

## NIOSH Research Initiatives to Prevent Back Injuries to Nursing Assistants, Aides, and Orderlies in Nursing Homes

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*Over the past 100 years, advances in nutrition, modern medicine, public health, and a multitude of public health improvements have increased the life expectancy of U.S. residents. The fact that Americans are living longer has resulted in extensive growth in our elderly population and a rapid employment growth that delivered about 2 million new jobs between 1980 and 1989 in the health care workforce. The Bureau of Labor Statistics Injury and Illness Data for nursing homes rose from 10.7 to 18.6 injuries or illnesses per 100 full-time workers between 1980 and 1992. The injury and illness rates among nursing home workers are partly due to the physical stress of providing round-the-clock assistance with the basic activities of daily living, such as getting in and out of a bed or chair, as well as bathing and toileting. The National Institute for Occupational Safety and Health (NIOSH) is conducting a series of research studies to identify strategies to reduce the risk of musculoskeletal injuries to workers in nursing homes. NIOSH has funded two laboratory evaluations of resident transferring methods and one field study in an actual nursing home. The purpose of this paper is to describe the key findings from past NIOSH research initiatives and to present an overview of future research.* © 1996 Wiley-Liss, Inc.

**KEY WORDS:** disease prevention, back injuries, nursing homes, intervention research

### INTRODUCTION

"The adult human form is an awkward burden to lift or carry. Weighing up to 200 pounds and more, it has no handles, it is not rigid, and it is susceptible to severe damage if mishandled or dropped. When lying in a bed, a patient is placed inconveniently for lifting, and the weight and placing of such a load would be tolerated by few industrial workers" (Lancet, 1965). This editorial was published in the Lancet 30 years ago, and the message remains as urgent today. Nursing personnel have both high prevalence rates of back pain (Biering-Sorenson, 1985; Cust et al., 1972; Deh-

lin et al., 1976; Harber et al., 1985; Stubbs et al., 1983a,b; Videman et al., 1984) and high incidence rates of workers' compensation claims for back injuries (Jensen, 1987; Klein et al., 1984; Personick, 1990; and Bureau of Labor Statistics, 1994). In August 1994, the Bureau of Labor Statistics reported illness and injury rates for the nursing home industry that are higher than any rate reported for the construction industry, an industry in which hazardous worksites are well documented. An analysis of 1 year of workers' compensation data from the State of New York identified 961 back strain and sprain cases involving nursing aides, orderlies, and attendants (Jensen, 1986). Injury rates for back sprains and strains for nursing aides, orderlies, and attendants ranked higher than for construction laborers, garbage collectors, and truck drivers. Nursing aides, orderlies, and attendants filed more claims than any other occupation and also had the highest rate of back injury per 1,000 workers. The high injury toll and millions of dollars spent annually on nursing back injuries prompted the National Institute for Occupational Safety and Health (NIOSH) to investigate

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Accepted for publication August 25, 1995

strategies to reduce work-related back injury among nursing personnel. This paper summarizes NIOSH's research activities to prevent musculoskeletal disorders in nursing home workers.

## **NIOSH RESEARCH INITIATIVES**

In 1987, NIOSH funded a University of Wisconsin study designed to perform laboratory evaluations of resident transferring tasks to reduce back stress among nursing personnel in a nursing home. The skills of researchers in nursing and biomechanical engineering were concurrently applied to evaluate a variety of tasks in which nursing home residents require physical assistance to get in and out of bed, out of chairs, and from chair to chair. The study had three objectives: (1) to identify the most back-stressing resident handling tasks performed by nursing assistants; (2) to perform an ergonomic evaluation of these tasks; and (3) to select resident transferring methods that reduce biomechanical stressors on nursing personnel, while being safe and comfortable for the nursing home resident. After the technical evaluation of resident transferring methods in the laboratory, the transferring methods were implemented and evaluated in an actual nursing home.

## **ANALYSIS OF RESIDENT TRANSFERRING TASKS**

Thirty-eight nursing assistants were surveyed to rank and rate 16 different resident handling tasks for perceived stresses to the low back (Garg et al., 1992). Nursing assistants were also observed for 79 4-hr shifts and videotaped for 14 4-hr shifts, to determine the number of resident handling tasks performed per shift, the use of assistive devices, and an estimate of the biomechanical stresses to the low back. In this nursing home, nursing assistants generally worked in teams of two and performed an average of 24 of the most stressful resident transfers per 8-hr shift by manually lifting and carrying residents. The eight most stressful tasks were identified as (1) transferring a resident from toilet to wheelchair (WC), (2) WC to toilet, (3) WC to bed, (4) bed to WC, (5) bathtub/whirlpool/shower to WC, (6) chair-lift to WC, (7) weighing residents, and (8) lifting residents up in bed. Assistive devices (a mechanical lift and gait belt) were used for less than 2% of the transfers. The reasons cited for not using assistive devices included discomfort, fear, and loss of independence of the residents; perceptions that the devices were not safe or that the devices were not accessible when they were needed; high physical stresses on nursing personnel, even when using the assistive devices; additional time to use the equipment; lack of training on how to use the assistive devices; and staffing shortages. Confined workspaces, uneven floor surfaces, beds with no height or headboard adjustment, and stationary handicap

