Ceiling lifts as an intervention to reduce the risk of patient handling injuries

A Literature Review

First created August 19th, 2002

Last updated May 25th, 2006

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Note: Parts of this literature review have been included in the joint OHSAH and Interior Health project entitled "A cost benefit analysis of mechanical ceiling lift installations in 16 facilities in the Interior Health Authority: An added cost or a benefit?"

Introduction

Musculoskeletal injuries (MSI) are the major source of work-related disability among healthcare workers [1,2,3,4,5,6,7,8,9,10]. The risk of musculoskeletal disorders among healthcare workers is well documented in the literature and in workers' compensation claim statistics. Studies conducted in a number of countries, including Canada[11], the United States, the United Kingdom, Holland[12], China[13], Sweden[14], and Australia[15], and in a number of healthcare settings, including acute care facilities[12,13,14], extended care facilities and home care settings[16] have all found a high risk of musculoskeletal injuries among nursing personnel. Higher incidence rates of MSI have been observed in healthcare workers compared to the general population[17] and to other occupational groups[18] such as construction workers, loggers, and truck drivers[19]. In Canada, the evidence is similar[20,21] with the injury rate for the healthcare sector from 1996 to 2000 higher than the average for all other industries combined[22]. In 2003, the injury rate per 100 Full Time Equivalent (FTE) workers for the Acute and Long term care sectors in British Columbia (BC) were 4.0 and 8.0 respectively, while the injury rate for all other industries in BC was 2.6[23].

There is a high prevalence of back pain among nurses[5,11,24], influencing up to 81% of the nursing population with many MSIs not often reported to supervisors. Although definitions of MSI outcomes vary, the reported prevalence of upper-body musculoskeletal symptoms among nursing personnel during the past 12 months, as reviewed by Koehoorn and Sullivan[25], ranged from 24% to 60% in published studies[26,27] and for lower-body symptoms from 33% to 72%[28,29].

Risk Factors

Owen[30] summarizes the evidence that back injuries are a major problem for those nurses providing direct patient care. Nurses with frequent and direct physical contact with patients have been shown to have a higher incidence of back injuries than those who work with patients infrequently, and nurses who have been injured commonly report patient handling as a major cause of their injury[11,18,31,32,33,34,35].

Biomechanical analyses of spinal compressive and shear forces[36,37] and worker perceptions[38] suggest that manual lifting and transferring tasks are particularly high-risk activities. When nursing tasks are rated for the level of back stress, patient handling tasks are listed as more stressful to the back than non-patient handling tasks, both for rankings of perceived stress by nursing personnel and through biomechanical studies[39]. As well, a recent survey of compensation data in BC reflects that overexertion accidents during patient handling are by far the major cause of injury claims among BC healthcare workers[40].

Among the types of tasks commonly associated with patient handling, there is extensive evidence to suggest that manual lifting is a major risk factor for MSI. Nurses who generally lift more frequently have been shown to be at increased risk for MSIs[19,28,41] as have nurses who report frequently lifting heavy objects[28,42]. Nurses who frequently lift heavy objects are also at higher risk for herniated disc and genital prolapse[43]. Similarly, both heavy and repetitive lifting has been identified as major risk factors for back injuries in a number of professions[44].

Manual patient handling such as lifting and transfer patients/residents from one destination to another has been identified as a high risk activity[7,33,45]. The risk on the musculoskeletal system is due to: the weight or required force to lift/transfer or reposition a patient/resident, the horizontal and vertical location of the patient/resident relative to the healthcare worker, the frequency, duration and orientation of lifting, stability of the patient, workplace geometry, and environment[36,46,47,48]. The

potential for injury is not only due to overcoming a heavy patient/resident's body weight, but is further compounded by the patient's size, shape, deformities, level of fatigue, cognitive functioning, cooperation as well as the worker's physical impairments or lower limb function, balance, and coordination[7,49]. Cognitively impaired patients/residents can be unpredictable and may suddenly become combative, resist efforts, or go limp during a transfer, causing a nurse to lose balance and/or make sudden unexpected movements. These sudden unexpected movements and resultant muscular contractions can cause high muscular forces within the erector spinae of approximately 145-187% of one's Maximum Voluntary Contraction (MVC)[50] leading to fatigue and possible failure of the muscles surrounding the lumbar spine[51,52,53].

