Safety in Bariatric Patient Transfers[§]

Edgar Ramos Vieira[*,1,2,3], David Dyer[1], Lee Richardson[1] and Jim Raso[1,2]

[1]*Glenrose Rehabilitation Hospital, Edmonton – AB, Canada*

[2]*University of Alberta, Edmonton – AB, Canada*

[3]*University Nine of July (UNINOVE), São Paulo – SP, Brazil*

Abstract: *Background*: Bariatric patients are being seen more frequently in health care. Transferring these patients is a challenging and risky task.

Objectives: To analyze safety and reduce risks for the musculoskeletal system of bariatric patients and health care workers during transfers from bed to wheelchair and back.

Methods: Clinical intervention study of patient transfers using portable and ceiling lifts. The study was conducted in the largest freestanding rehabilitation center in North America. Forty transfers from bed to wheelchair and back involving eight bariatric patients (age: 46-62y, BMI: 42-48kg/m^2) were observed systematically, and four were video-recorded to illustrate the analysis. Two proactive risk assessments were performed and compared using a scoring system to evaluate the risks during the processes of transfers using portable and ceiling lifts.

Results: The bariatric patient transfer system using portable lifts was replaced by installing and using ceiling lifts. The safety of the processes involving the two systems was compared in relation to risk of injuries to staff and patients. Using of ceiling lifts as opposed to portable lifts resulted in 28% reduction of low detectability incidents, 26% reduction of moderate effect incidents, and decreased both high and moderate probability incidents (22% and 30% reduction, respectively). Finally, it resulted in approximately 25% reduction on the sum of risk scores for the failure modes and causes requiring action.

Conclusions: The results suggest that using ceiling lifts is safer than using portable lifts for bariatric patient transfers. The remaining risks were alleviated by training the staff and elaborating standardized procedures to perform these transfers.

Keywords: Patient transfers, bariatrics, safety, equipment.

INTRODUCTION

Obesity (body mass index > 30 kg/m^2) is currently one of the most important health, medical, social and financial problem in North America. Obesity rates in Canada for some age groups have doubled in the past 25 years. The percentage of those who are morbidly obese (body mass index > 40 kg/m^2) increased from 0.4% in 1990 to 1.3% in 2003, and the trend does not appear to be abating. The highest prevalence of overweight and obesity is among men 65 to 74 years old and among women 55 to 64 years old [1]. It is not surprising that bariatric (morbidly obese) patients are being seen more frequently in health care settings. From April 2005 to June 2006, 30 patients weighting more than 135 kg were admitted to the rehabilitation hospital where this study was completed. Although this represents approximately only 2% of the total in-patient population, this is a very high needs group requiring specialized lifts, architectural changes to doorways and additional manpower to manage the daily therapy routine of this population. Providing care for hospitalized obese patients is a challenge for health care workers [2]; "basic activities demand careful planning in order to prevent accidents and injuries to either staff members or the patient" [3]. Nurses have a positive attitude toward caring for bariatric patients, but they have serious concerns about their safety and increased workload [4]. Patient transfers impose significant loads on the musculoskeletal system of healthcare workers even with non-obese patients [5]. The increased weight of the patient population results in a significant increase to the physical workload of health care professionals responsible for transferring these patients [6].

Caregivers are among the professionals with the highest rates of musculoskeletal disorders [7]. Bending, twisting, heavy lifting and making forceful movements are frequent in patient transfers, and increase the risk of low back and other musculoskeletal disorders [8-10]. Female nursing aides had low back disorders resulting in at least one day off work six times more often than all other female workers in Sweden; lifting was a major risk factor and was related to 84% of the low back disorders [11]. In a previous study we found that 70% of the recorded low back disorders in nurses were related to patient transfers [12]. In addition to the risks to the health care workers, bariatric patients have increased risk of falls due to low functional status as a result of co-morbidities, difficulties bearing their own weight, lack of standardized procedures and technical limitations of the

*Address correspondence to this author at the 6-10, University Terrace, University of Alberta 8303 112 Street, Edmonton, Alberta, T6G 2T4, Canada; Tel: +1(780) 435-2718; Fax: +1(780) 492-9040;
E-mail: evieira@ualberta.ca

[§]This work was performed at the Glenrose Rehabilitation Hospital, 10230-111 Ave, Edmonton, Alberta, Canada, T5G 0B7.

