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Occupational musculoskeletal disorders among supermarket cashiers

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There are approximately one million workers in the United States who are employed as supermarket cashiers. Over the past several years, these workers have been reported to develop work-related musculoskeletal disorders, especially carpal tunnel syndrome (1—4). In 1988, the United States National Institute for Occupational Safety and Health (NIOSH) received a request from the United Food and Commercial Workers International Union to evaluate the prevalence of occupational musculoskeletal disorders among supermarket cashiers in one supermarket chain and to make recommendations to improve the workstation design. In response to this request, a cross-sectional epidemiologic investigation and an ergonomic evaluation were conducted (5).

Methods

Of the 28 stores owned by the supermarket chain, four stores, reflecting a variety of checkstand designs, were chosen for study. The medical evaluation consisted of an interviewer-administered questionnaire and a standardized musculoskeletal physical examination which was offered to all supermarket workers, excluding those in the meat department. In order to determine whether there was significant selection bias, we offered those who did not participate in the field evaluation a chance to complete the questionnaire through a telephone interview.

The statistical analysis was initially limited to only those who participated in the field evaluation. A case of a work-related upper extremity musculoskeletal disorder was defined as a worker who complained of symptoms, during the past year, in the neck, shoulder, elbow, or hand and wrist. The symptoms should have occurred at least once a month or lasted at least one week, should have started after the worker was employed in his or her current job, and should not have been associated with an acute injury. In addition the worker should have had an abnormal diagnosis in the musculoskeletal examination.

The prevalence of disorders was determined, and an unconditional multiple logistic regression analysis was used to compare the prevalence among cashiers to that of all other supermarket workers, while confounders, including age, hand-intensive hobbies, and systemic diseases, were controlled for. Since the cashiers were almost exclusively female (96%), the statistical analysis was confined to female employees.

The ergonomic evaluation included an analysis of videotapes of cashiers processing seven standard cart orders and 27 normal customer orders. These orders were distributed among four stores and five different checkstand designs. The standard cart was a basket of 33 common items processed through each checkstand to provide for a uniform comparison of different checkstand designs. As part of the analysis, job- and worker-specific information was collected. The job data included cycle time, number of items in the order, number of scans, and number of key-ins. Cycle time was defined as the amount of time elapsed between reaching for the first item in an order and completing the last movement associated with that same order, including cash tendering and bagging. Worker data included total number of movements for the left and right hands, presence of awkward postures of the hand, forearm, shoulder and back, and the job activities most associated with these awkward postures. Information on 46 noncashier job activities was also collected, with the exception of the job-specific data that did not apply, such as numbers of scans and key-ins.

The awkward postures cataloged were flexion, extension, and ulnar and radial deviations of the wrists; supination and pronation of the forearms; abduction and flexion of the shoulders; and flexion (forward bending) and rotation of the trunk. The average and peak forces were estimated on the basis of observed postures and the weight of handled items.

Results

A total of 119 female cashiers and 55 other female supermarket workers participated in the medical field evaluation, and an additional 41 workers (9 cashiers and 32 other workers) completed telephone interviews. Participation in the field was 85% for the cashiers and 55% for the other workers, which increased to 91 and

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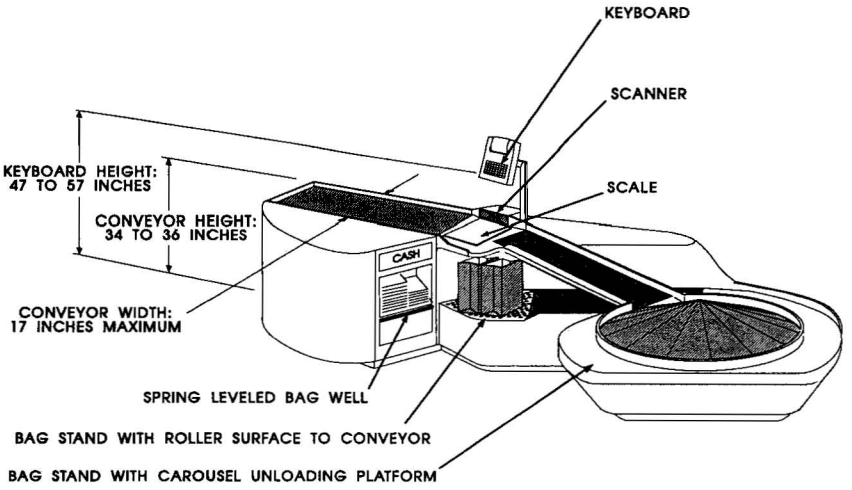