In addition to the risk from lifting heavy weights, several recent biomechanical studies examining a range of nursing activities found that many nursing postures are "poor" and that poor posture was a risk factor for lower back pain among the nurses examined[54]. Working in a stooped, bent or twisted position has been listed as a risk factor in several other studies of nurses[7,42,54] and has been well documented in biomechanical studies as a cause of MSI. As well, in a study comparing occupational lifting between nursing aides and warehouse workers, it was suggested that nursing aides perform more lifts of long duration in awkward postures, do more carrying, exert horizontal force more often, and are exposed to more unexpected rapid changes than warehouse workers[55]. It was concluded that such lifting factors placed the nursing aides at greater risk for MSI than the warehouse workers.

Studies examining the biomechanical loads on caregivers during patient handling tasks find that the loads often exceed the permissible limit set by the U.S. National Institute of Occupational Safety and Health (NIOSH) and others[7,36,39,56] . Maximum allowable limits of 3400 N for compressive forces on the L5/S1 disc have been recommended for occupational manual handling tasks. Estimates of the compressive forces associated with manually handling patients usually exceed this safety guidance[7,32,36,37,56].

In addition to the risk for injury due to peak forces during acute events, cumulative loading may also lead to more chronic MSI conditions. In conditions of chronic onset, workers may gradually feel sensations of tiredness, weakness, stiffness, and dull pain. Caregivers often cannot recall a specific acute event causing the injury, thus suggesting cumulative loading as a causative factor, rather than a single event resulting in an injury. Several epidemiological and biomechanical studies have also found evidence to support that cumulative stress may be a risk factor for MSI.

The combination of a high injury prevalence associated with patient handling, and the characteristically large estimates of biomechanical stress associated with manual techniques for patient handling, have spurred considerable efforts by researchers and health and safety practitioners to study interventions that replace manual patient handling techniques with mechanical options such as floor and ceiling lifts, and which also show the effectiveness of these approaches and their favourable cost benefit [57,58,59,60,61,62,63,64].

Mechanical Interventions

Many researchers and health and safety practitioners have recommended replacing manual patient handling with mechanical options (engineering controls) through introduction of mechanical floor and ceiling lifts[14,35,36,55,56,62,63,64] to reduce or eliminate many of the MSI risk factors associated with patient handling. Studies examining the effectiveness of using mechanical equipment have found decreases in injury rates, perceived decreases in risk of injury[63,65], as well as decreases in lifting and

stooped and twisted trunk positions[66]; though some potential increased risks of cumulative loading have been noted (cumulative loading may result in chronic MSI conditions).

In an effort to introduce engineering controls to patient handling procedures, numerous healthcare organizations have adopted no-manual-lifting policies[67]. In British Columbia, a Memorandum of Understanding was signed in 2001 between the Healthcare Unions and Employer which stated:

> " all parties agree to establish a goal of eliminated all unsafe manual lifts of patients/residents through the use of mechanical equipment, except where the use of mechanical lifting equipment would be of risk to the well-being of the patients/residents. The employer shall make every reasonable effort to ensure the provision of sufficient trained staff and appropriate equipment to handle patients/residents safely at all times, and specifically to avoid the need to manually lift patients/residents when unsafe to do so. If the use of mechanical equipment would be a risk to the well-being of the patients/residents, sufficient staff must be made available to lift patients/residents safely.