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Table 1. Operational Definitions for the Classification of the Failure Modes and their Causes

	Detectability	Effect	Probability
High	The system failure or hazard will be identified before it causes harm and before it interrupts completion of the task.	The patient outcome could be death or permanent loss of function (sensory, motor, physiologic, or intellectual) not related to the natural course of the patient illness or underlying condition. Staff or visitor outcome could be death or hospitalization of three or more people. Property damage could exceed $250,000.	It is likely to occur at least once in the next year.
Moderate	The system failure or hazard will be identified before it causes harm but not before it interrupts completion of the task.	The patient outcome could be permanent lessening of function (sensory, motor, physiologic, or intellectual) not related to the natural course of the patient illness or underlying condition. Including disfigurement of the patient, surgical intervention being required, increased length of stay for two or more patients, or an increased level of care for two or more patients. Staff or visitor outcome could be hospitalization or treatment beyond first aid. Property damage could be between $50,000 and $250,000.	It is likely to occur at least once in the next three years.
Low	The system failure or hazard will not be identified before it causes harm or before completion of the task.	The patient outcome would not be injury, nor increased length of stay or level of care. Staff or visitor outcome could be first aid treatment only, no lost time or restricted duty. Property damage would be less than $50,000 or loss of any utility without adverse patient outcome.	It is possible but unlikely to occur in the next three years.

equipment used to assist with transfers [13]. Falls may cause fractures, soft tissues injuries and/or aggravation of existing wounds. Depending on the diagnosis, the rehabilitation process entails frequent therapy sessions outside of in-patient units requiring multiple transfers.

The estimated prevalence of obesity (BMI $\geq$ 30 kg/m^2) from 1976 to 1980 in the US adult population was 15%; from 1988 to 1994 the estimated prevalence was 23%, and from 1999 to 2002 it was 31%. There was 107% increase on the estimated prevalence of obesity in the US adult population between 1988 and 2002 [14]. Thus, it is important to develop and evaluate safe methods to deal with this population in healthcare. Little has been documented about the special problems of transferring bariatric patients in healthcare and on safety assessment of transfer techniques that have been proposed for this population. In this study, a multidisciplinary team mapped, evaluated, and reduced the risks for the musculoskeletal system of both bariatric patients and their health care workers during transfers from bed to wheelchair and back.

MATERIALS AND METHODOLOGY

The study was conducted in a major Canadian rehabilitation hospital (the largest freestanding rehabilitation center in North America). The healthcare staff and patients were informed of the objectives and procedures of the study and their consent was obtained. The work was done in accordance with the appropriate institutional review body and carried out with the ethical standards set forth in the Helsinki Declaration of 1975. Forty bariatric patient transfers from bed to wheelchair and back involving eight bariatric patients (age: 46-62y, body mass index: 42-48kg/m^2) using portable, floor lifts and using ceiling lifts were observed. Four transfers were video-recorded using two cameras simultaneously to capture different angles of the task permitting complete the visualization of the job. Proactive risk assessments were performed for the transfers. Video-frames were used to illustrate the concepts and specific parts of the transfer. A diagram with representative frames was made to document the process flow – a description of the steps of the transfers and their phases. The failure modes (potential risks) and their causes were defined to identify potential risks and opportunities for interventions. The failure modes and their causes were classified (high, moderate, or low) in relation to their detectability, effect, and probability [Patient Safety International LLP, unpublished]. Incident detectability is how likely it is that the system failure or hazard will be detected by staff before it causes harm or interrupts completion of the required task or procedure. Incident effect represents the seriousness of the most likely worst case outcome for the patient, visitor, staff or property damage. Incident probability refers to how often the system failure or hazard has occurred in the past. The ratings are based on personal experience and the history of this type of event at the hospital. The operational definitions used to classify the events as having high, moderate, or low detectability, effect, and probability are presented on (Table **1**).

