JOB ROTATION

An Administrative Strategy for Hazard Control

By DONALD D. TRIGGS and PHYLLIS M. KING

Since the dawn of the industrial age, workers have been performing tasks that involve forceful exertions, repetitive manipulations, and awkward or weak postures. Over time, these tasks have been shown to cause injuries that are commonly known as cumulative trauma disorders (CTD).

The rate of industrial injuries has been decreasing at a steady pace, yet the impact of CTDs has greatly increased. In fact, OSHA states that work-related musculoskeletal disorders (WMSD) total one-third of all lost workday injuries and illnesses, accounting for some 650,000 cases in the U.S. in 1997—and costing up to $20 billion annually, with indirect costs estimated at $60 billion (OSHA "Background on the Working Draft"). Upper extremity WMSDs, including carpal tunnel syndrome, account for only 4.4 percent of all compensable cases, yet have greater severity in terms of days off work than do other illnesses and injuries.

HAZARD CONTROL MEASURES FOR CTDs

Controlling the CTD problem is often as multifaceted as the causes of these injuries. Controls are typically divided into two categories: engineering and administrative.

Many firms are using job rotation as a way to control the development of cumulative trauma disorders.

Although both strategies have advantages and disadvantages, engineering controls are preferred because of their permanency and consistency. In other words, if a workstation, tool, process or machine is ergonomically correct, the potential for CTDs is minimized or eliminated. In fact, in a perfect world, the ergonomic design of all human/machine interactions would prevent CTDs from ever occurring.

Unfortunately, this utopia does not exist due to the lack of ergonomic knowledge, financial resources and engineering staff, and time constraints. Although engineering controls are typically the most difficult to implement, OSHA recommends that they be considered as the final solution because they eliminate hazards completely.

Administrative controls are popular because they are typically low-cost and easily implemented. These controls reduce individual exposure to ergonomic stressors by distributing the exposure among other employees. By limiting exposure, they can help delay or prevent the onset of CTDs or reduce the magnitude of fatigue and discomfort experienced by one employee at the risk of exposing additional employees to these stressors (Goldstein).

The key disadvantage of these controls is their reliance on human behavior for success. Since administrative controls do not remove the hazard, they must be constantly monitored, enforced and evaluated. OSHA views them as an interim solution—in place until the engineering control can be implemented.

JOB ROTATION

Job rotation is a popular administrative control. This strategy involves moving employees from workstation to workstation at a specific interval.

It does not change the risk factors present in a facility, it merely distributes them more evenly across a larger group

of people. The goal: To minimize the exposure level.

Various case studies (e.g., Jonsson 108+; Hazzard, et al 29+; Henderson 443+; MacLeod and Kennedy) have examined the perceived benefits of job rotation. These include:

- cross-trained workforce;
- reduced boredom and monotony;
- reduced work stress;
- increased innovation/motivation;
- increased free-time activity;
- reduced CTDs;
- increased production;
- reduced absenteeism;
- lower turnover rates;
- increased ability to handle change.

Some of these studies also discussed the challenges of implementing job rotation. The primary problems involve changing the work structure, workplace culture and employee behavior—not the strategy itself. Cited problems included:

- experienced workers not wanting to learn new types of work;
- machine operators not wanting to "lend" their machines to others;
- practical problems of physically moving from one job to the next;
- unsuitable wage forms;
- training;
- difficulties identifying appropriate jobs;
- inappropriate use of job rotation by management;
- difficulty in determining injury causation.

Several studies offer evidence against job rotation. One stated that through a learning process, individuals are likely to have developed a behavioral strategy that protects them from apparent hazards of the job (Lavender); rotation of unskilled workers into a stressful job increases the risk of injury with each rotation. Another study argues that job rotation degrades task specialization, which reduces productivity and product quality (Cosgel and Miceli).

ELEMENTS OF JOB ROTATION

The level of success a program achieves is directly related to the amount of planning involved in its development. The minimum steps needed to develop a job rotation program are:

1) Set goals.
2) Survey existing conditions.
3) Analyze tasks.
4) Develop rotation schedule.
5) Provide training/break-in period.
6) Implement rotation schedule.
7) Monitor the program.