The first approach to the no-manual lift policy was through the introduction of mechanical floor lifts for lifting and transferring patients to reduce the risk of injury to staff[68,69]. However, according to Garg et al. [69,70], patients found certain mechanical lifts to be more uncomfortable and less secure than some manual methods of patient handling. Furthermore, a study by Retsas et al. found that staff reported ease in manual lifting as the primary reason for not using mechanical devices[35]. Mechanical floor lifts have also been reported to require more time and space to use[68]. In fact, the major problem with using floor style mechanical devices is that they pose a large risk for injury: workers can trip over or run into them; lifts on wheels are not always stable; devices can be bulky, thus requiring space to store and to maneuver; considerable arm strength and back torsion are required to move the lifts when wheels are not in optimal condition; special restrictions in the work environment may make their use very cumbersome; they may not be compatible with the bed design, which may not allow the pushing of the lift's legs far enough under the bed; and they are not always available for easy use[69,70,71].

The use of mechanical interventions for lifting, transferring and repositioning patients is better than manually handling patients[49,72]. However, if the appropriate equipment is not readily available, a sense of frustration is felt by the workers. When work processes are delayed, workers feel guilt and annoyance because patient care cannot be met in an efficient manner[35]. Many traditional interventions to this problem, based on teaching workers proper body mechanics while manual lifting, have not yielded widespread success in reducing injury rates[10,73]. The use of overhead ceiling lifts is usually the preferred method for reducing patient lifting injuries and is also favoured by healthcare workers[74,63] over other types of equipment, such as floor lifts[63]. Nevertheless, it should be noted that Collins et al.[62] found floor lifts to be effective in reducing resident handling injuries and other injuries (e.g. slips and falls, struck by items, etc) as well as injuries associated with assaults and violent acts across six nursing homes. Staff did not find any significant differences between mechanical floor lifts and ceiling lifts in terms of perceived risk for injury[75]; but responses were based entirely on perceptions of caregivers and therefore conclusions should not be drawn on the effectiveness of floor lifts.

In recent years, ceiling-mounted lift devices have been increasingly promoted as an alternative to conventional floor lifts for patient handling[22,59,66,74,76]. Engst et al. describe a ceiling lift as consisting of a ceiling mounted track, an electric motor, and a patient sling. Ceiling lift tracks can be configured in numerous arrangements to accommodate many beds in a single room and even multiple rooms. Since ceiling lifts are positioned above bed level, they solve many of the common problems associated with floor lifts. This style of lift requires minimal physical effort to manoeuvre, offers the added feature of always being available for use in patient care areas, and requires less space to operate and store. There is generally two different types of ceiling lift motors: portable and fixed. Portable motors are easily attached and detached from the ceiling lift tracks, while fixed motors cannot be taken off of the ceiling lift tracks.

Holliday et al. reported significant time-savings when ceiling lifts were used as a method of lifting and transferring patients. Additionally, Zhuang et al.[37] found that using ceiling lifts to transfer residents from bed to chair eliminated approximately two-thirds of the exposure to low-back stress, compared to manual methods. Ceiling lifts can reduce many of the variables related to unexpected patient/resident behaviours and create a safer situation for healthcare workers[10,71].

Advantages of Ceiling Lifts

Ronald et al. evaluated the effectiveness of a ceiling lift program one year after implementation in a 125 bed extended care facility. Implementing a ceiling lift program significantly reduced (58% reduction, p=0.011) the rate of MSI to nurses and care aides caused by lifting and transferring. Spiegel et al. estimated the payback period for direct costs associated with this ceiling lift program to be 3.85 years. A shorter payback period of 1.96 years was estimated if indirect savings and the trend of rising compensation costs were also considered. A follow-up evaluation using three years of additional data revealed a 40% reduction in total claims costs, an 82% reduction in lift and transfer claims costs, and an 83% reduction in lost hours due to lift and transfer injuries, demonstrating the longer term effectiveness of ceiling lift systems[77].

The Interior Health Authority[78] conducted a case study of a no lift program at an 257 bed extended care facility with ceiling lifts installed over all of the resident beds. When examining patient handling injuries, there was a 53% reduction in WCB claims costs across the whole facility with one unit decreasing the cost of their patient handling injuries by 93% ($9837.45 to $467.87) over a five month period prior to staff using the ceiling lifts and five months after using the lifts. Expanding this analysis to one year pre- one year post installation, there was a 41% reduction in days lost due to patient handling injuries. In addition, the average cost per claim decreasing by 45% indicating that staff injuries were less severe following the ceiling lift initiative.