After the classification of the failure modes and causes, they were scored according to the matrix presented in (Table **2**) [Patient Safety International LLP, unpublished].

A multidisciplinary team including staff nurses, physical therapists, researchers, and decision makers participated and provided feedback in the proactive risk assessment of the transfers, and participated in the decision of the action plan (interventions) to address the risks identified. It was decided that actions to address the specific risks would be required when the scores were higher than eight. Finally, the intervention was implemented (see results for details) and a new proactive risk assessment was performed following the same methodology and procedures used during the evaluation of the transfers using the portable lift to test the redesigned system of bariatric patient transfer from bed to wheelchair and back.

RESULTS

The process involved the following main steps: place the sling under the patient, lift the patient, transport the patient, lower the patient, and remove the sling from underneath the patient. (Fig. **1**) presents the process flow diagram for the

Table 2. Proactive Risk Assessment Matrix to Determine Scores (Patient Safety International LLP, Unpublished)

		Probability								
		High	Mod	Low	High	Mod	Low	High	Mod	Low
Effect	High	27	18	9	18	12	6	9	6	3
	Mod	18	12	6	12	8	4	6	4	2
	Low	9	6	3	6	4	2	3	2	1
		Low			Moderate			High		
		Detectability								

bariatric patient transfer from bed to wheelchair using a portable lift. The process flow diagram for the transfer from the wheelchair to the bed followed the same steps in the inverse order. Several sub-processes were identified for each of the steps. For example, (Fig. **2**) presents the sub-processes involved in transporting the patient using the lift. Failure modes and their causes were determined for each of the sub-processes. For example, Table **3** presents the failure modes and their causes identified for the sub processes of transporting the patient using the lift. All failure modes and causes were scored by the multidisciplinary group following the method described previously. Table **4** presents the triage of failure mode causes requiring action (score > 8) identified for the sub processes of transporting the patient using the lift.

The bariatric patient transfers using the portable lift were very risky for both patients and health care workers. Given the multiple significant risks identified during the use of portable lifts to transfer the bariatric patients from bed to wheelchair and back, these lifts were replaced by acquiring and installing ceiling lifts to perform these transfers. A new proactive risk assessment was performed for the transfers using the ceiling lifts following the same steps previously described. Using ceiling lifts removed the need for moving the lift with the patient. Table **5** presents the results and numbers (#) related to the triage of failure modes and causes for both processes, including the relative risks when using the ceiling lifts as opposed to the portable lifts. The use of ceiling lifts as opposed to portable lifts resulted in reductions in: the total # of risks (23%); the # of low (28%) detectability risks; the # of moderate (26%) and high (8%) effect risks, and the # of moderate (52%) and high (22%) probability risks, with an increased # of low probability risks (3 *vs* 2). Finally, it resulted in 24% reduction on the sum of risk scores for the failure modes and causes requiring action.

DISCUSSION

The development of the process diagram increased the understanding of the steps of bariatric patient transfer from bed to wheelchair and back. The process diagram helped to clarify the requirements and risks involved, which might

