

Workplace Prevention and Musculoskeletal Injuries in Nurses

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Objective: The purpose of this study was to describe the availability of preventive devices and training in relation to neck, shoulder, and back musculoskeletal injuries/disorders (MSD) in registered nurses.

Summary background data: Nurses have one of the highest rates of MSD of any occupation. Studies have shown that mechanical lifting devices and lifting teams can reduce MSD rates and associated costs.

Methods: Data from 1163 randomly selected currently working nurses (1+ years on the current job) were collected in anonymous mailed surveys (74% response rate). MSD cases had neck, shoulder, and/or back symptoms for at least 1 week, or at least monthly, and moderate or more pain, in the past year.

Results: Nurses with mechanical lifting devices available were significantly less likely to have neck or back MSDs. Back injury was less likely when lifting teams were available. However, adjustable beds and transfer sheets were associated with greater odds of back MSD. Training in workstation adjustment was associated with significantly lower MSD prevalence, though postural training was not.

Conclusions: Though use of mechanical devices and lifting teams was limited in nursing workplaces, these prevention strategies were related to reduced odds of MSD. Nursing administrators can use these findings to consider workplace changes.

Work-related low back pain costs an estimated \$49 billion annually in the United States.¹ Nurses have

one of the highest rates of back and other musculoskeletal injury (MSD) among all occupations.² Back injuries are most frequent, with annual prevalence ranging from 30% to 60%,^{3,7} along with neck (31%-48%) and shoulder injuries (43%-53%).^{5,7,8} The median lost workdays for registered nurses with MSD was 5 days per episode.⁹ MSD also may contribute to nurse turnover. The percentage of nurses who reported ever changing jobs for a neck, shoulder, or back MSD was 6%, 8%, and 11%, respectively.¹⁰ This is particularly disturbing given the current shortage of nurses and the increasing need for nursing care projected over the next decade.¹¹

Preventive measures such as lifting teams, lifting devices, and accompanying training programs have been shown to reduce MSDs, while assisting nurses in delivering patient care.¹²⁻¹⁹ Teams consist of 2 to 4 members instructed specifically to lift and transfer patients.²⁰⁻²¹ Lifting teams have reduced back injuries, related absenteeism, and healthcare and workers' compensation costs. For example, teams saved \$65,000 on the day shift, dropping injury rates from 39 to 2.4 per 1000 in 1 year at a US hospital.¹³ In another large hospital, accidents resulting in lost time went from 16 to 1, saving \$144,000 in the following year.²² Regarding the impact of mechanical lifting devices on injury rates, Lynch¹⁵ noted a decrease in reported back injuries with just a marginal increase in use of the devices. Elford and Straker²³ found that eliminating manual handling of the patient was the best option to reduce back injuries.

In contrast, other devices (eg, transfer sheets and adjustable beds) have not been shown to be as effective as mechanical lifting devices, although they have some benefit in reduced forces on the body.²⁴⁻²⁷ Also helpful are administrative controls, such as "no

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lift” policies and training that promotes mechanical lifting and discourages manual lifting. A zero-lift program decreased workers’ compensation costs, lost workdays,²⁸ and nurse injuries.²⁹ A “no-axilla” lift policy, combined with walking belts and repositioning sheets, reduced back injuries by nearly half.³⁰

On the other hand, training focused exclusively on lifting without accompanying devices or teams has not been successful. Education-only programs did not prevent low back pain and sick leave,^{31,32} because such training generally promotes unsafe techniques with excessive forces on the body.³⁰

Most research suggests that all lifting and transferring techniques put the worker at some risk.²⁷ When fewer nurses are required to have lifting responsibilities, work absenteeism due to injury is decreased, and worker compensation costs are diminished.²² The limited reports on mechanical devices suggest that use levels are suboptimal.³³ Data on lifting teams in hospitals or other settings are also lacking. Therefore, the purpose of this study was to describe the availability of preventive measures and training in relation to neck, shoulder, and back MSD among registered nurses. Use of mechanical devices and reasons for use were also examined. Nurses’ preferred techniques for conducting patient transfers are described, and recommendations based on our findings are provided.

