



The effects of caregiver experience on low back loads during floor and overhead lift maneuvering activities

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ABSTRACT

This study investigated the effects of caregiver experience on peak external forces and moments generated at the L5/S1 joint of the low back when maneuvering loaded floor-based and overhead-mounted patient lifting devices. Twenty caregivers were divided into more-experienced and less-experienced groups based on the product of two factors: their years of lifting experience and the frequency of lifting the caregivers had done in the past. Ground reaction forces and moments as well as motion capture data were recorded while caregivers performed five different maneuvering tasks with both lifts in each of three conditions (caregiver subjects worked alone, as the primary caregiver in a pair, and as the secondary caregiver in a pair). Six outcome measures (net external forces and moments at the L5/S1 joint) were recorded. Multivariate analyses of variance of all net external forces and moments were done separately for the floor and overhead lifts. A significant effect of experience level was found for the floor lift ($p = 0.006$) but not for the overhead lift ($p = 0.163$). A follow-up univariate analysis of floor lift activities found significant differences between more-experienced and less-experienced caregivers for Turn, Push and Legs Up activities.

Relevance to industry: Previous work has shown that overhead lifts reduce the loads on caregivers compared to floor lifts. The findings of this study further underscore the need to purchase overhead lifts to protect less-experienced caregivers (including informal family caregivers) who are at increased risk of back injury when maneuvering floor lifts.

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1. Introduction

Caregivers (including nurses, nursing aides, healthcare workers, etc.) have the highest incidence rates for nonfatal occupational injury and illness involving days away from work according to the Bureau of Labor Statistics (BLS, 2008). These injuries are largely due to patient handling tasks (Edlich et al., 2004; Engkvist, 2004; Leighton and Reilly, 1995; Nelson et al., 2007; Waters, 2007b). The use of mechanical patient lift devices (lifts) can reduce the risk of caregiver injury during patient transfers (Collins et al., 2004; Evanoff et al., 2003, 2004; Trinkoff et al., 2003; Zhuang et al.,

2000, 1999). However, there are important differences between the two main types of lift devices – floor lifts (devices that roll on a set of wheels on the floor) and overhead lifts (lifts that are suspended from a track attached to the ceiling). Some qualitative research has shown that overhead lifts are preferred to floor lifts based on psychophysical measurement (Alamgir et al., 2009; Engst et al., 2005; Holliday et al., 1994; Zhuang et al., 2000). Unfortunately, psychophysical measurements may over-estimate the capabilities of the body's tissues particularly when dealing with infrequent heavy lifting activities as is the case with patient handling (Waters, 2007a). Also, thresholds of discomfort can be lower for novice workers than for experienced workers (Parakkat et al., 2007). For these reasons, biomechanical studies may be better for comparing overhead and floor lifts.

The two most relevant biomechanical studies that investigated this issue both chose to use novices (individuals with little to no experience with patient lifting) as test subjects (Marras et al., 2009; Rice et al., 2009). Rice et al. (2009) measured horizontal hand forces generated by a single participant to maneuver lifts while varying

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