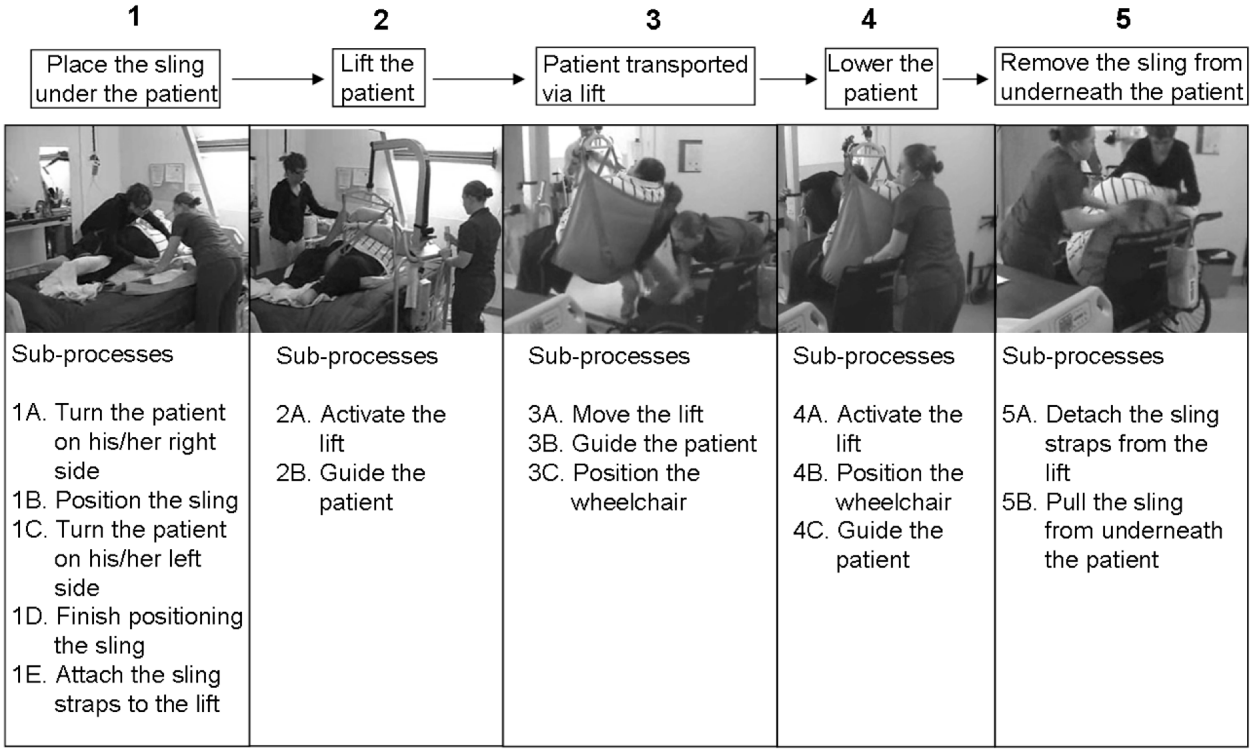

Fig. (1). Process flow diagram for bariatric patient transfer from bed to wheelchair using a portable lift including illustration of the steps and identification of the sub-processes involved.

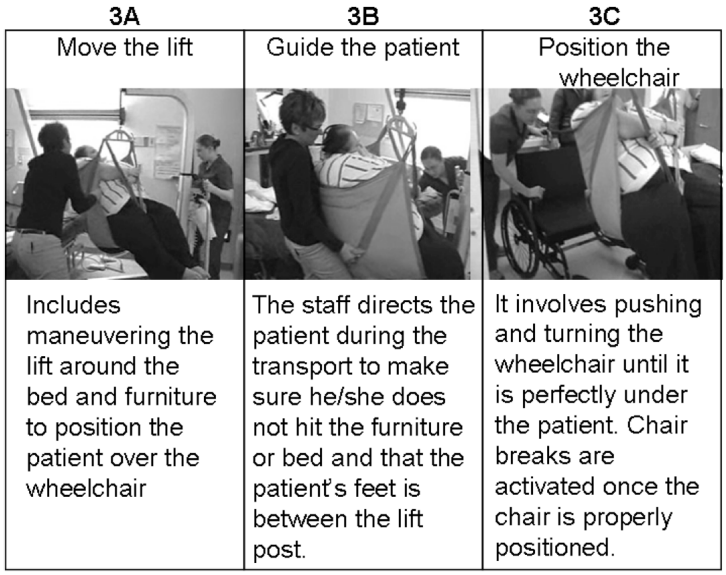

Fig. (2). Sub-processes for Step 3 – Patient transported *via* lift, including illustration of the sub-processes and their descriptions.

have been overlooked otherwise. The participatory approach used in this study, including front line caregivers (staff nurses, physical therapists), researchers, and decision makers, helped to ensure the reliability of the identification of all relevant sub-processes and potential failure modes. The inclusion of decision makers supported the commitment to ensure the project completion, and helped to understand how the program would be rolled out. The most challenging aspect of the process was obtaining time commitment from individuals given the different and busy schedules.