Set Goals

Too often, job rotation is implemented with no specific goal to attain. In most settings, goals may include:

- Reduce or eliminate CTDs.
- Reduce boredom.
- Increase productivity and quality.
- Reduce absenteeism and turnover.
- Create a teamwork atmosphere.
- Encourage innovation and foster the problem-solving skills of employees.

Survey Existing Conditions

The best way to survey existing conditions is to create a questionnaire designed to obtain employee feedback. The questionnaire should be administered following a short discussion on ergonomics and job rotation; it should focus on perceived exertions of specific body parts relative to the task(s) performed. Data such as years of service performing a specific task may be useful, as may identifying whether a tool is used and beneficial.

Data collected provide qualitative information for the rotation scheduling process. A questionnaire also provides pre-rotation data that can be used in a pre/post comparison to assess the effectiveness of the initiative.

Analyze Tasks

This activity provides the quantitative data needed to develop a job-rotation schedule; it should be performed using proven quantitative techniques such as the 1991 NIOSH Lifting Equation (Waters, et al 749+); strain index (Moore and Garg); and rapid upper limb assessment (RULA) (McAtamney and Corlett 91+). Task elements to be analyzed include: object weights; reach distances; work heights; cycles per minute; task duration; and back and upper extremity postures.

Develop a Rotation Schedule

A job-rotation schedule should be based on both qualitative and quantitative data gathered via the questionnaires and job analysis. One topic of much debate is how many jobs an individual should rotate between. Some suggest the number should be kept to a minimum, perhaps two or three, which allows employees to become "experts" at each task (MacLeod and Kennedy). Others suggest that cross-training employees on all jobs will improve the teamwork process (Volpe, et al 87+).

Whatever the number of tasks selected, the schedule should attempt to alternate employees between dissimilar tasks. For example, a materials-handling task that involves a NIOSH lifting index of 1.5 should be rotated with a task that has a lifting index below 1.0. Likewise, an assembly task that has a strain index of 7.25 should be paired with a task that has an index of less than 5.0. Ideally, paired tasks should require opposite activities—for example, a manual materials-handling task paired with an assembly task.

A study on electromyographical responses to job rotation found the greatest benefits were tasks that were dynamic and required more actual variation in muscular load (Jonsson 108+). Unfortunately, many facilities do not have such tasks.

Therefore, the challenge is to develop a creative schedule. For example, when developing a schedule for an assembly production line where tasks are similar and relatively static, the qualitative information gathered via questionnaires may be more important. Minute variations may also provide scheduling opportunities (e.g., rotation from a task that involves applying five fasteners with a pneumatic tool to a task involving only one).

Provide Training and Break-In Periods

Once an individual's rotation schedule is devised, a sufficient break-in period should be provided. This period enables an employee to develop behavioral strategies needed to limit risk factors; it also enables proper techniques to be learned without the added pressure of "making rate." Workers should be trained to perform their primary tasks within the new rotation, and also on a secondary task in order to provide coverage for absenteeism and turnover.

Implement the Schedule

In practice, this may require some flexibility. For example, if bottlenecks occur, line balancing based on the rotation schedule may be needed to smooth production flow. The schedule must be monitored to make sure workers who have difficulty performing new tasks can obtain assistance without fear of reproach. An assessment can then be performed to determine whether further training and/or accommodation is necessary.

Perceived Benefits of Job Rotation

- cross-trained workforce
- reduced boredom and monotony
- reduced work stress
- increased innovation/motivation
- increased free-time activity
- reduced CTDs
- increased production
- reduced absenteeism
- lower turnover rates
- increased ability to handle change

Potential Challenges of Job Rotation

- experienced workers not wanting to learn new types of work
- machine operators not wanting to "lend" their machines to others
- practical problems of physically moving from one job to the next
- unsuitable wage forms
- training
- difficulties identifying appropriate jobs
- inappropriate use of job rotation by management
- difficulty determining injury causation

Monitor the Program

The rotation program should be evaluated periodically to ensure that its goals are being achieved and expectations met. A follow-up questionnaire should be administered to quantify the program's effectiveness from the workers' perspective. Other metrics include shifts in injury rates, changes in productivity and quality levels, and variations in absenteeism and turnover rates.

CONCLUSION

Job rotation is not *the* solution to CTDs. However, it is being used by many companies to minimize the occurrence of CTDs. In light of OSHA's focus on ergonomics, many companies will likely consider job rotation as an interim solution while they re-engineer work processes to include ergonomics principles.

