

Title:

**Have we created an alternative MSD risk from a reliance on hoisting?
An academic review paper.**

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Introduction

There is clear evidence to show that the size of patients entering health care is increasing in the western world. Some systems have been developed to help reduce the risks of managing the movement of larger people (Muir and Archer-Heese, 2009). The focus of risk reduction in patient handling has rightly been on the reduction of lifting injuries as a priority. Given the development of a wide range of lifting equipment to assist with the movement of larger people the consensus is that we are in a relatively well controlled risk position. Evidence shows the provision of hoisting equipment reduces the risks of injury but the question raised in this review asks whether the risks are reduced enough? Recent studies have suggested that the push, pull and rotation forces required to move regular and large weight patients (Marras et al, 2008, Rice et al, 2009) exceed the much lower safe working limits for creating spinal damage from shear force in certain circumstances. This paper challenges the situations where current thinking would be to provide a mobile passive lifting hoist or mechanical means to transfer a larger adult.

Literature Analysis**Patient handling**

A series of systematic reviews have failed to identify musculoskeletal disorder (MSD) reduction from patient handling interventions (Van Poppel, 2004, Bos et al, 2006, Amick et al 2006, Haslam et al, 2006, Dawson et al, 2007, Martimo et al, 2008). More inclusive reviews identify that other outcomes could be used to show success (Hignett et al 2003, Fray and Hignett 2006, Fray and Hignett 2009). The volume of evidence for the reduction of known risk factors is growing and the development of multi-faceted ergonomics, equipment and education packages are showing improvements in practice (Nelson et al 2006, Collins et al 2004, Hignett 2003).

Systems adopted in the UK were directed by the introduction of the Manual Handling Operations Regulations 1992 (HMSO 2004) and the subsequent development and support of both statutory providers and professional organisations. Though the countries of Europe all had the same EU directive the responses have not all been the same (Hignett et al, 2007). The North American systems and approaches have not had the pressure of national legislation but some state legislation has more recently been implemented from 2006 onwards.

Risk Reduction Strategy

The information and guidance contained in the documents relating to the management of health and safety in the workplace (HMSO 1992 a,b,c) stated the need for a systematic assessment of workplace hazards, the reality of risk controls in patient handling is different.

Research information identified that lifting people was the most easily identified risk (Owen and Garg 1989, 1990 and 1991, Takala and Kukkonen 1987, Zhang et al 1999, 2000 Menzel et al 2004) and the measure for lumbar compression was critical. Interestingly a comprehensive biomechanical study (Marras et al 1999) using the lumbar motion monitor continued the evidence that compression values seriously exceeded the known recommended limits and should be rectified. It also showed that the methods for manual assistance also exceeded the safe limits for shear (anterior-posterior and/or lateral).

The clear evidence presented related to lifting hazards, the reactive management style of the National Health Service and the chance of high return with simple process change lead to a large focus on the removal of hazardous lifting and transfer tasks with a lifting component. It has been the development of safer handling policies in their various definitions that have lead to much improvement in the management of patient handling risks. Proof of the success of developing multi-faceted interventions have mostly been recorded in studies from North America. Biomechanical and workload reductions have been recorded in a number of studies (Daynard et al 2001, Nelson et al, 2006, Ronald et al, 2002, Marras et al, 1999, Engst et al, 2005,). The cost benefits of such a process have also been recorded (Spiegel et al, 2002, Chhokar et al, 2005, Martin et al, 2009). Patient and staff perceptions improved with use of ceiling track systems (Alamgir et al 2009). These studies have also measured differences between the use of mobile hoists and ceiling track systems (Santaguida et al, 2005).

Push-pull risks

The focus of most of the biomechanical studies and workplace studies, above, have been on the lifting component and the resulting spinal compression loading. More specifically the concentration is on identification and then avoidance of any very high compression loading. This fails to address the more complex question of physical work done represented by force over time exposure. Daynard et al (2001) showed that when using handling aids and

mechanical lifting the cumulative effort was increased, as the time taken was usually higher, but the peak forces were reduced. A recent study (Fray and Hignett, 2009) that restructures a lateral transfer task by the use of an innovative pressure reducing device showed significant savings in physical exposure by removing tasks and reducing the time taken to complete the transfer. This is the cumulative loading or exposure over time question that frequently taxes occupational injury research and prevention literature.