Numerous measures would be required to reduce these

Table 3. Failure Modes and their Causes Identified for the Sub Processes of Transporting the Patient Using the Lift

Sub-Processes					
3A: Move the Lift		***3B: Guide the Patient***		***3C: Position the Wheelchair***	
Failure Modes	**Causes**	**Failure Modes**	**Causes**	**Failure Modes**	**Causes**
3A(1) Patient not transported	(a) lift is too heavy to move				
	(b) not enough space to move the lift				
3A(2) Lift moved incorrectly	(a) moved too fast	3B(1) Staff injured when guiding the patient	(a) overexertion when trying to pull/push the patient	3C(1) Wheelchair is not positioned	(a) bariatric wheelchair not available
	(b) hits a corner or the bed and can not be maneuvered adequately		(b) staff caught between patient and lift or bed		(b) not enough room to position the wheelchair
	(c) inadequate procedures are used				
3A(3) Staff injured in transport	(a) overexertion when trying to move the lift			3C(2) Wheelchair is positioned incorrectly	(a) wheelchair can not be aligned with patient
	(b) staff caught between patient and lift, lift and furniture or wall	3B(2) Patient injured during lift	(a) patient limbs are caught on the straps		(b) wheelchair brakes are not activated and chair moves
3A(4) Patient injured in transport	(a) patient limbs are caught on the straps		(b) patient swings and hits the lift or furniture	3C(3) Staff injured when positioning the wheelchair	(a) overexertion when trying to pull/push the wheelchair
	(b) patient swings and hits the lift or furniture or falls		(c) straps are misplaced and patient falls		
	(c) straps are misplaced and patient falls		(d) wrong sling is used hurting the patient		(b) overexertion when bending over to activate wheelchair breaks
	(d) wrong sling is used hurting the patient		(e) lift fails; cannot support patient	3C(4) Patient injured when positioning the wheelchair	(a) not enough clearance – chair hits the patient
	(e) lift fails; cannot support patient				

Table 4. Triage of Failure Mode Causes Requiring Action (Score ≥ 8) Identified for the Sub Processes of Transporting the Patient Using the Lift

Failure Mode Cause: (Why Would this Occur?)	Detectability	Effect	Probability	Score
3A(2) Lift is moved incorrectly:	L	M	H	18
(a) moved too fast	L	M	M	12
(c) inadequate procedures are used	L	M	H	18
3A(3) Staff injured in transport:	L	M	H	18
(a) overexertion when trying to move the lift	L	M	H	18
(b) staff caught between patient and lift, lift and furniture or wall	L	M	M	12
3C(1) Wheelchair is not positioned:	M	M	M	8
(a) bariatric wheelchair not available	M	M	M	8
3C(2) Wheelchair is positioned incorrectly:	M	M	H	12
(b) wheelchair brakes are not activated and chair moves	M	M	H	12
3C(3) Staff injured when positioning the wheelchair:	L	M	H	18
(a) overexertion when trying to pull/push the wheelchair	L	M	H	18
(b) overexertion when bending over to activate wheelchair breaks	L	M	H	18
3C(4) Patient injured when positioning the wheelchair:	L	M	M	12
(a) not enough clearance – chair hits the patient	L	M	M	12

risks and some risks could not be modified given the task requirements. It is not unusual to transfer patients heavier than 200 kg. Different portable lifts, designed specifically for bariatric patients, could reduce the risk of equipment failure (breakdown during the transfer). However, bariatric portable lifts would not resolve all the issues identified. Bariatric portable lifts are not functionally different; they are just "bigger and stronger". Actually, it would be more difficult to maneuver the oversized portable lifts. The ceiling lifts not only resolved the issues of space and maneuverability but also reduced the likelihood of equipment failure because their weight capacity is 362 kg which covers most of the patients frequently transferred in this facility.