In a study of overhead ceiling devices in an extended care unit of a hospital, Engst et al.[79,63] found a greater proportion of nursing staff used ceiling lifts to lift and transfer residents from bed to chair than manually or with floor lifts. In addition, perceptions of pain, discomfort and risk of injury were significantly decreased when lifting and transferring with the ceiling lift. This evaluation of perceptions is important to examine not only as a window into the relative risk of injury but to evaluate the acceptance of ceiling lifts as an effective intervention. In a study conducted by Miller et al. it was shown that when caregivers in both an intermediate care facility and extended care unit of a hospital began to use ceiling lifts, they perceived that the ceiling lifts made their job easier to perform, and preferred them over both mechanical floor lifts and manual methods for lifting and transferring patients. However, when examining perceived discomfort, those caregivers in the facility with the higher ceiling lift coverage perceived themselves to be at less risk for injury than those with

less ceiling lifts. Therefore, the influence of ceiling lifts on perceived risk of injury may be influenced by the relative need, availability of ceiling lifts, and the availability of alternate equipment such as mechanical floor lifts.

The most recent study on ceiling lifts was conducted by Miller et al.[75] that explored the effectiveness of portable ceiling lifts in a new multi-level care facility. It differs from the majority of other studies in that it evaluates the impact of portable ceiling lifts on extended care residents rather than fixed ceiling lifts; and the ratio of ceiling lifts to residents beds is one to six instead of one to one. Results of the study are consistent with those reported by Engst et al[63] in which it demonstrated reductions in patient handling injuries despite the type of ceiling lift used. It is recommended that proactive installation of ceiling lifts in newly built long-term care facility should be considered as an effective method to reduce patient handling injuries and their associated costs.

Many of the current ceiling lift studies have found dramatic reductions in the cost and severity of lifting and transferring tasks[22,58,61,76,77]. However, studies have shown that ceiling lifts may not be suitable for all patient handling tasks[58,59,61]. Ronald et al. demonstrated that ceiling lifts did not positively impact rates of MSI caused by repositioning patients in bed and that in a study conducted by Engst et al., repositioning injuries actually increased after the introduction of ceiling lifts into an extended care unit of a hospital even though staff perceived them to be the safest method for repositioning residents.

Conclusion

Patient handling is a high risk activity in healthcare with those nurses providing direct patient care at a higher risk of injury than those who do not. Higher incidence rates of MSI have been observed in healthcare workers compared to the general population. The implementation and use of appropriate engineering controls to reduce patient handling injuries has had a positive impact. However, it has been shown that mechanical floor lifts are more uncomfortable and less secure than some manual methods of patient handling. Therefore, many in healthcare have advocated the installation of ceiling lifts into healthcare facilities. Researchers has found that ceiling lifts eliminated many of the risk factors associated with patient handling and healthcare staff using ceiling lifts have found them to be safe and effective. However, ceiling lifts were not found to have the same impact in reducing the risk of injury or compensation costs when they were used for repositioning tasks, even though perceptions of risk when using ceiling lifts for repositioning were lower than for other methods.

Ceiling lifts are a relatively new intervention to decrease the risk of patient handling injuries and further evaluations and equipment trials are needed to better understand the impact of ceiling lifts on reducing risk of injury related to repositioning tasks and effectiveness in terms of the availability of ceiling lifts when and where needed, and the availability of alternate equipment such as floor lifts.

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ABOUT THIS DOCUMENT

The Occupational Health and Safety Agency for Healthcare (OHSAH), which operated from 1998-2010, was a precursor to SWITCH BC. Conceived through the Public Sector Accord on Occupational Health and Safety as a response to high rates of workplace injury, illness, and time loss in the health sector, OHSAH was built on the values of bipartite collaboration, evidence-based decision making, and integrated approaches.

This archival research material was created by OHSAH, shared here as archival reference materials, to support ongoing research and development of best practices, and as a thanks to the organization's members who completed the work.

If you have any questions about the materials, please email hello@switchbc.ca or visit www.switchbc.ca