CHAPTER ONE

Scope of the Problem

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MOVING AND HANDLING PATIENTS: A CORE FUNCTION OF NURSES

In 1966, Virginia Henderson wrote a definition of nursing that clearly delineated the nursing profession from that of medicine:

> The unique function of the nurse is to assist the individual, sick or well, in the performance of those activities contributing to health or its recovery (or a peaceful death) that he would perform unaided if he had the necessary strength, will or knowledge. And to do this in such a way as to help him gain independence as rapidly as possible (p. 15).

During the course of most severe illnesses, afflicted individuals lose the ability to move on their own and require assistance for repositioning and movement. This responsibility falls to nursing care providers, who reposition patients to prevent pressure ulcers and promote comfort, put weakened limbs through range of motion to prevent contractures and promote circulation, ambulate patients to prevent blood clots and pneumonia, transfer patients to wheelchairs and stretchers so that they can travel to centralized services, and reposition bedridden patients as

they bathe them, position patients for toileting, and reposition bedridden patients as linens are changed. Addressing patient mobility needs is a nursing function that can mean the difference between extensive complications or an uneventful recovery. Since the task of assisting patients with mobility deficits is inseparable from nursing care, it is essential to determine how nurses can perform these tasks safely.

A NEW APPROACH

A hundred years ago, this advice appeared in an early nursing textbook:

> "It is very good for strength
> To know that someone needs you to be strong."
> (Committee of the Connecticut Training-School for Nurses, 1906, preface verso).

In the 21st century, a new approach is recommended for patient handling and movement; it is not based on physical strength, but on the following principles:

1. The process of musculoskeletal pain, injury, and disability is affected by multiple causes involving the interaction of the caregiver, patient, and environment.
2. The lifting, transferring, and repositioning of patients can lead to fatigue, musculoskeletal pain, and disabling injuries.
3. The series of events involving the interaction of the patient, the caregiver, and the environment can be modified or interrupted to reduce the risk of injury to caregivers when lifting, transferring and repositioning patients.
4. Laboratory and field research have identified promising safe patient handling and movement (SPHM) programs that can greatly reduce the risk of injury to caregivers regardless of their age, length of employment, or shift.
5. SPHM programs can protect patients by reducing their risk of pain, skin tears, bruising, and being dropped.
6. A SPHM program is multi-faceted; it consists of mechanical equipment to lift and reposition patients, a safe-lifting policy, employee training on lift device usage, patient care assessment protocols and algorithms, unit-based peer safety leaders, and administrative support.
7. Periodic medical examinations should be performed on caregivers to identify musculoskeletal disorders early in their development. These examinations should be conducted by healthcare providers who are knowledgeable about the caregiver's work exposures.
8. Administrative support and unit-based peer safety leaders are required to coordinate the resources and activities necessary for an effective SPHM program.
9. Although schools of nursing continue to teach manual patient handling methods, this new approach to patient handling and movement provides the information and tools necessary to support a paradigm shift in the nursing profession away from manual patient lifting and the over-reliance on body mechanics to multi-faceted SPHM programs.

HISTORY OF NURSING AND PATIENT HANDLING AND MOVEMENT

Since the emergence of professional nursing in Florence Nightingale's time, the musculoskeletal hazards of nursing work have not only been accepted as an inherent part of the job but also been blamed on the hapless (female) victim's lack of strength and poor lifting technique. In 1898, a standard nursing text exemplifies this mindset.

> "Occasionally the complaint is made that a nurse has injured her back or strained herself in some way in moving a patient. This will generally be because she has failed to do the lifting properly" (Hampton, 1898, p. 102).

Amazingly, over 100 years later, "lifting properly," now known as body mechanics, is still the foundation of many of the educational programs for nursing students, despite the technological, scientific, and evidence-based revolution affecting all other aspects of care.

Although nurses have always been at risk for musculoskeletal injury, a significant rise in work-related disability can be traced to the shift in the nursing workplace from homes to hospitals and the change in how nursing care is delivered. Due to the reputation of hospitals as unclean facilities, only 10% of the sick were cared for in such institutions in 1915 (Joel & Kelly, 2002). Most nurses worked in private homes caring for a single patient. Long periods of bed rest were often the prescribed treatment, while patients were regarded as helpless, as is apparent from reading early nursing arts texts.

> "Should a patient help himself? Not at all, if he is very ill. Never let him sit up or turn himself alone. Save his strength in every way" (Committee of the Connecticut Training-School for Nurses, 1906, p. 55).

With the advent of penicillin in the early 1940s, the reputation of hospitals began to change from one of high risk and last resort to a place of healing. More patients began receiving healthcare in hospitals rather than in their homes, resulting in a major post-World War II nursing shortage (Joel & Kelly, 2002). Due to the revolutionary concept of early ambulation, which made its way from the battlefield to hospitals sometime in the early 1940s (Sheldon & Blodgett, 1946), nurses found their workloads increasing from a single patient to a multitude of post-operative patients who had to be ambulated. Early ambulation increased the physical burden on nursing staff because they assisted unstable patients who could collapse or lose their balance with little notice. It was not long before articles about "aching backs" began to appear in nursing journals (Svec, 1951).