railings around toilets were identified as barriers that made manual and device assisted transfers more difficult. One of the most important considerations before transferring a resident is an assessment of the resident. This includes an assessment of any resident characteristics that might affect the way in which a resident can be transferred. This assessment should include, but not be limited to, the resident's weight, main disability, and specific difficulties in moving; weight-bearing ability; comprehension and ability to understand instructions; sensory loss; combativeness; muscle rigidity; spasticity; pain; and methods of transferring prior to admission (assistance from relative or specific assistive devices).

## **ASSISTIVE DEVICES**

A comprehensive search of the literature was conducted; site visits were made to nursing homes/personal care facilities, hospitals, and medical supply stores; and assistive device specialists were consulted to assess the use of assistive devices and current transfer methods. Slings, belts, sliding boards, turntables, shower/toileting chairs, and hoists were identified as assistive devices used to transfer residents in nursing homes. The following criteria were used to select assistive devices for further study: (1) the device must be appropriate for the task; (2) the device must be safe for both the resident and the nurse; (3) the device should be comfortable for the resident; (4) the device should be understood and used with relative ease; (5) the device should be time-efficient; (6) need for maintenance should be minimal; and (7) the device must be maneuverable in confined workspaces. Through preliminary trials, a walking belt, MEDesign sling, shower/toileting chairs, and two hoists met the criteria for further study. The gait belt and one lift did not meet all the criteria but were recommended for evaluation because of their current widespread use in the industry (Owen, 1988). The sliding board, sling with rings, and the turntable failed to meet all the criteria and were not recommended for further evaluation.

## **LABORATORY EVALUATION OF RESIDENT TRANSFERRING METHODS AND ASSISTIVE DEVICES**

The five manual techniques (walking belt with one and two nurses, gait belt with two nurses, MEDesign sling with one nurse, and a grasp under the arm manual lifting method) and three mechanical hoists were evaluated in the laboratory. Resident transfers were simulated in the laboratory using the standardized tasks of transferring a resident from bed to wheelchair and wheelchair to bed, wheelchair to toilet and toilet to wheelchair, and wheelchair to shower chair (Garg et al., 1991a,b). The following criteria were used to evaluate the transferring methods: (1) the compres-

sion forces on the L5-S1 disc of the nursing assistant; (2) percentages of females capable of safely performing the task; (3) level of physical stress as perceived by the nursing assistants; (4) resident comfort ratings; (5) resident security ratings; (6) applicability of method to different types of residents; (7) overall method preferences of nurses; and (8) time required to perform the transfer. Based on this laboratory experiment, a hoist was recommended for transferring totally dependent residents. A 5-inch-wide canvas walking belt wrapped around the waist of the resident and that has handles that provide a good handhold for the nursing assistants was recommended for transferring partially dependent residents. The walking belt was recommended over the gait belt because it was rated as more comfortable and more secure by the study subjects serving as residents. The use of a shower chair with removable foot pedals and arm supports was recommended for further evaluation in the field study to eliminate the necessity for two transfers for residents who are being both toileted and showered. Furthermore, transferring residents to a shower chair in their room should eliminate the need for transfers in confined lavatory workspaces. To expand on the evaluation of transferring methods in the laboratory, the transferring methods were implemented and evaluated in an actual nursing home.