Methods

Sampling and Data Collection

A random sample of 2000 actively licensed registered nurses (RNs) from 2 states (1000 per state) was selected. Of those, 67 were ineligible, leaving 1933 in the sample, with 1428 (74%) responding. We limited this analysis to the 1163 respondents working as nurses in the past year, who were in their current job for at least 1 year.

These nurses were mostly women (94%) with 18% from ethnic minority populations (ie, non-European). Two thirds were currently married (67%) with a mean age of 45 years. Half had at least a college degree, two thirds were employed as staff/general duty nurses, and 57% worked in hospitals. The overall sample characteristics closely resemble RN samples in the United States,³⁴ though currently working nurses tended to be younger.

Data were collected via anonymous mailed survey, using contents and procedures recommended by Dillman³⁵ and Heberlein and Baumgartner.³⁶ Surveys were mailed to homes from October 1999 to February 2000 and consisted of an 8-page form mea-

suring neck, shoulder, and back problems; physical demands; job characteristics, prevention issues, and health and well-being. Six contacts were made by first-class mail, including 3 questionnaires with incentives. Surveys were electronically scanned; data were cleaned using logic, range, and consistency checks.

Variables Measured

The availability of preventive initiatives was measured by asking whether the following were available in the workplace: lifting teams, mechanical lifting devices, adjustable beds, and sliding/transfer boards. Training was measured by asking if nurses had been trained on their current job in correct work postures, use of lifting devices, adjustment of workstation equipment, and recognizing workplace hazards. The researchers formulated these items with input from a nurse ergonomist. Reliability using coefficient alpha was adequate for the 8 items (0.70), though each was analyzed separately for this report.

Nurses with mechanical devices available were also asked how often they used them (never, sometimes, always), and about 4 factors related to use of devices (ease of use, ease of adjustment, if they are well maintained, and if they are readily available).

Musculoskeletal problems were ascertained by inquiring about symptoms in the neck, shoulder, and/or back including pain, numbness, tingling, aching, stiffness, or burning in the past year, adapted from the Nordic questionnaire.³⁷ An “MSD case” was defined as a relevant symptom lasting at least 1 week, or occurring at least monthly, with a pain intensity of at least 3 on a 5-point pain scale on average.³⁸ We excluded nurses with non-work-related injuries/accidents occurring up to 3 months *prior* to onset of the symptoms. Nurses meeting MSD case criteria were compared to nurses who were completely asymptomatic for any neck, shoulder, or back MSD problem (reference group).

To assess lifting techniques, nurses were asked what their preferred technique would be for transferring a patient from a bed to a chair. Choices given were solo lift, 2-person lift (not a lifting team), lifting team, mechanical lift, and other. Variables that may serve as potential confounders of these relationships were also measured and adjusted for in the analysis. These included lifestyle factors (body mass index [BMI], overall conditioning [ie, exercises regularly], and smoking) along with demographics (age, ethnicity, and having children under 4 years old).

Data Analysis

The existence of workplace training programs and control measures was described by tabulating the relevant questions. For bivariate analyses, frequencies and crosstabulations were generated as appropriate for use of mechanical devices and preferred transfer method, as a result of the descriptive nature of these issues. Individual logistic regression models were generated for each preventive device and training variable in relation to neck, shoulder, and back MSD, with adjustment for lifestyle and demographic factors. Adjusted odds ratios are presented from these models, with *P*-values for each significant estimate.

Results

In this sample, the prevalence of neck, shoulder, and back MSD cases was noted to be 24%, 22% and 32%, respectively. For the availability of preventive devices, only 10% of nurses reported that they had a lifting team available in their workplace. Almost half had mechanical lifting devices (48%), 61% had transfer board/sliding sheets, and three quarters (77%) had adjustable beds. For training, most nurses indicated that their workplace trained them in correct work postures (75%); 46% were trained in adjusting workstation equipment and 46% in the use of mechanical lifting devices. Eighty-five percent were trained to recognize workplace hazards.

Of those who had mechanical lifting devices available, 57% reported that they sometimes used it and only 6% always used it. Of those with devices available, 74% reported receiving training in the use of devices. Among those who reported that they sometimes or always used the devices, three quarters reported that they were easy to use (78%), easy to adjust (74%), and well maintained (75%), and 61% said devices were readily available. Compared to those who did not use devices, there was no difference in the ease of use, adjustment, or maintenance level; only the ready availability differed (48%). This was a significant difference, indicating that availability was related to use ($P = .01$).