To meet the demand for bedside caregivers, hospitals reorganized nursing duties from the one-on-one model followed in the home by private duty nurses to a team concept. With the team concept, professional nurses had responsibility for a large number of patients, delegating some less-skilled tasks, such as ambulation and repositioning, to unlicensed assistive personnel. Exposure to lifting patients took its toll on these nursing aides and orderlies as well. Those with the job classification "nursing aides, orderlies, and attendants" are now reporting the highest number of musculoskeletal injuries with lost workdays in the US (US Bureau of Labor Statistics, 2004). Registered nurses (RNs) rank #7; it is the only professional group represented in the top 10 ranking.

The first citation in nursing for the phrase "body mechanics" appeared in the American Journal of Nursing in 1945 at the close of World War II. The author, a physician, wrote: "The recent appreciation of the value of reconditioning in the armed forces has stimulated a fresh interest in protective body mechanics for all patients" (Wright, 1945, p. 699). He added that "if nurses could be instructed in such a program," it could be "a protection to patients and themselves" (p. 703). Shortly thereafter, in 1946, a textbook appeared, *Body Mechanics in Nursing Arts*. This text contains many biomechanical illustrations of nurses shifting their weight while repositioning patients. The scientific foundation for this approach was absent. See Figure 1.1 for an example.

As the concept of body mechanics in nursing progressed, a 3-year demonstration project was published promoting "the value of the consistent use of good body mechanics to both nurses and patients" (Winters, 1950, p. 745). Winters (both an RN and a physical therapist) tried out a model curriculum at Vanderbilt University's School of Nursing and concluded that the 20-hour training program in body mechanics should be "an essential part of every nursing curriculum." Cited among the benefits to the student was learning to "use her own body efficiently

FIGURE 1.1 Illustration of body positioning in an early body mechanics text book (Fash, 1946).

to prevent unnecessary fatigue and strain" (Winters, 1950, p. 746). Like many traditions passed down through the legacy of nursing arts, there was no evidence presented that these techniques actually reduced fatigue and strain, let alone injury, or were safe for patients.

Lacking any evidence-based alternative to this approach to lifting and moving patients, yet facing the need to teach students how to handle and move patients, schools of nursing continued to emphasize body mechanics for the remainder of the 20th century and have continued teaching this approach into the 21st century. A 1958 practical nursing textbook stated: "Lifting does not always require strength. It takes skill which the nurse can readily develop once she has made good body mechanics a habit" (Gill, 1958, p. 299). Current fundamental nursing skills textbooks continue to include sections on body mechanics. Once the belief was established that proper body mechanics was a skill that would prevent musculoskeletal injuries, blaming the victim when an injury occurred was the logical inference.

Apparently the failure of proper body mechanics to protect nurses was due to more than lack of skill; it was also due to a physiological defect common among nurses. In 1965, a British researcher concluded that "the weak backs of nurses" were the reason injuries and sprains were so prevalent among the nursing profession ("Nurses have weak backs,"

1965). In contrast, in the same year, a British medical journal wrote an eloquent and enlightened editorial "The Nurse's Load" (1965, p. 422).

> The adult human form is an awkward burden to lift or carry. Weighing up to 100 kg or more, it has no handles, it is not rigid, and it is liable to severe damage if mishandled or dropped. In bed a patient is placed inconveniently for lifting, and the placing of a load in such a situation would be tolerated by few industrial workers. Since much of the nurse's day is spent in lifting patients, it is no small wonder that orthopedic wards often contain nurses with strained backs as patients.

Unfortunately, since Gill's work was published in the late 1950s, more than a million direct patient care providers have suffered from work-related back pain and disabling injuries. Even though the responsibility and blame for work-related injuries have fallen on the nursing profession, good body mechanics cannot always be used. For example, the "bent knees, straight back" method of lifting does not work well for lifting patients. When a patient is being lifted from a bed, the placement of the patient requires the caregiver to assume awkward postures and excessive forward bending. At the same time, the bed can restrict a nurse's ability to bend the knees. Other factors that can contribute to the difficulty of lifting a patient are the size and weight of the patient, the patient's propensity to fall or lose balance, the bed height, patient combativeness and/or their inability to help. Additionally, the vast majority (90%) of the lifting and moving of physically dependent patients is performed by female nursing staff (Lloyd, 2004; US Department of Labor, 2004) who lack the upper body strength of men.

CONSEQUENCES OF MUSCULOSKELETAL INJURIES IN NURSING PERSONNEL

Nurses are clearly concerned about becoming injured during the performance of their work. The basis for their fear is that a back injury can end their careers and earning capacity (Helminger, 1997). In a 2001 study conducted by the American Nurses Association, 4826 nurses cited "disabling back injury" as their second highest health and safety concern; "stress and overwork" was listed as number one. Consequences to employers include the high costs of workers' compensation insurance to pay for medical care and days away from work for injured workers, as well as the need to hire replacement workers (Menzel, 1998). Protecting the health and safety of nursing personnel is vital not only to the staff members and their employers but also to the nation's health. An insufficient number of hospital nursing staff, a problem that is exacerbated by

loss of nursing staff due to back injuries, results in an increased risk of deaths and complications among hospitalized patients (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002).

