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Case Studies

Ergonomics in the Supermarket

Dawn Tharr, Column Editor

Ergonomic Assessments of Supermarket Cashiers

Case 1 Evaluation

David Orgel, Monica Milliron, and Linda Fredrick

On August 15, 1988, the National Institute for Occupational Safety and Health (NIOSH) received a request from the employees at a supermarket to evaluate musculoskeletal injuries, primarily in the upper neck and shoulders, thought to result from operating registers at the express checkout.

An initial ergonomic and medical evaluation was conducted on November 7, 1988. This consisted of observation of work practices, videotaping and still photography of the operation of the checkout, and private medical interviews with employees. Measurements of the workstation were recorded so that working heights and reach distances could be determined.

Analysis of the data indicated the following:

1. Reaching the far corner of the checkstand may cause excessive trunk flexion.
2. The keyboard's height and distance from the cashier may cause excessive static stress and shoulder flexion.
3. Improper work practices such as scanning bulky or heavy items may be a contributing factor.

On January 13, 1989, a baseline symptom questionnaire was completed by full-time or fill-in cashiers. Subsequently, the following changes in the express checkout work practices and design were instituted:

1. A physical barrier was placed at the far corner of the checkstand to reduce excessive trunk flexion.
2. A telescoping keyboard was installed to reduce static stress and shoulder flexion.
3. All cashiers and fill-ins were required to view a videotape on proper checkout work practices.

On September 1, 1989, approximately four months after institution of these changes, the symptom questionnaire was repeated on the same cashiers. There was a significant decrease in symptoms of the neck, back, or shoulder and of the low back, buttock, or leg in the follow-up investigation; however, there was no change in arm, forearm, or wrist symptoms. The most effective intervention to reduce musculoskeletal discomfort from the employees' perspective was the adjustable keyboard.

Data from this investigation indicated that an ergonomic hazard existed from the operation of the express checkout due to excessive trunk and shoulder flexion and body twisting. Initial changes in the workplace design resulted in a significant decrease in symptoms but further improvements would require more extensive interventions. Additional recommendations were provided to further improve the workstation ergonomics.

The case studies approach is a staple of occupational and environmental hygiene education and practice. Case studies allow us access to approaches attempted by others. As such, they may or may not represent every state-of-the-art, but they do tell us more about the actual state of practice.

Every case study must have an objective, and each invariably includes observations from which an evaluation may emerge. Most case studies include recommendations. It should be remembered that recommendations are made at a single point in time and are likely to apply at that time but may become less applicable as more effective methodologies emerge.

"Case Studies," a regular feature of *Applied*, is coordinated by Dawn Tharr. We welcome submissions from our readers.

Case 2 Evaluation

Sherry Baron, Monica Milliron, and Daniel Habes

In August 1988, NIOSH received a request to evaluate whether cashiers of a major supermarket chain developed cumulative trauma disorders (CTDs).

NIOSH's investigation consisted of both a medical/epidemiological and an ergonomic investigation. The goal of the medical investigation was to determine the prevalence of upper extremity CTDs in the cashiers as compared to other supermarket workers. This part of the investigation included a detailed questionnaire and physical examination to assess whether current workers have a potentially work-related CTD. The ergonomic investigation utilized direct observation as well as videotapes to determine the degree of repetitive motion, forceful motion, and awkward postures required by the current workstation design. This analysis was then used to make specific recommendations for redesign of the checkstands.

Evaluation Design and Methods

Three corporations in the supermarket chain agreed to participate in this study. These three corporations owned 28 stores. NIOSH chose four of these stores to include in the investi-

gation because they utilized different types of checkstand designs.

The evaluation of each worker included a questionnaire which asked if the worker had pain, aching, stiffness, burning, numbness, or tingling during the past year in the neck, shoulder, elbow, hand, or back. Other questions elicited more detailed information concerning work history, hobbies, working a second job, history of acute injuries, and other medical problems associated with musculoskeletal disorders.