For preferred transfer method, the most popular choice was a 2-person lift (46%). This was followed by lifting team (17%), and then mechanical device (16%), which are the healthiest choices for the nurse. Preferences varied by location of practice, with those in nursing homes (29%) and home health agencies (31%) more likely to prefer mechanical lifts, whereas the 2-person lift was preferred in the hospital (49%). Preferences also varied by nursing position. The proportion of nurses choosing lifting

teams or mechanical devices was lower in staff nurses (30%) and nurse managers (28%). Other administrators (39%), clinical nurse specialists (52%) and educators (41%) were more likely to choose these options. For specialty differences, gerontology and home health nurses were more likely to prefer mechanical devices (28%). Those who had been trained in the use of lifting devices were twice as likely to prefer use of the devices compared to the rest of the sample. Lifting teams were preferred by cath lab/diagnostic, postanesthesia care unit, and oncology nurses (32%-36%).

Relation to Musculoskeletal Injury/Disorder

For the preventive devices considered, all were significantly related to back MSD. Having lifting teams and lifting devices available in the workplace was highly protective, because both were associated with significantly *lower* odds of back MSD. In contrast, availability of transfer boards/sliding sheets and adjustable beds was associated with significantly *higher* odds of back MSD. For neck MSD, only lifting devices were significantly associated, and again the association was protective (Table 1). All significant associations remained after adjusting for lifestyle factors and demographics.

Table 1 data were provided in the form of odds ratios, which estimate the chance of having an MSD if a particular preventive device was available, or training content received. They are best interpreted as follows: for adjustable beds, the odds ratio (OR) for back MSD was equal to 1.67. This indicates that nurses with adjustable beds in the workplace were 67% more likely to have a back MSD compared to nurses without such beds, after adjustment for demographic and lifestyle covariates. To have a significant odds ratio, the 95% confidence interval (CI) should not contain 1.0, which is the odds ratio that indicates "no relationship." As the CI for this estimate was (1.16-2.41), it does not contain 1.0; therefore, there is a significant association of adjustable beds with higher back MSD ($P < .01$).

Odds ratios can also estimate protective relationships, such as those in which the prevalence of MSD is lower among those with the device. In these situations, the odds ratio will be less than one. For example, nurses in workplaces with a lifting team were only about half as likely to have a back MSD (OR = 0.50) compared to those without lifting teams in the workplace. The presence of a lifting team was protective to nurses, as they were significantly less likely to have a back MSD (95%, CI = 0.26-0.94), even after adjustment, as indicated by the

Table 1. Adjusted Odds of Developing a Neck, Shoulder, or Back Musculoskeletal Injury by Availability of Preventive Devices in the Workplace for Currently Working Nurses With One or More Years on This Job, 1999-2000 (N = 1163)

Preventive Devices Available at Work	Adjusted Odds Ratio* (95% Confidence Interval)		
	Neck (n = 225)	Shoulder (n = 185)	Back (n = 289)
Lifting team	0.90 (0.50-1.61)	0.68 (0.35-1.32)	0.50 (0.26-0.94)†
Transfer boards/sliding sheets	1.34 (0.94-1.91)	1.08 (0.74-1.58)	1.50 (1.07-2.10)†
Adjustable beds	1.44 (0.98-2.09)	1.31 (0.87-1.96)	1.67 (1.16-2.41)‡
Mechanical lifting devices	0.45 (0.22-0.89)†	0.66 (0.33-1.31)	0.53 (0.29-0.97)†

*Models adjusted for demographics and lifestyle factors. Reference group: nurses who are completely asymptomatic at all 3 body sites

†P < .05

‡P < .01

confidence interval that did not contain 1.0 ($P < .05$).

