

## PHYSICAL RISK FACTORS FOR WORK-RELATED LOW BACK DISORDERS IN NURSES AND STEEL WORKERS

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### Aims

The objective of this research was to assess the physical risks for work-related low back disorders (WLBD) in order to arrive at recommendations for job modifications and training programs.

### Methods

Two steel companies and one acute care hospital participated in this research. A review of five-year injury records was performed. A questionnaire survey was completed by 47 nurses and 108 steel workers (SW) (participation rate > 70% of full time workers). Evaluations of maximal range of motion (ROM) using electrogoniometers, lumbar lordosis using photogrammetry, strength and electromyographic activity (EMG) of the erector spinae and rectus abdominis of 25 nurses and 25 SW were done for normalizing occupational tasks. Physical demand analyses of manual patient transfers, turning and repositioning patients in bed (36 nurses), and of the steel blade punching task (23 SW) were performed. It included measuring lumbar motion during work and the estimation of the compression, shear forces on the lumbosacral joint, ligament strain, and percentage of the population capable of performing the tasks using University of Michigan model. All nurses were female and all SW were male subjects. Statistical analysis included descriptive analysis and analysis of variance with Fisher's least significant difference (LSD) post-hoc test. The normality of the distributions was tested using the Kolmogorov-Smirnov test, and the homogeneity of the variances was checked using Levene statistic. The significance level was set to 0.05.

### Results

The percentage of the respondents that reported to have at least one WLBD while working and that reported to have low back pain at the time they were filling out the questionnaire were, respectively, 65% and 30% in the orthopedic nurses (ON), 58% and 25% in the ICU nurses (IN), and 36% and 16% in the SW. The mean (SD) weight handled was 47 (30) kg by the ON, 26 (10) kg by the IN, and 35 (11) kg by the SW. The perceived job exertion on a 10-point scale was 7 (2) for the ON, 6 (2) for the IN, and 5 (1) for the SW. Patient transfers by the ON, turning and repositioning patients in bed by the IN, and punching holes in steel blades by the SW were considered the most physically demanding and risky tasks of their occupation. There were differences between forces and EMG during maximum voluntary exertion (MVE), job simulated, and preferred levels for lifting (squat and stoop), pushing, and pulling. The job simulated forces [79 (16) % of MVE for nurses and 72 (22) % of MVE for SW] were higher than the preferred levels [56 (21) % of MVE for nurses and 55 (17) % of MVE for SW ( $p < 0.01$ )]. There were also differences between the nurses and SW's lumbar lordosis ( $F = 22.3$ ,  $p < 0.001$ ), extension ROM ( $F = 8.5$ ,  $p = 0.004$ ), and rotation ROM ( $F = 16.9$ ,  $p < 0.001$ ). The peak flexion was no different than the flexion ROM for the stretcher to bed, bed to chair, and chair to bed transfers. The mean lumbar flexion during the stretcher to bed transfer was > 50% of the ROM, being higher than during all other tasks (mean difference > 12%,  $p < 0.01$ ). Peak flexion during the positioning phase of the punching task (SW) was 90 (13) % of the ROM and the mean flexion represented more than 60% of the ROM. For the nurses, the instantaneous compression at L5/S1 [4754 N (437)] and population without sufficient torso strength [37% (9)] were highest during the pushing phase of the bed to stretcher transfer. The shear force [487 N (40)] and ligament strain [14% (5)] were highest during the pulling phase of the stretcher to bed transfer. For the steel workers, the instantaneous compression during the positioning phase of the punching task was 2828 (318) N and shear was 219 (33) N. This phase also represented higher ligament strain ( $p < 0.001$ ).

### Conclusions

Nursing tasks impose significant biomechanical demands on the lumbar spine. High flexions and forces are critical aspects of the transfers requiring most of the nurses' capabilities. For the SW, between 95% and 99% of the male population would be capable of performing the job and the instantaneous forces were not markedly high. However, the extent of lumbar flexion used was close to the full range; the sustained high flexions and pushing forces were determined to be the likely cause of higher incidence of WLBD. Evidence based recommendations for modifications and training programs to reduce the risk of WLBD in nurses and SW are proposed.