THE EXTENT OF MUSCULOSKELETAL PROBLEMS IN NURSING PERSONNEL

In 1985, Harber and associates surveyed over 500 nurses in a California hospital and found that over half had experienced back pain in the previous 3 months. A random sample of licensed nurses in Wisconsin by Owen (1989) found that 52% of hospital nurses experienced work-related low-back pain in the past year; 48% of these stated that lifting and repositioning patients in bed had precipitated their low-back pain. In 2001, a survey of 113 direct patient care providers in a Florida Veterans Health Administration (VHA) facility found current musculoskeletal discomfort of at least moderate severity in 62% of the direct patient care staff (Menzel, Brooks, Bernard, & Nelson, 2004). In 2002, a survey of over 1100 RNs found that 47% experienced back pain in the previous year (Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002).

The musculoskeletal injury problem among nurses is not unique to the United States. Epidemiological studies around the world have consistently identified nursing personnel at high risk of low-back pain and musculoskeletal injury (Menzel, 2004). In England, Stubbs, Buckle, Hudson, Rivers, & Worringham (1983) reported that 43% of nursing personnel suffer from low-back pain annually, twice as much as the general population, and attributed 84% of these episodes to moving or supporting a patient. It is estimated that 16% of the sick leave taken by nurses in England is due to back pain (Pheasant & Stubbs, 1992). One study showed that 18% of nursing personnel stopped working because of low-back pain (Videman et al., 1984). A study of 3159 young (mean age 24.8) nurses in Taiwan found the 1-year prevalence of back pain to be 69.7% (Lee & Chiou, 1994). In Greece, researchers found a 1-year prevalence of back pain of 75% in that country's nurses (Alexopoulos, Burdorf, & Kalokerinou, 2003).

Even though the rates of injury reported by caregivers in hospitals and nursing homes are excessively high, it is suspected that there is significant underreporting. Many nurses work with musculoskeletal pain but do not file claims. Cato, Olson, and Studer (1989) found that 78% of nurses with back pain in the previous 6 months did not report it to management, while Owen (1989) found that 67% (126 of 189) of nurses suffering from low-back pain related to work did not report the incident in writing

(Owen, 1989). Student nurses have reported back pain related to "heavy" work on patient units (Klaber-Moffett, Hughes, & Griffiths, 1993).

THE RISKS OF WORKING AT HOSPITALS AND NURSING HOMES

Since 1980, the Bureau of Labor Statistics (BLS) has recorded injury and illness rates in hospitals and nursing homes (Personick, 1990). In the 1980s, the nursing home and personal care industry consistently incurred more than 100,000 non-fatal occupational injuries and illnesses. The epidemic of injuries in nursing and personal care facilities led the BLS to commission a series of studies in 1988 focusing on industries with the largest numbers of workplace injuries and illnesses (Personick, 1990). The first of these studies was initiated in the Nursing and personal care industry due to the high number of injuries and because 1988 marked the sixth consecutive annual increase in injury rates in nursing homes. As shown in Figure 1.2, from 1980 to 1992, the injury incidence rate for hospitals and nursing homes steadily increased and has steadily declined since the mid 1990s. Personick noted that incidence rates steadily increased from 10.7 per 100 workers in 1980 to a peak of 18.6 per 100 workers in 1992 (US Department of Labor, 1994).

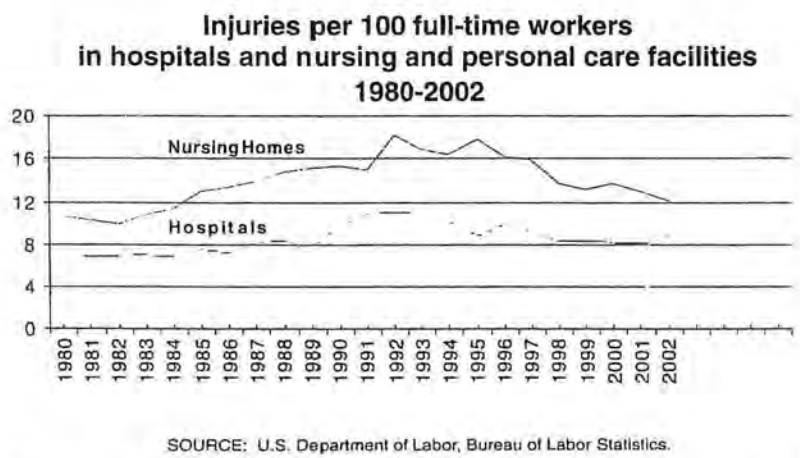

FIGURE 1.2 Injuries per 100 full-time workers in hospitals and personal care facilities (Source: U.S. Department of Labor, Bureau of Labor Statistics)

The risk of back pain has been consistently higher in nursing homes than hospitals, presumably because residents require more physical assistance from nursing staff members to perform their activities of daily living, such as getting in and out of beds or chairs, bathing, and toileting. In addition, there are usually fewer staff members per number of patients in nursing homes versus hospitals, increasing the lifting exposure for individual workers. The majority of the industry's reported injuries were serious enough to require time off from work or restrict a caregiver's work activity. Of the 151,000 injuries and illnesses reported in nursing homes in 1988, approximately 88,000 resulted in lost work time (Personick, 1990). The tenure of the injured worker in the nursing home tended to be relatively short (less than 1 year) at the time of the incident (Personick, 1990; Collins, Wolf, Bell, & Evanoff, 2004). The highest injury rates in nursing homes occurred among nursing assistants less than 25 years old.