As with any tool, job rotation can be used—and misused. If it is performed correctly, injury rates can be reduced (Henderson 443+). However, these programs must be carefully designed since poorly designed rotation schedules may actually increase worker stress levels (Putz-Anderson). Furthermore, rotating employees incorrectly may, over time, produce disorders among the entire workgroup (Putz-Anderson).

Traditionally, organized labor has opposed job rotation due to issues such as worker seniority job bid systems, variation in pay grades and contract disputes. Ingenuity and creativity can be used to overcome these hurdles and create an atmosphere of opportunity and improvement.

An example of this occurred when the human resources manager of a Massachusetts textile factory implemented job rotation by grouping individual sewing and packaging stations into a work "cell." The goal was to streamline specific processes in order to increase efficiency.

Initially, workers were skeptical about the change from being compensated based on a piece-rate basis to being compensated based on the cell's performance. However, the productivity gains realized were quickly attributed to the fact that individuals were working as a team and were less fatigued physically and mentally.

The cell concept was approved during contract negotiations for tasks that naturally lend themselves to this new format (i.e., no highly specialized tasks were included). Union members can bid into a cell position when it becomes available, just like any other task. "The cell concept and job rotation isn't for everyone," the manager states. "Some people prefer to work by themselves and to have control over their wages."

Many forms of job analysis techniques are available, ranging from advanced computer/video imaging systems to simple checklists. Unfortunately, a methodological job rotation system based on proven, existing ergonomic models does not yet exist. Such a system must be flexible enough to work for the diverse tasks that exist, yet be structured enough so that someone with a limited background in ergonomics can use it. ■

REFERENCES

Cosgel, M. and T. Miceli. "Job Rotation: Cost, Benefits and Stylized Facts." University of Connecticut, Working Papers Website: <http://www.lib.uconn.edu/economics/papers.html.> 1998.

Goldstein, S. *Getting Started with Ergonomics.* Ann Arbor, MI: Human Solutions, 1995.

Hazzard, L., et al. "Job Rotation Cuts Cumulative Trauma Cases." *Personnel Journal.* 71(1992): 29-32.

Henderson, C. "Ergonomic Job Rotation in Poultry Processing." *Advances in Industrial Ergonomics and Safety.* IV(1992): 443-450.

Jonsson, B. "Electromyographic Studies of Job Rotation." *Scandinavian Journal of Work Environment Health.* Supplement 1. 14(1988): 108-109.

Lavender, S. "The Development of Preparatory Response Strategies in Anticipation of Sudden Loading of the Torso." In *Proceedings of the Human Factors Society 34th Annual Meeting.* Santa Monica, CA: Human Factors Society, 1990.

MacLeod, D. and E. Kennedy. "Job Rotation System: Report to XYZ Co., 1993." <http://209.85.88.134/iob.htm.>

McAtamney, L. and E. Corlett. "RULA: A Survey Method for the Investigation of Work-Related Upper Limb Disorders." *Applied Ergonomics.* 24(1993): 91-99.

Moore, J.S. and A. Garg. " A Comparison of Different Approaches for Ergonomic Job Evaluation for Predicting Risk of Upper Extremity Disorders." London: International Ergonomics Assn., 1994

Occupational Safety and Health Administration. "Background on the Working Draft of OSHA's Proposed Ergonomics Program Standard." <http://www.osha.gov/SLTC/ergonomics/index.html.>

Putz-Anderson, V. *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs.* London: Taylor & Francis, 1988.

Volpe, C., et al. "The Impact of Cross-Training on Team Functioning: An Empirical Investigation." *Human Factors.* 38(1996): 87-100.

Waters, T., et al. "Revised NIOSH Equation for the Design and Evaluation of Manual Lifting Tasks." *Ergonomics.* 36(1993): 749-776.

Donald D. Triggs, *CEA, is an ergonomic consultant/engineer with AON Ergonomic Services in Milwaukee. He holds a B.S. in Manufacturing Engineering Technology and is enrolled in the graduate program at the University of Wisconsin, Milwaukee. He is a member of ASSE's Wisconsin Chapter.*

Phyllis M. King, *Ph.D., OTR, is an associate professor in the Dept. of Occupational Therapy at the University of Wisconsin, Milwaukee. She teaches graduate-level courses in ergonomics and occupational health and rehabilitation.*