Safer patient transfers may result in shorter length of stay. Safer patient handling techniques may result in fewer patient and staff injuries and lost time. The detailed risk assessment resulted in more efficient use of human resources. In addition to the safety aspects of using ceiling lifts, some patients reported (voluntary comments, not systematically collected) that the quality of care was improved by using ceiling lifts. They said that they felt “better and safer” during the transfers using the ceiling equipment. It is important to highlight that ceiling lifts should only be used when required. Patients should be encouraged to use their capabilities. Equipment should only be used when patients can not self-transfer. Overuse of transfer equipment may be detrimental to patient rehabilitation and independency. Patient assessment, equipment availability, and awareness of equipment use and techniques are required to define optimum patient transfer strategies for balancing optimum healthcare outcomes and safe workplaces.

Despite the improvement obtained by using ceiling lifts, there were still significant safety issues present in this task. To alleviate the remaining risks, the healthcare workers will be trained to perform the transfers and patient handling tasks based on the specific risks identified, and they will be instructed to use standardized procedures during bariatric patient transfers. Training and education combined with ergonomic interventions and using mechanical lifts were found to be effective in reducing the prevalence of low back disorders in healthcare professionals [15-16]. We were not able to directly compare our results with those of other studies because we did not find studies using this methodology or using comparable equipment specifically for bariatric patient transfers. In addition, the cost and actual injury rate implications of installing ceiling lifts were not directly evaluated on this study. A longer follow up period is required before an adequate analysis may be carried out. However, a previous study estimated that the investments (installation costs) were recovered within 0.82 to 2.5 years. The savings and investment recovery estimates were mainly attributed to the reduction (2/3 reduction after implementation) of patient transfer-related injuries and associated costs (e.g. compensation costs and time lost) [17]. Future studies should be performed to evaluate the cost-benefit, the compliance, and the effectiveness of installing and using ceiling lifts for bariatric patient transfers. However, we recognize that this will be complicated due to the many confounders and challenges around adequate surveillance systems.

CONCLUSION

The results of this study provide important practical information for hospital staff as well as addressed a void in the scientific literature related to issues related to transferring the emergent population of bariatric patients. Using ceiling lifts as opposed to portable lifts resulted in significant reduction of the risk of injuries for bariatric patient and their caregivers. Before the intervention, the major changes occurred in transporting the patient *via* the portable lift (Step 3). The

Table 5. Total Number of Risks Identified (#); Break Down of the # of Risks Classified as Having Low (L), Moderate (M), or High (H) Detectability, Effect, and Probability (Refer to Table 1 for Complete Definitions); Sum of the Scores Received by the Risks (Refer to Table 2 for the Scoring Matrix, and Refer to Table 4 for Examples), and Relative Risks (RR) for the Patient Transfers Using Ceiling Lifts as Opposed to Portable Lifts (1 = Same Risk, >1 = More Risk, <1 = Less Risk)

Type of Transfer	Number (#) of Risks				Sum of Scores
	Total #	Detectability	Effect	Probability	
Using the portable lift	66	53 L 13 M 00 H	00 L 54 M 12 H	02 L 27 M 37 H	1006
Using the ceiling lift	51	38 L 13 M 00 H	00 L 40 M 11 H	03 L 19 M 29 H	763
RR of using ceiling lifts	**0.77**	**0.72 L** **1.00 M** **1.00 H**	**1.00 L** **0.74 M** **0.92 H**	**1.50 L** **0.48 M** **0.78 H**	**0.76**

need of moving the lift with the patient was removed by using ceiling lifts. This was a significant improvement because moving the portable lift with the patients on it was the most demanding and risky part of the transfer. However, it is important to highlight that the use of portable lifts is not discouraged. In the absence of a ceiling lift, portable lifts are preferable and significantly safer than manual transfers [5].