## FIELD STUDY

An ergonomics program was implemented and evaluated in two units of a nursing care facility. The ergonomics program included the use of mechanical hoists for totally dependent residents, walking belts for transferring partially dependent residents, and a training program to train nursing assistants in the use of these transferring methods (Garg and Owen, 1992b). Fifty-seven nursing assistants employed in two units of the nursing home participated in the study. Residents were classified into three categories based on their physical ability: (1) dependent, weight-bearing; (2) dependent, non-weight-bearing; and (3) independent. For transferring dependent, weight-bearing residents, a manual transferring method using two people to assist a resident is recommended. The walking belt is fastened around the waist of the resident and has handles on both sides that provide a good handhold for both nurses that is not in direct contact with the resident's skin. A hoist was recommended for dependent, non-weight-bearing, residents. Each dependent resident's bed was marked with a blue or red dot, to indicate whether a belt or hoist should be used for that resident. Each dependent, weight-bearing resident was provided with an appropriate-sized walking belt (small, medium, or large), with the resident's name written on it. Each wing of the two units involved in the study was provided with a hoist with small, medium, large, and extra-large slings, and a shower chair. One hoist had a weighing scale attached to it. In addition, one unit was provided with a

ramp-type weighing scale. A separate frame and a sling were provided for lifting residents from floor level. Commodes in residents' bathrooms were raised to about wheelchair height. Toilet hand rails were adjusted so that the shower chair could fit over the toilet. Adaptive clothing (trousers and dresses) were provided for those residents who were to be toileted, using the hoist. The floor in the shower had to be modified to allow easy pushing and pulling of the shower chair into and out of the shower.

A biomechanical evaluation of resident-handling tasks showed that the mean compression forces on the nursing assistant's lumbar spine and the mean forces exerted by the hands of the nursing assistants were significantly reduced. Prior to the intervention, the percentage of the female nursing assistants capable of safely performing the resident transferring tasks was estimated to be 41%; after the intervention, the percentage of female nursing assistants capable of performing the resident transfers rose to 83%. For residents who were recommended for transfer with a hoist, a hoist was used to transfer those residents 87% of the time. For residents who were recommended for transfer with a walking belt, the walking belt was used for 81% of the transfers. It was concluded that an ergonomics program in nursing homes offers great promise for reducing the physical stresses and risk of low back pain to nursing personnel. However, because of the small number of nursing assistants participating in the study and the short period of follow-up evaluation after the intervention was implemented, no firm conclusions could be drawn about the reductions in injuries to nursing assistants or the reduction in costs associated with these injuries.

Since the first NIOSH-funded laboratory evaluation of assistive devices and transferring methods (Garg and Owen, 1991), extensive design improvements in assistive devices have made assistive devices more time efficient, resistant to tipping over, and safer for both nursing personnel and residents. To build on the studies conducted under contract at the University of Wisconsin, NIOSH is currently funding a follow-up laboratory study at West Virginia University to evaluate 14 transferring methods (three manual methods and 11 methods using assistive devices, including nine battery-powered hoists). Resident transferring methods are being evaluated for their time efficiency, safety and comfort of the resident, and biomechanical stress for the nursing personnel.

## FUTURE FIELD STUDIES

Nursing homes have implemented a number of strategies to prevent the incidence of musculoskeletal injuries to nursing personnel and reduce the costs associated with these injuries. NIOSH is currently planning two studies in conjunction with the health care industry to evaluate the effectiveness of programs that have been implemented to prevent

injuries in nursing homes. The first study proposes to evaluate an array of injury prevention strategies in nursing homes. NIOSH is planning to describe the demographics of each nursing home's workforce and residents and injury prevention initiatives. The outcome of these programs will be assessed on reduction in injury rates, injury costs, turnover rates, and other factors considered important by the nursing homes industry.

The second study plans to evaluate the impact of lifting equipment and medical management programs for reducing injuries and injury-related costs associated with transferring, handling, or supporting residents. Injury incidence rates and injury-related costs will be computed for up to 5 years prior to the implementation of lifting equipment and medical management programs and will be tracked for 1 year following implementation. The effectiveness of lifting equipment will be evaluated for its impact on reducing injury rates relative to each nursing home's historical injury experience and to a control group of nursing homes matched on risk factors that are known to affect injury rates. The assessment of each resident's needs, characteristics (weight, cooperativeness), and physical condition (including size, shape, and deformities, along with any physical impairments of lower limb function, balance, and coordination) will also be evaluated with regard to the method of transfer prescribed for each resident.

## CONCLUSION

In summary, the most back-stressing resident-transferring tasks performed by nursing assistants have been identified. Laboratory studies have identified alternative methods of transferring residents that reduce the biomechanical stressors placed on nursing assistants, that are time efficient, that are easy to use, and that provide a safe and comfortable transfer for the resident. A small-scale field study demonstrated that an ergonomics program that uses well-designed assistive devices and sound manual resident transferring methods can significantly reduce the physical stresses and risk of low back pain to nursing personnel. Future research goals are aimed at evaluating the effectiveness of a variety of prevention strategies across a large population of nursing assistants. The proposed field studies are being conducted to provide an objective evaluation of the prevention strate-

gies currently being implemented in nursing homes for their effectiveness on reducing injury incidence and costs.

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