It is not clear what contributed to the steady increase in injury rates prior to 1992; however, in the early to mid 1990s research efforts increasingly began to focus on the prevention of musculoskeletal injuries among healthcare workers. The steady increase in musculoskeletal injuries prompted nursing homes and hospitals to examine ways to contain the escalating workers' compensation costs. Around this same time, the Occupational Safety and Health Administration began to target nursing and personal care facilities as part of a special emphasis program citing imminent hazards due to patient lifting under the "general duty clause." In response to a perceived demand for better equipment to lift and transfer patients, healthcare equipment manufacturers responded by improving existing patient lifting equipment and by developing an extensive amount of new patient handling technology.

Although no studies have formally examined factors affecting the trends in nursing home and hospital injury rates since 1980, it is suspected that a number of factors have affected the fluctuations in injury rates. During the late 1980s, the issue of musculoskeletal injuries in nursing homes was drawing international attention. The National Institute for Occupational Safety and Health (NIOSH) began to sponsor feasibility studies on how to reduce musculoskeletal injuries related to patient handling in healthcare settings (Garg & Owen, 1992). Since 1993, the incidence rate in nursing homes has steadily declined with consecutive decreases in all but one of the past 10 years (Figure 1.2).

The results of an Institute of Medicine study (1986), *Improving the Quality of Care in Nursing Homes*, directly led to the nursing home reform provisions in the Omnibus Budget Reconciliation Act of 1987. The law was enacted to upgrade the staff requirements for US nursing homes

certified by Medicare or Medicaid. The law mandated that, by 1990, nursing homes must provide licensed nursing services during all hours and that nursing aides must complete at least 75-hours of training in nursing skills and residents' rights. The result was the most far-reaching revision to the standards, inspection process, and enforcement system since the passage of Medicare and Medicaid in the mid 1960s (Hawes, 1990). The new standards spoke to the process of care that was expected and to the requirement that care would promote "the maximum practicable functioning" for each individual resident. Federally mandated staffing standards may have prompted nursing homes to increase staff retention by improving working conditions by providing more mechanical lifting equipment.

In addition to these regulatory forces, increases in workers' compensation costs forced hospitals and nursing homes to consider ways to return injured employees to work in modified duty status, thereby avoiding paying indemnity (wage replacement) (Menzel, 1998). Because the BLS tracks injuries involving days away from work, it is likely that this movement toward modified duty has reduced the number of injured workers recorded as missing time from work. The following sections discuss what is causing these injuries.

Occupational Risk Factors

An assessment of workers' compensation claims for back strains and sprains concluded that nursing aides and practical nurses ranked in the 10 occupations with the highest rate of back strains or sprains claims. Only heavy laborers, such as garbage collectors and warehouse workers, ranked higher than nursing personnel (Klein, Jensen, & Sanderson, 1984). Within categories of direct patient care providers, certified nursing aides (CNAs) and orderlies suffered the highest rates of musculoskeletal injury followed by licensed practical nurses (LPNs) and then RNs (Jensen, 1987). When examining injury rates for female workers in the United States, nursing aides and orderlies have the highest prevalence (18.8%) and report most cases of work-related back pain of all occupations (Guo et al., 1995). In contrast to services provided by hospitals, the nature of patient care in nursing homes calls for substantially more nursing aides than LPNs or RNs. The high risk of back pain among CNAs, can be attributed to job-related exposure to high-risk tasks; their job includes provision of "basic care and duties such as feeding, bathing, dressing, grooming, or moving patients under the direction of nursing staff" (US Department of Labor, 2002). In contrast, the job descriptions for RNs and LPNs include assessing patient health problems and

providing nursing care to the ill, but make no mention of moving patients (US Department of Labor, 2004). Contrary to this inexplicable omission in BLS's occupational classification, many RNs and LPNs perform patient handling and movement tasks as part of their regular responsibilities.

The increase in nursing workloads has continued to the present. With higher levels of patient acuity and shorter hospital stays, today's hospitalized patients are more dependent on nurses to assist them with mobility needs. Due to the pronounced trend of discharging the less seriously ill to recuperate elsewhere, the average length of hospital stay declined from 7.5 days in 1980 to 4.9 days in 2001, concentrating the number of sick people who need more assistance in acute care facilities (National Center for Health Statistics, 2003). Yet there have been few innovations in nursing practice or hospital infrastructure since World War II to assist direct patient care staff in caring for this increasingly dependent patient population.