Each participant was also given a standardized physical examination. Two physician examiners were used who were not aware of the worker's job title and questionnaire results.

Results

The study results indicated that checkers had a higher rate of CTDs compared to noncheckers and that there was a dose–response relationship between checking and these disorders.

Ergonomic Recommendations

Analysis of the videotapes indicated that checkstand design and worker practices were contributing factors to the observed postural stresses of cashier work. Presented below are the design characteristics of a recommended checkstand and examples of worker practices that should be eliminated.

Checkstand Design

The design characteristics of the checkstand that influence the patterns of motion of the cashier are the placement of the scanner, keyboard, cash drawer, scale, and bagging area. The proper positioning of these components in the checkstand area will reduce the level of biomechanical stress experienced by cashiers and ultimately should reduce the rate of CTDs for cashiers.

A list of recommendations for design of an ergonomically sound checkstand follow:

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. The scanner should be mounted vertically and present a horizontal beam toward the cashier. A horizontal beam capable of reading three sides of an item minimizes handling of scannable items because most product codes are located on the vertical surface of a container or box. For a conveyor height of 34–36 inches, the reach to the end of the scale and conveyor belt should be no more than 17 inches, provided that all items can be handled within 12 inches to the right or left of the cashier. If cashiers must reach more than 12 inches to the right or left, the conveyor width should be reduced to 14 inches.
2. Situate the keyboard in front of the cashier, above the scanner. The keyboard would have adjustment capabilities in all directions (up–down, right–left, toward–away from the cashier). The angle of the keyboard would also be adjustable. The height of the keyboard will vary with the size of the cashier, but in general, the range of height adjustability should be between 47 and 57 inches.
3. Locate a bag stand to the right of the cashier (right chute design) that permits each item to be bagged immediately after scanning. This arrangement would eliminate the rehandling and lifting of items that currently accumulate in the bagging area. The top of the empty bags should be positioned at a height even with the conveyor. Filled bags are delivered to the customer by either a belt or roller conveyor.
4. Locate the cash drawer to the side of the cashier (opposite the bag stand) at a height of 32–36 inches from the floor, with the near edge of the drawer no more than 18 inches from the cashier.
5. Provide an adjustable sit/stand bar in the checkstand area to allow for rest when possible during the job cycle, e.g., customer check writing, waiting for customer, etc. Padded mats that are designed to reduce leg fatigue while standing should also be considered for the checkstand area.

Cashier Work Practices

Many of the observed patterns of motion did not appear to be controlled by the design of the checkstand, but rather were chosen by the cashiers to expedite the processing of an order or to be helpful to the customer. Training programs should be developed to make the cashiers aware that these extra movements add to the risk of the job and should be eliminated whenever possible. These activities include:

1. Reaching over the conveyor to unload/load grocery items from/to the customer's shopping cart.
2. Tying filled plastic bags before handing them to the customer.
3. Reaching for items to be scanned instead of waiting for the conveyor belt to bring items to the scanner. (This problem may be due to inconvenient location of the conveyor control mechanism.)
4. Scanning an item more than two or three times and not keying-in multiple purchases of a single item. Multiple scanning versus keying items is an issue of tradeoff that must be investigated further. It is possible that multiple scanning of items is a work practice chosen by some cashiers to avoid reaching to an inconveniently located keyboard.

Editor's Note: The Case Studies were conducted by NIOSH personnel. David Orgel is in the Division of Surveillance, Hazard Evaluations and Field Studies; Monica Milliron and Linda Fredrick are in the Division of Biomedical and Behavioral Science. Sherry Baron is in the Division of Surveillance, Hazard Evaluations and Field Studies, and Monica Milliron and Daniel Habes are in the Division of Biomedical and Behavioral Science.

For more information on cumulative trauma disorders, contact: NIOSH, Hazard Evaluation and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226; telephone: 1-800-35–NIOSH.