KEY POINTS

- There are significant safety differences between patient transfer (lifts) equipment.
- The major risks of injury when using the portable lifts occurred in moving the lift with the patient on it.
- Using ceiling lifts as opposed to portable lifts resulted in significant reduction of the risk of injuries for bariatric patient and their caregivers.
- To further increase safety, it is necessary to provide training to the staff and standardize the procedures to perform transfers.

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REFERENCES

[1] American Obesity Association (AOA). AOA Fact Sheets: Obesity in the U.S. 02 May 2005: Available from: http://www.obesity.org/subs/fastfacts/obesity_US.shtml. Date of access: 25 March 2007.

[2] Zuzelo P. Bariatric patient care BASICS: bias, airway, skin, incontinence, chronicity, and safety. Pa Nurse 2005; 60(3):18-9.

[3] Fox K, Spence-Jones G. Foreword. Crit Care Nurse Q 2003; 26(2): 81-2.

[4] Zuzelo PR, Seminara P. Influence of registered nurses' attitudes toward bariatric patients on educational programming effectiveness. J Contin Educ Nurs 2006; 37(2): 65-73.

[5] Vieira ER. Why do nurses have high incidence of low back disorders, and what can be done to reduce their risk? Bariatric Nurs Surg Patient Care 2007; 2(2): 141-7.

[6] Baptiste A, Leffard B, Vieira ER, Rowen L, Tyler RD. Caregiver injury and safe patient handling. Bariatric Nurs Surg Patient Care 2007; 2(1): 7-16.

[7] Bejia I, Younes M, Jamila HB *et al.* Prevalence and factors associated to low back pain among hospital staff. Joint Bone Spine 2005; 72(3): 254-9.

[8] Brulin C, Gerdle B, Granlund B, Hoog J, Knutson A, Sundelin G. Physical and psychosocial work-related risk factors associated with musculoskeletal symptoms among home care personnel. Scand J Caring Sci 1998; 12(2): 104-10.

[9] Lagerstrom M, Hansson T, Hagberg M. Work-related low-back problems in nursing. Scand J Work Environ Health 1998; 24(6): 449-64.

[10] Smedley J, Egger P, Cooper C, Coggon D. Manual handling activities and risk of low back pain in nurses. Occup Environ Med 1995; 52(3): 160-3.

[11] Engkvist IL, Hagberg M, Linden A, Malker B. Over-exertion back accidents among nurses' aides in Sweden. Saf Sci 1992; 15(2): 97-108.

[12] Vieira ER, Kumar S, Coury HJCG, Narayan Y. Low back problems and possible improvements in nursing jobs. J Adv Nurs 2006; 55(1): 79-89.

[13] DeJohn P. Bariatric patients require whole new line of supplies. Hosp Mater Manage 2005; 30(3): 1-9.

[14] National Center for Health Statistics. Prevalence of Overweight and Obesity among Adults: United States, 1999-2002. 09 September, 2008: Available from: http://www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm. Date of access: 09 October 2008.

[15] Bos EH, Krol B, Van Der Star A, Groothoff JW. The effects of occupational interventions on reduction of musculoskeletal symptoms in the nursing profession. Ergonomics 2006; 49(7): 706-23.

[16] Li J, Wolf L, Evanoff B. Use of mechanical patient lifts decreased musculoskeletal symptoms and injuries among health care workers. Inj Prev 2004; 10(4): 212-6.

[17] Chhokar R, Engst C, Miller A, Robinson D, Tate RB, Yassi A. The three-year economic benefits of a ceiling lift intervention aimed to reduce healthcare worker injuries. Appl Ergon 2005; 36(2): 223-9.

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