Recent studies have, in addition, raised questions related to the potential problems of the pushing and pulling associated with healthcare tasks and in particular the use of hoists for patient transfers. Marras et al (2009) measured the spinal loads for a person manoeuvring a hoist across a fixed course and compared a ceiling tracked system with a floor based system. The key findings were that the patient weight affected the force needed with a floor based system but not a ceiling track system and the shear loading for the floor based system exceeded the safe working limit for shear during push tasks. Another study (Rice et al, 2009), which used hand held dynamometers to measure actual push pull forces for moving hoists, concurred with the relationships of weight to force for floor standing hoists and that floor standing hoists required more force than ceiling track systems.

Importantly neither study investigated the forces required to obtain an ideal sitting or lying position or the complexities and postural loads of positioning the hoist sling. These two studies that measure the physical requirements of the solutions to handling issues may lead to further questions relating to some of our known risk reduction systems. It is worthy of note that these studies were completed with patients weighing up to 163kg and 146kg respectively to identify the hazards of larger individuals.

Population changes

Recent observations have indicated that the size of western populations is increasing (DOH 2004, Heena 2005, Hedley et al 2004). The growth in adult prevalence is matched by the increase in problems with increasing size and weight of infant populations (Stamatakis 2002, Hedley et al 2004). A systematic review (Baird et al 2005) showed there is agreement from many studies that childhood growth is a clear indicator for adult obesity. Given that a Cochrane review (Summerbell et al 2005) also indicated the general lack of success of intervention strategies for reducing population obesity for the long term and the desired weight in adult populations is also growing (Maynard et al 2006). Most of the evidence indicates to the providers of healthcare that the amount of overweight, obese and morbidly obese patients requiring healthcare interventions will increase over the foreseeable future. The reluctance to design environments and systems for these types of patients will be short-sighted and potentially hazardous for the carers delivering the hands on treatment.

The development of products, equipment and management systems for the reduction of patient handling risks has seen improvements (Muir and Archer-Heese 2009, Hignett and Chipchase, 2007). The range of beds, hoists and

handling aids allows healthcare providers access to a wider variety of physical solutions to the transfers of larger people.

Summary of literature

The management of patient handling risks has improved over the past 20 years. The use of education, equipment and management systems all have made an impact on practice but any reduction in MSD has not been proven. Recent studies have shown that the safer methods of mobile hoists and ceiling track systems have reduced the lifting loads on healthcare workers but there is some doubt over the push pull requirements to use some hoists. Evidence that handling bariatric patients is high risk has been confirmed in one study. Randall et al (2009) showed when bariatric patients (BMI>35kg/m²) were <10% of the workload, handling accidents accounted for almost 30% of the recorded staff injuries. The crossover of these areas of published research raise questions regarding the future provision of equipment to assist with the movement of larger and bariatric patients.

Discussion

Larger people or bariatric care

Randall et al (2009) suggest that the handling of people with BMI over 35kg/m² may raise the injury potential. The increased awareness and development of bariatric handling systems (Gallagher 2004, VISN8 2006) would agree with the increased risk. An unpublished study in a UK hospital (OHS 2009) showed that the perception of significant risk when moving very large patients changed behaviour in a positive way. This creates a possible subgroup of high risk patients that fit the description of large but not noted as bariatric. The evidence of the growing population indicates that this specific group will continue to be more prevalent in the future. As familiarity with bariatric patients widens, the level at which the highly protective behaviour is triggered may also increase thus increasing the number of people in the larger but not bariatric category.

Hoists as a handling solution?

Early biomechanical studies recorded high levels of spinal compression due to lifting tasks. Hoisting or mechanical lifting has been proven to allow these lifting risks to be avoided (Hignett 2003). The interpretation of this research has focussed on the removal of lifting tasks and has not evaluated the push pull levels or the cumulative workload in as much detail. Warming et al (2009) and Knibbe and Friele (1999), both used self reported logs to identify the 24 hour exposure to physical loads with a good level of reliability. These studies show that the number of care related tasks (e.g. re-positioning, limb movement, push, pull) add significantly to the patient lifting risks of the lifting/hoisting tasks.

Documented guidance to the safe use of hoists is in most UK care provider E.g. Fray et al 2001, Smith (Ed) 2005. A task analysis of the potential phases for hoisting show that many of the physical tasks may not be improved by the provision of the hoist device. Table 1 shows the different physical actions that may be included in a transfer task and whether the provision of different hoist types affects the completion of the task.