The association of training with MSD varied more by content of the training than body site. Training in the adjustment of workstation equipment was associated with significantly lower prevalence of all MSDs, and training in workplace hazards with significantly lower neck and shoulder MSD. As has been found elsewhere,³⁹ training in mechanical lifting devices by itself was not related to back MSD (Table 2). However, when we looked at use of mechanical devices combined with training (among those with devices available), we found that nurses using the devices with training were less likely to have back MSDs than nurses using devices without training (data not shown). This suggests that the training is important for safe use of these devices, and may be needed to get the full benefit of this equipment.

Limitations include the cross-sectional nature of the study, so that the direction of the association between preventive devices and MSD cannot be deter-

mined. Self-reports can also lead to validity concerns, especially for symptom data. Methodologic studies suggest that self-reported symptoms are valid, but may underestimate less serious MSD symptoms.⁴⁰ To address this, we focused on MSDs that met a case threshold definition.⁸ Those with symptoms requiring no medical care were more likely to have recall inconsistencies that were reduced by asking about more recent events.³⁷ Finally, we do not know how many people actually used the lifting team, transfer board/sliding sheets, and adjustable beds, though one can infer that the lifting team was rarely used due to its low prevalence in workplaces.

Discussion

Nurses with lifting devices and lifting teams in their workplace were significantly less likely to have an MSD. Also noteworthy was the protective association of lifting devices for neck injuries. In contrast, we were surprised to find that nurses with transfer

Table 2. Adjusted Odds of Developing a Neck, Shoulder, or Back Musculoskeletal Injury by Training Content Provided on the Current Job for Currently Working Nurses With One or More Years on This Job, 1999-2000 (N = 1163)

Training	Adjusted Odds Ratio* (95% Confidence Interval)		
	Neck (n = 211)	Shoulder (n = 171)	Back (n = 275)
Use of mechanical lifting devices	1.00 (0.69-1.46)	0.77 (0.51-1.15)	1.05 (0.74-1.50)
Adjusting workstation equipment	0.56 (0.38-0.81)†	0.53 (0.36-0.80)†	0.60 (0.42-0.85)†
Recognizing workplace hazards	0.48 (0.29-0.80)†	0.46 (0.27-0.79)†	0.62 (0.38-1.02)
Correct work postures	0.81 (0.53-1.23)	0.65 (0.42-1.01)	0.88 (0.59-1.31)

*Models adjusted for demographics and lifestyle factors. Reference group: nurses who are completely asymptomatic at all 3 body sites

†P < .01

boards and adjustable beds available were significantly *more* likely to have back MSD. This could be because transfer boards and other repositioning devices have been shown to reduce spinal loads, yet may still exceed recommended thresholds for spinal compression forces.²⁷ Adjustable beds have also been given equivocal ratings in preventing back injury.²⁴

Unfortunately, only about half of nurses reported availability of lifting devices in their workplace and only 10% had lifting teams available, whereas the majority had adjustable beds and transfer sheets in their workplaces. Availability of lifting devices was key, but training in the use of the devices was also important in promoting use and protecting nurses from MSD.⁴¹ The challenges of providing safer lifting in home care settings also need to be addressed.

Despite the evidence supporting the use of mechanical devices and lifting teams, in most circumstances practicing nurses preferred a 2-person lift. Administrators and advanced practice personnel such as clinical specialists and educators were more likely to prefer lifting teams and mechanical devices, suggesting that they may be well positioned to guide implementation of safer lifting strategies in nursing workplaces. The finding that

those who were trained to use mechanical devices were more likely to prefer this option for patient transfers is also encouraging.

This suggests an opportunity for implementation of safer lifting policies. Lifting policies need to address prevention of both initial injury, and further trauma or re-injury to the affected body part. Most studies indicate that initial costs for preventive programs and equipment are high; however, total cost savings were significant in workers' compensation premiums and time away from work, and often occurred within the same year of implementation.^{13,42,43} The association of training in workstation adjustment with reduced MSD at all body sites is intriguing, and should be studied further.⁴⁴ This suggests that ergonomic training may be beneficial for nurses if they have adaptable workstations.

Administrators can work with occupational safety departments and employees to assess unit working conditions and the availability of optimal equipment, and support evidence-based lifting strategies. Findings suggest that opportunities for diffusion of safer technologies abound, and that promotion of policies to reduce injury will need to address nurse preferences to have the greatest success in prevention.

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