moving the lift with the patient. This was a significant improvement because that was the most demanding and risky part of the transfer. In addition, the risk of equipment failure (breakdown during the transfer) was reduced because the higher load capacity offered by the ceiling lifts. Ceiling lifts were also preferable because they reduced the amount of storage space required and the need for “search, gather” and moving equipment, reducing non-compliance by having the equipment always available for use. The intervention resulted in 28% reduction of low detectability incidents (53 vs. 38), 26% reduction of moderate effect incidents (54 vs. 40), and decreased both high and moderate probability incidents [22% (37 vs. 29) and 30% (27 vs. 19) reduction, respectively]. Finally, it resulted in approximately 25% reduction on the sum of risk scores for the failure modes and causes requiring action (1006 vs. 763) (Vieira, 2007b).
Studies have shown that having ceiling lifts and other supports in long-term-care facilities result in reduced number of work-related injuries, greater work satisfaction and morale (Joseph, 2006b). Another study, evaluated the effectiveness of using ceiling lifts in a new long-term-care facility (Miller et al., 2006). There was one ceiling lift for every six beds in the facility evaluated. The intervention resulted in decreased number of injuries and reduction in costs related to patient handling injuries in the long-term-care facility where the intervention was implemented in relation to a control (no intervention) facility. Another study found that using lifting devices can reduce up to 84% of time loss and costs from lifting injuries experienced by healthcare workers (Yassi et al., 2005). This finding was corroborated by Joseph and Fritz 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, OR, USA, with the number of injuries three years after lift installation (Joseph and Fritz, 2006). The intervention resulted in 80% reduction in the number of injuries related to patient handling and 83% reduction of 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 et al., 2004).
Ceiling Lifts in Healthcare

The Occupational Health and Safety Agency for Healthcare in British Columbia (OHSAH, 2002) developed programs to reduce the high rates of musculoskeletal injuries sustained by healthcare workers as a result of lifting and/or patients/residents’ 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 up to $7500 CAN / bed were considered justifiable for the installation of ceiling lifts to eliminate unsafe manual lifts (OHSAH, 2002). This figure was based on approximately 67% expected reduction of overexertion injuries sustained while lifting patients/residents. Costs up to $4000 CAN / bed would be justifiable when approximately 33% reduction is expected. OHSAH reported a 58% reduction of musculoskeletal injuries claims at the St. Joseph’s Hospital, Comox, BC, Canada, after the installation of ceiling lifts.

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

Having ceiling lift rails linking the bedroom with the washroom would further reduce the number of steps required during toileting tasks. In addition, it would address a common concern of healthcare professionals - i.e. having to lift a patient that fell in the washroom between the toilet and the wall being 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).

Regarding the different slings to be used with the ceiling lifts for specific tasks such as repositioning, transferring, toileting and bathing, OHSAH recommends that some slings should be left under the patient/resident when not in use. They also emphasize that toileting and bathing slings should not be shared among patients/residents, and special care and provisions should be in place for patients/residents with infectious conditions making sure that the same slings are not used by different patients 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).

The James A. Haley Veterans’ Hospital in Tampa - FL, USA, 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
Ceiling Lifts in Healthcare

technology” (Baptiste, Ergonomist/Biomechanist, Patient Safety Center of Inquiry at the Tampa VA 2007, personal communication). According with 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 the 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 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).

One of the concerns regarding the installation of ceiling lifts in healthcare facilities is the potential that caregivers will use the lifts all the time even for patients that could and should transfer themselves with little or no assistance. This could result in reduced mobility, increased dependency and prolonged hospitalization. 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 with less dependent patients would go against the work of rehabilitation professionals (physical therapists and occupational therapists). These concerns are legitimate but should not interfere with the decision of implementing and making ceiling lifts available for staff to use with patients who would require such assistance. Adequate education and training is necessary for proper patient transfer decision making.
Ceiling Lifts in Healthcare

**Conclusion**

Musculoskeletal safety of healthcare workers and patients can be improved by the use of ceiling lifts. Having lifts available, organizing the workflow, reducing the steps required during transfers and handling tasks can significantly reduce the risk of musculoskeletal injuries. There is some supporting evidence for the installation of ceiling lifts in patient rooms and the extension of this into bathrooms. However, future studies are necessary because the use of ceiling lifts in healthcare is relatively new.
Ceiling Lifts in Healthcare

References


Ceiling Lifts in Healthcare


42. Vieira ER. Why do nurses have high incidence of low back disorders, and what can be done to reduce their risk? *Bariatric Nursing and Surgical Patient Care*. 2007a; 2:141-147.
Ceiling Lifts in Healthcare


This piece of the submission is being sent via mail.