Physical Action	Mobile Hoist	Ceiling Track Hoist
<ul style="list-style-type: none"> • Locating and collecting hoist 	Manual	
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Fit sling 	Manual	Manual
<ul style="list-style-type: none"> • Lift from present surface 	Mechanical	Mechanical
<ul style="list-style-type: none"> • Move hoist to new surface or • Move new surface into position 	Manual	Mechanical (if in line with track position)
<ul style="list-style-type: none"> • Reposition patient (sitting or lying) 	Mechanical(if powered repositioning)	Mechanical (if powered repositioning)
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Lower to new surface 	Mechanical	Mechanical
<ul style="list-style-type: none"> • Adjust patient to best position 	Mechanical (if powered repositioning)	Mechanical (if powered repositioning)
<ul style="list-style-type: none"> • Remove sling 	Manual	Manual

Table 1. Effect of hoist provision on physical components of transfer tasks

When the use of hoisting systems is compared for the full range of physical tasks many components are not affected. If this transfer is compounded by the two surfaces being a significant distance apart then a transportation phase is also added. The present design of hoists do not allow for the transportation of patients over anything other than very short distances. Design options for the transport of people in a sitting or lying position have already indicated that for large patients a powered transport device would be suitable (Kim et al 2009). Some technological solutions are available to assist in this movement e.g. Bed movers, powered wheelchairs or trolleys and one motor driven hoist for the movement of larger patients (www.Smartlift.eu). The need to move people in a confined space also raises the force requirements and so powered systems may be indicated in more regular transfer tasks, e.g. bathing or toileting, with larger patients (Marras et al 2009). The increase in the use of hoisting solutions for other activities, e.g. during rehabilitation, also suggests the consideration of powered hoists as a possible requirement.

Financial Considerations

Publications that consider handling equipment options have identified the need for powered systems to assist with patient transport (Nelson and Fragala, 2004) but noted that the cost might be prohibitive for integrated powered systems e.g. trolleys. Charney (2004) and Siddarthan et al (2005)

both discuss methods for calculating the direct, indirect and intangible costs of MSD resulting from patient handling injuries and guide the calculation of a cost benefit analysis for provision of any intervention strategy.

The reality of potential losses in UK healthcare is guided by the NHS pay scales and the replacement fees for lost staff time. As an example one injury that leads to 3 months sickness absence of a mid level band 5 nurse (NHS Employees, 2009) could cost £8400 in the direct costs of not having the nurse at work, the same again for the replacement staff to complete the shift pattern. Without adding all the indirect expenses and costs this would amount to £16800.

The financial balance of prevention against losses always shows preference to the small fees for prevention but full investment in prevention solutions is rarely seen. Solutions for prevention are regularly delivered at cost minimal solutions so mobile hoists are preferred. The alternatives of powered or two dimensional ceiling track hoist systems are price comparable and might provide a better solution with a cost effective return through reduced accidents and ill health costs.

Future Considerations

The provision of a vertical mechanism passive lifter has some benefits but it is important to appreciate the cumulative effects of the other assistive tasks, e.g. pushing, pulling, rolling, positioning, and transporting patients in the causation of fatigue and possible injury. The possible costs of increased sickness absence need to be considered when supplying the mechanical solutions for handling larger adults in the healthcare environment.

This academic review raises questions that might need to be considered in the future design of patient handling and healthcare solutions for the movement and positioning of larger patients:

- Improve the understanding of movement and positioning requirements of the larger individual
- Avoid the pushing and pulling loads by having powered movement e.g. bed movers and powered hoist movement
- Consider sling sizing and sling design to minimise risks for application and removal e.g. hoistable clothing
- Consider powered positioning for sitting/reclining, increased patient comfort and therapeutic benefits e.g. powered positioning in 3 axes.
- Consider the combination of hoists with transport actions to reduce the in/out manoeuvres for sling application
- Ensure compatibility between the hoisting system and the bed mechanisms
- Encourage patient handling research to examine the cumulative load for patient handling tasks in addition to the single high risk lifting factors

These considerations are leading the provision of healthcare tasks towards full automation and the possible use of robots and intelligent communication to assist with care tasks. Intelligent bed systems (Hill-Rom 2009) offers patient status information linked directly to hospital networks. A recent study in the Norwegian Association of Local and Regional Authorities (Nursing Times 2009) showed that carers would value the use of robots to free up carers to have more time for face to face duties. A BBC news (2009) article suggests that technological advances can already deliver a caring robot to assist with treatments, communication interventions and patient movement tasks. It is time to consider how much more we can utilise from innovative solutions rather than following traditional hoist design?

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