Personal Risk Factors for Musculoskeletal Injury and Low-Back Pain in Nurses

When musculoskeletal injuries in nursing personnel are examined by occupation, age, gender, length of employment, and other potential risk factors, certain subgroups of nursing personnel emerge at higher risk for sustaining injury. A study of work-related injury in the Central Arkansas Veterans Healthcare System examined medical center employee injuries from 1998 to 2000 in terms of age, gender, employment type, employment status, shift length, body mass index (BMI), workers' compensation claims prior to current employment, employee health and wellness activity attendance, lost time claims, and medical/loss of productivity costs (Brown & Thomas, 2003). Notable characteristics of injured employees included advancing age, female gender, long working hours, increased BMI, history of prior back and upper extremity injuries, no health and wellness activity attendance, and lost time with injury. Back and shoulder strain, falling-related injuries, and repetitive motion injuries were the most severe and costly injuries. The association between BMI and musculoskeletal injuries in nursing personnel has not been seen by other researchers (Smedley, Egger, Cooper, & Coggon, 1997).

Authors of one study examined a range of etiologic risk factors, including personal and work-related factors, and identified heavy lifting, work experience, age, work knowledge, work habits, and sitting habits to be significant predictors of back pain. Heavy lifting was found to be the

most significant risk factor for nursing back pain (Lee & Chiou, 1994). Specifically, the results showed that the more and heavier the patients lifted, the older the nurse, the longer the work experience, the poorer the knowledge of work postures, the poorer the work habits, and the poorer the sitting habits, the higher the 1-year prevalence of low-back pain. Venning et al. (1987) examined the contribution of personal and job-related factors as determinants of back injuries in 5469 nurses. Factors found to be significant predictors of back injury included greater exposure to frequent lifting, working as a nursing aide versus an RN, and a previous history of back injury, suggesting that job-related factors rather than personal factors are the major predictors of back injury in nurses.

When examining 416 back injury reports at an 1100-bed acute and tertiary care hospital, the rate of injury among 1645 nurses was found to be highest for those working on orthopedic, medicine, neurology, spinal, and surgery wards (Yassi et al., 1995). In fact, 51% of the orthopedic nurses sustained at least one back injury during the 2-year study period. Gender did not significantly affect the risk of back injury; however, injuries were slightly more common in nurses with less seniority, and younger nurses were at a significantly increased risk of back injury. Lifting and transferring patients with assistance were the two most common activities for back injury (22.6% and 23.3%, respectively). Injured nurses attributed 52.3% of their injuries to inadequate training; inadequate staffing was given as the primary reason for 13.8% of the injuries. In a large-teaching hospital, the total injury rate for nurses ranged from 14.2 per 100 nurses in the intensive care unit to 3.8 per 100 nurses in the pediatric unit (Goldman, Jarrard, Kim, Loomis, & Atkins, 2000).

Environmental and Physical Risk Factors

In addition to the heavy lifting and physical demands associated with manually lifting patients, the forward bending, twisting, and reaching required when feeding, bathing, and dressing patients are also associated with an increased risk of musculoskeletal injury (Harber et al., 1987; Owen & Garg, 1991). The height of the bed has an important influence on the working posture and handling capacity of nurses (Lee & Chiou, 1994). Simple nursing tasks such as measuring blood pressure and giving injections at the bedside can generate high static loads on the musculoskeletal system of nurses (Harber et al., 1987).

Lifting and moving patients manually has been identified as a high-risk activity (Agnew, 1987; Garg, Owen, & Carlson, 1992; Marras, Davis, Kirking, & Bertsche, 1999; Nelson & Fragala, 2004; Zhuang, Stobbe, Hsiao, Collins, & Hobbs 1999; Stubbs, Rivers, Hudson, & Worringham, 1981). Moving or lifting a patient in bed was perceived

to have precipitated 61% of the low-back pain episodes and 60% of the lost workdays (Owen, 1989).

Changes in Work Organization

The healthcare industry has undergone sweeping organizational changes. The increase in managed care has resulted in shorter hospital stays and sicker hospitalized patients with higher levels of acuity. Between 1981 and 1993, total hospital employment grew steadily, whereas the number of nursing personnel employed declined by 7.3% (Lipscomb, Trinkoff, Brady, & Geiger-Brown, 2004). In a cross-sectional study of 1163 nurses, it was found that nurses who reported that the healthcare system where they worked underwent more than six organizational changes also reported significantly more musculoskeletal disorders involving the neck, back, and shoulders when compared to nursing staff who reported no more than one change in the way their work was organized (Lipscomb et al., 2004). The Minnesota Nurses Association found that when RN positions in hospitals decreased by 9%, the number of work-related injuries or illnesses among RNs in those hospitals increased by 65% (Shogren, Calkins, & Wilburn, 1996).