Figure 1. Drawing of a checkstand meeting the design recommendations of the National Institute for Occupational Safety and Health. (1 inch = 2.54 cm)

85%, respectively, following the telephone interviews. The supermarket cashiers had a higher prevalence of cumulative trauma disorders than the other supermarket workers. The logistic regression analysis found statistically significant increases in the odds ratio for the rate of disorders among the cashiers for shoulder and hand-related musculoskeletal disorders. The prevalence of disease based on the questionnaire alone was determined for all of the participants, including the telephone respondents. There was no decrease in the odds ratios once the telephone participants were included; thus no significant selection bias was shown.

The video analysis indicated that the main ergonomic stress factors of cashiers were repetitive hand movements and awkward postures. These stresses were due in part to checkstand design and in part to cashier work practices. Average forces were estimated to be low, and peak forces to be medium.

Stressful postures resulting from the checkstand design included shoulder and trunk flexion while the worker reached for items on the conveyor belt, wrist extension and flexion while scanning items, wrist extension while operating the keyboard, shoulder flexion and trunk rotation while reaching to the scale to weigh produce, and wrist flexion and excessive reaching while bagging.

Cashier work practices that contributed to musculoskeletal stress were tying plastic bags closed and handing them to the customer, reaching over the conveyor to retrieve items from a customer's cart, reaching for items to be scanned instead of waiting for the conveyor to bring them to the scanner, scanning an item more than two or three times, and not keying-in multiple purchases of a single item.

Since only a small sample of the noncashier activities was recorded on videotape, the stress factors and risk levels of these jobs cannot be accurately reported or compared with those of the cashiers. An analysis of portions of these jobs indicated, however, that the noncashiers were exposed to similar ergonomic stresses and that the overall risk of these jobs was probably moderate.

Discussion

This evaluation found an association between working as a cashier and developing musculoskeletal disorders. The comparison group, other supermarket workers, was also found to have exposure to ergonomic stresses. Therefore, the measured association is probably an underestimate of the true relative risk of work as a cashier compared with the work of people with few ergonomic stressors. NIOSH is continuing research in the retail food industry to characterize better the ergonomic risk factors.

Our ergonomic evaluation identified several aspects of the design of the checkstand which contributed to the postural stresses. On the basis of this analysis NIOSH recommended several design characteristics that would improve the cashier workstation. The recommendations are as follows:

1. Locate the scale and the scanner in front of the cashier. The scale should be placed horizontally (mounted flush with the conveyor) to eliminate twisting and reaching to weigh produce.
2. Situate the keyboard in front of the cashier, above the

scanner. The keyboard should have adjustment capabilities in all directions (up-down, right-left, toward-away from the cashier). The angle of the keyboard should also be adjustable.

3. Locate the cash drawer to the side of the cashier at a height of 32—36 inches (81—91 cm) from the floor, with the near edge of the drawer no more than 18 inches (46 cm) from the cashier.
4. Provide an adjustable sit-stand bar in the checkstand area to allow for rest when possible during the job cycle (eg, customer check writing, waiting for customers, etc). Padded mats to stand on that are designed to reduce leg fatigue should also be considered for the checkstand area.
5. It is preferable to have another worker bag grocery items. If this is not possible, bagging areas should be flush with the conveyer to avoid unnecessary lifting of items.

A concept of a checkstand that meets the design criteria is presented in figure 1.

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