Evolution of Prevention Effectiveness Research

Ineffectiveness of Body Mechanics Training. Training alone has not been shown to reduce the risk of patient-lifting related injuries to nursing personnel (Dehlin & Lindberg, 1976; Dehlin, Berg, Anderson, & Grimby, 1981; Nelson, Fragala, & Menzel, 2003a; Snook, Campanelli, & Hart, 1978; Wood, 1986). Research on healthcare worker back injuries has progressed from the early work that described the injury prevalence and incidence by job title, age, gender, and other demographic characteristics (Cust, Pearson, & Mair, 1972) to examining the effectiveness of training programs. After it became widely recognized that the hazard of lifting heavy human bodies could not be alleviated by training alone, subsequent studies examined patient lifting from an ergonomic viewpoint; researchers began conducting task analyses and biomechanical evaluations of patient handling activities with the intent of redesigning and adapting patient handling tasks to not exceed the capacities of caregivers.

Task Analyses. Task analyses are one of the tools used to conduct ergonomic assessments to evaluate methods used for lifting and transferring patients. From the perspective of epidemiology, task analyses provide an

assessment of the caregiver's exposure to physical risk factors that can contribute to musculoskeletal disorders. The capacity of a caregiver to perform the requirements of lifting tasks requires an understanding of the biomechanical forces, postures, the hand grip a nurse holds a patient with, the vertical height a patient is lifted and the distance a patient is moved (Waters, Putz-Anderson, Garg, & Fine, 1993).

For patient handling, aspects of the lifting task that must be considered include the weight of the patient, the weight-bearing ability of the patient, and the posture and the type of grip that the caregiver has on the patient while lifting. The challenge of lifting and moving patients is further complicated by the patient's size, shape, level of fatigue, cognitive functioning, cooperation as well as the worker's physical impairments, lower limb function, balance, and coordination (Lloyd, 2004). Cognitively impaired patients can be unpredictable. They may abruptly struggle or resist the caregiver, or become limp during a transfer, creating a sudden unexpected load on the caregiver (Lloyd, 2004). This sudden loading can cause excessively high forces that can injure the spinal muscles (Anderson 2001). Task analyses conducted in nursing homes identified the most physically demanding tasks as transferring physically dependent residents to and from the toilet, in and out of beds and chairs, repositioning in bed, and transfers for bathing and weighing residents (Garg et al., 1992).

Biomechanical Laboratory Studies. Historically, the caregiver has used his or her own physical strength to provide manual assistance to the patient. In 1987, Bell indicated that patient lifts had been available for 100 years, but it was not until the early 1990s that published studies began to demonstrate that the risk of injury to caregivers in nursing homes could be reduced through the use of mechanical lifting equipment.

Extensive research has documented high levels of biomechanical stress on caregivers when performing patient lifting and repositioning tasks (Gagnon, Sicard, & Sirois, 1986; Lloyd, 2004; Marras et al., 1999; Ulin et al., 1997; Zhuang et al., 1999). A biomechanical evaluation of nine battery-powered lifts, two assistive devices, and a manual baseline method for transferring nursing home residents from a bed to a chair revealed that the method of transfer and the resident's weight affected a nursing assistant's low-back loading (Zhuang et al., 1999). The use of portable or ceiling-mounted mechanical lifts significantly reduced the nursing assistants' back compressive forces and removed about two-thirds of the exposure to lifting activities per transfer as compared to the baseline manual method (Zhuang et al., 1999).

Laboratory-based biomechanical studies have identified safer ways to lift and move patients by removing the excessive forces and extreme postures that can occur when manually lifting patients. The collective assessment of the biomechanical laboratory studies led to the conclusion that mechanical lifting equipment could significantly reduce the biomechanical stress that lead to musculoskeletal injuries when compared to manual methods (Garg et al., 1992; Harber et al., 1985; Marras et al., 1999; Owen, 1987; Zhuang et al., 1999).

Field Studies and Demonstration Projects. The research literature on back and musculoskeletal injuries among nurses has been expanding rapidly since the 1980s. More recently, the emphasis on nursing back injury research has shifted from describing the magnitude of the problem to seeking solutions to eliminate the problem. After laboratory studies demonstrated that mechanical lifting equipment could significantly reduce the physical stresses imposed on caregivers under controlled conditions in the laboratory, the next phase of research was to validate the effectiveness of mechanical lifting equipment in real-world settings. The most recently published studies have been field studies conducted in hospitals and nursing homes. A strong body of intervention effectiveness research has been amassed demonstrating that mechanical lifting equipment as part of a SPHM program can significantly reduce musculoskeletal injuries among healthcare workers (Collins et al., 2004; Garg, 1999; Garg & Owen, 1992; Nelson & Fragala, 2004; Yassi et al., 2001).

One of the first comprehensive intervention evaluation studies demonstrating the effectiveness of mechanical lifting equipment in the context of a comprehensive program was funded by the NIOSH and conducted by Garg & Owen, (1992). The program evaluation included:

- Identifying the most stressful patient handling tasks
- Performing an ergonomic evaluation of these tasks
- Conducting a laboratory study to select less stressful patient transferring tasks
- Conducting a field study to evaluate mechanical lifting equipment
- Training nursing staff how to use the equipment
- Modifying toilets and shower rooms
- Applying the techniques to resident care

The authors concluded that ergonomic intervention programs were effective in reducing the risk of low-back pain in the small sample of nursing personnel in the study, and stated that large-scale studies in different nursing homes were needed to confirm the above findings. Building on these findings, a larger study assessed the long-term effectiveness

of patient handling programs in seven nursing homes and one hospital (Garg, 1999). Fifty-one months after the resident lifting program was introduced, injuries from resident transfers decreased by 62%, lost workdays by 86%, restricted workdays by 64%, and workers' compensation costs by 84%.

In a study conducted by the NIOSH (Collins et al., 2004), a safe resident handling and movement program reduced resident-handling workers' compensation injury rates by 61%, lost workday injury rates by 66%, and restricted workdays by 38%. Additionally, the number of workers suffering from repeat injuries was reduced. During the 36 months before the intervention there were 129 workers' compensation claims attributed to resident handling, and 11 workers filed more than one workers' compensation claim for musculoskeletal injuries. During the 36-month post-intervention period, 56 workers' compensation claims were attributed to resident handling and only 3 employees filed more than one workers' compensation claim associated with resident handling tasks.

The VHA conducted an evaluation of ceiling-mounted patient lifts on a 60-bed nursing home unit deemed to be "high risk" based on the number and severity of injuries reported over a 2-year period (Tiesman, Nelson, Charney, Siddharthan, & Fragala, 2003). At 18-months post-intervention, the incidence of injuries was slightly lower; however, lost workdays were reduced to zero. Subjective ratings by caregivers indicated a high level of satisfaction with the program.

In a separate study, (Nelson et al., 2003b), a multi-faceted program was evaluated in 23 high-risk long-term care units in seven VHA facilities with ~80 nursing personnel. The multi-faceted program included mechanical patient lifts, patient care assessment protocols, no-lift policies, and training on the proper use of patient handling equipment. During the post-intervention period, there was a significant decrease in the rate of injuries and modified duty days, an increase in caregiver satisfaction, and a decrease in the number of "unsafe" patient handling practices performed daily, as reported by nurses. Ninety-six percent of the nurses ranked lifting equipment as the most important program element.

A randomized controlled trial compared the effectiveness of training and equipment to reduce musculoskeletal injuries, increase comfort, and reduce physical demands on staff performing patient lifts and transfers at a large acute care hospital (Yassi et al., 2001). This randomized controlled trial consisted of a "control" group, a "safe lifting" group, and a "no strenuous lifting" group. Both intervention groups received intensive training in back care, patient assessment, and handling techniques, whereas the no strenuous lifting group added mechanical lifts and other assistive equipment. The frequency of manual patient handling tasks was significantly decreased in the no strenuous lifting group. Self-perceived work fatigue, back and shoulder pain, safety, and frequency and intensity of physical discomfort associated with patient handling tasks were improved on both intervention groups, but staff in the no strenuous lifting group showed greater improvements.

A study was conducted in the extended care unit of a hospital to examine the marginal benefit of replacing a traditional floor lift patient lifting program with overhead ceiling lifts (Ronald et al., 2002). During the pre-intervention period there were five mechanical floor lifts, one manual transfer aid, and four beds serviced by two ceiling lifts. After completion of the resident lifting program, the unit included 3 floor lifts, 62 ceiling lifts, and 3 tubs serviced by ceiling lifts. The rate of musculoskeletal injuries caused by lifting/transferring patients was significantly reduced by 58% after the installation of ceiling-mounted lifts, but the rate of musculoskeletal injuries caused by repositioning did not decline. Although the ceiling lifts are designed for both lifting and repositioning residents, the ceiling lifts were actually not used for repositioning residents because of problems with the repositioning slings. Neither equipment nor environmental factors represented major causal factors for musculoskeletal injury pre- or post-intervention. Resistive behavior by patients was the major patient-related causal factor.

CASE MANAGEMENT OF INJURED WORKERS

One of the early field studies in Canada evaluated the effectiveness of a "Personnel Program" that was designed as a case management program to increase communication between injured workers, their doctors, the workers' compensation board, and the hospital administration (Wood, 1986). The Personnel Program significantly reduced the proportion of claims resulting in more than 1000 hours away from work (7.1% to 1.7%) and the frequency of claims filed for incidents. The author attributed the success of the program to carefully documenting and coordinating the complex interactions between the injured worker, the workers' compensation board, the doctors, and the hospital. The program also made a clear statement to workers: "As an employee of this hospital, you are our most valued resource and we cannot afford to replace you."

The findings of a study of 416 nursing back injuries at a large-teaching hospital in Canada add to the evidence that a return to work program can be effective in reducing the duration of time loss due to work-related back injuries (Tate, Yassi, & Cooper, 1999).

DEMONSTRATING COST–BENEFIT OF SPHM PROGRAMS

The establishment of safe patient lifting and movement programs not only provides benefits to caregivers and patients, but also makes good business sense. Cost–benefit analyses from study data demonstrate that the initial investment in lifting equipment and employee training can be recovered in 2–4 years through reductions in workers' compensation expenses. In a study in six nursing homes, the total capital investment in equipment was $143,556 and an estimated $15,000 was invested in training employees on how to use the equipment (Collins et al., 2004). Each nursing home spent an average of $26,500 on lifting equipment and employee training. The average annual savings in workers' compensation costs due to a reduction in employee injuries related to resident handling was $9150. Because the healthcare system was self-insured, the reduction in workers' compensation expenses was recovered immediately, rather than as a reduction in insurance premiums in future years. The reduction in workers' compensation expenses recovered the initial capital investment in slightly less than 3 years. The return on investment is even shorter if savings in indirect costs are considered (e.g., lost wages, cost of hiring and retraining workers).

An evaluation of a SPHM program among 780 nursing personnel from 23 high-risk long-term care units in 7 VHA facilities showed that equipment and training costs were recovered in saved workers' compensation expenses in approximately 24 months (Nelson et al., 2003b; Tiesman et al., 2003). In a study that evaluated resident lifting programs in seven nursing homes and one hospital (Garg, 1999), the sharp decrease in workers' compensation costs resulted in an average payback period of 15 months (range 5–29 months).

The impact of installing 65 ceiling-mounted lifts was evaluated in the extended care unit of a hospital in British Columbia; the aim was to determine if musculoskeletal injuries were reduced among healthcare workers (Spiegel et al., 2002). The ceiling-mounted lifts were purchased with a one-time capital expenditure of $344,323. Workers' compensation costs associated with lifting and transferring residents were reduced by 69% or $89,378 annually, resulting in a payback period of 3.85 years. Spiegel noted that whereas financial analyses are useful, they should not be the only factor in making program decisions. Qualitative information related to the well-being of the workforce and residents should be considered as well. The economic information generated by this study did not serve as the sole decision-making criterion, but rather was used in conjunction with qualitative nursing and patient issues. Installation of overhead mechanical lifting equipment is currently being considered as a possible standard for newly constructed hospitals in Canada.

INACTION AND INJURY

Despite the evidence of the effectiveness of these interventions, hospitals have been slower than nursing homes to adopt such programs, often citing the financial cost of equipment and associated training. Schools of nursing continue to teach manual handling methods, and many hospitals do not have mechanical aides to assist with patient transfers. Nursing licensure examinations continue to test nursing school graduates on manual handling, as is indicated by this statement from the 2004 NCLEX-RN Test Plan: "Use correct body mechanics to lift, transfer, transport, position and assist clients to ambulate" (National Council of State Boards of Nursing, 2003). Employers in the healthcare industry should work together to reduce the lifting burden for their employees. Likewise, educators should teach patient handling techniques based on the research evidence demonstrating the effectiveness of SPHM programs. State boards of nursing should discontinue testing prospective licensees on manual lifting methods that have been proven to be ineffective. With hospital nursing vacancies projected to be 800,000 by 2020 (Health Resources and Services Administration, 2002), nurses are a valuable resource that should be protected through the widespread implementation of SPHM programs.

SUMMARY

Since most schools of nursing continue to teach manual patient handling methods, and nurses tend to practice what they were taught in school, a paradigm shift is necessary to change the way patients are lifted and transferred. Because nursing homes and hospitals are beginning to implement ergonomics programs on a widespread basis in the United States, some nursing personnel have modified their patient lifting work practices. With the collaborative assistance of the nursing licensure boards and schools of nursing, this book can be a stimulus for changing the way patient lifting and the biomechanics of lifting patients are taught to nursing students.

Although musculoskeletal injury rates to nursing personnel vary by age, gender, length of employment, and job title, prevention strategies should provide protection for all nursing personnel regardless of age, height, or other pre-disposing factors. A body of research has been

accumulating that supports a multi-faceted approach to reducing the risk of patient handling injuries to caregivers. Teaching professionals need to replace manual patient handling methods taught in outdated biomechanical classes with the SPHM principles presented in the following chapters. These principles include ergonomic assessments of patient handling activities, patient assessment and use of algorithms, redesigning patient lifting tasks by utilizing new patient handling technology, use of unit-based peer safety leaders, and administrative support in the context of a SPHM program. With a SPHM program, nursing care providers can enjoy the rewards of their work free from pain and injury.

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CHAPTER TWO

Myths and Facts About Back Injuries in Nursing

Audrey L. Nelson, Guy Fragala, and Nancy N. Menzel

Hospitals and nursing homes have spent considerable time and effort attempting to prevent back injuries among nurses, with little improvement in the incidence or severity of musculoskeletal injuries. In 1989 there were 4.2 lost-workday injury and illness cases per 100 full-time workers in hospitals; in 2000 there were 4.1 per 100 (Bureau of Labor Statistics [BLS], n.d.). Healthcare institutions could undoubtedly use sound guidance in implementing more effective approaches to preventing injuries.

Manual lifting and other patient handling tasks are high-risk activities for both nurses and patients. The prevalence of work-related back injuries in nursing is among the highest of any profession internationally; annual prevalence rates of nursing-related back pain range from 35.9% in New Zealand (Coggan, Norton, Roberts, & Hope, 1994) to 47% in the United States (Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002) to 66.8% in the Netherlands (Knibbe & Friele, 1996). The 2000 incidence rate for back injuries involving days away from work was 181.6 per 10,000 full-time workers in nursing homes and 90.1 for hospitals, compared with incidence rates of 98.4 for truck drivers, 70 for

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CHAPTER 1

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