

The Companion Solution to Ergonomics:

Pretesting for the Job

by Keith Rosenblum



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The U.S. Department of Labor (DOL) defines a musculoskeletal disorder (MSD) as “injury or disorder of the muscles, nerves, tendons, joints, cartilage and spinal column.” Such strains and sprains represent the leading cause of injury and illness in U.S. industry. They account for 31 percent of the days that employees spend away from work if they have been on the job for less than one year, ac-



According to the DOL. In 2000, there were 578,000 MSDs. In the preceding six years, sprains and strains represented nearly half of the nonfatal occupational injuries and illnesses involving days away from work. And a 1998 Liberty Mutual Insurance Company study of its own losses indicates that overexertion injuries and illnesses lead workplace claims at a cost of about \$9 billion to employers nationwide.



While the number of lost-work time injuries and illnesses has been steadily decreasing since 1992, the percentage of MSDs does not appear to be affected. MSDs have become a serious public health burden by affecting the ability of enterprises to safely staff physically demanding jobs. The question confronting employers is whether ergonomic reengineering can counteract these losses or whether preemployment testing (also known as physical capabilities evaluation, PCE) may be the better solution. PCEs can identify employees who can safely perform the physical demands of the job. They also become an employee tool by enhancing self-confidence and validating the employees' ability to perform physically demanding work safely.



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Unfit Employees or Regulatory Failures?

Americans are continuing to physically decondition, which may lead to increasingly higher rates of strain and sprain injuries and illnesses both on and off the job. According to a survey by the U.S. Centers of Disease Control, the percentage of U.S. children who are overweight continues to rise after almost doubling during the past two decades. These kids will comprise the labor pool of tomorrow.

Such unfit employees are more likely to incur musculoskeletal injuries, according to A.S. Jackson, in his *Exercise Sport Science Review* paper "Preemployment Physical Evaluation." Numerous noted medical researchers, such as W. Monroe Keyserling and T. Pohnonen, have also demonstrated the direct relationship between fitness, strength and the propensity for occupational strain and sprain injuries.

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MSDs—cannot help that 10 percent to 15 percent of the workforce who are most likely physically mismatched to the physical demands of their jobs. Yet, the Occupational Safety and Health Administration's April 2002 plan to reduce ergonomic injuries—a combination of industry-targeted guidelines,

tough enforcement measures, workplace outreach and advanced research—focus almost exclusively on reducing the ergonomic hazards in the workplace.

When OSHA first conducted its comprehensive preliminary risk assessment of MSDs in the workplace, however, it also reviewed and identified alternative interventions, including employee screening. Although scientific literature is essentially void of prospective, peer-reviewed validation studies, the marketplace is ablaze with provider-produced research indicating a positive relationship between strength testing and the reduction of work-related injuries.

The addition of these evaluations can be easily incorporated at relatively low cost with immediate impact on MSD development. Implementing ergonomics interventions and properly matching applicants to the physical demands of the job could practically eliminate workplace MSDs.

How Valuable Is Employee Evaluation?

A University of Michigan study conducted from 1973 to 1977 found workers three times more likely to be injured on the job when they had not

demonstrated the required physical work demands. A more current survey of the major providers and distributors of PCEs indicates consistent reductions in client MSD claims frequency, ranging from 20 percent to 96 percent.

Advanced Ergonomics, Inc. in Dallas, for example, reports in its 1998 eleven-year review of programs at food, soft drink and retail distribution companies a reduction in claims frequency from 26 percent to 40 percent. WorkSTEPS, in Las Colinas, Texas, reports an average 50 percent reduction among dozens of companies in various industries and sectors over the last decade.

In 1995, Twinsburg, Ohio-based Injury Reduction Technology, Inc., conducted a prospective investigation with American Airlines, which appears to be the only study validated by a third-party epidemiological review. The results of the study were submitted to the *Journal of Aerospace Medicine*, but were not published. The abstract of the study indicates a 92 percent reduction in MSDs experienced by its fleet service clerks.

Although not all of these reports hold the weight of peer-reviewed investigations, their consistency, verified by vendor clients, justifies consideration by OSHA to consider PCE intervention as an additional, not alternative, approach to controlling MSDs.

All Assessments Are Not Alike

Preemployment PCEs fall into two broad categories: job simulation and physical capability. Job simulation attempts to measure the applicant to the essential functions of a specific job by attempting to simulate physically demanding work activities.

Physical capabilities tests, on the other hand, measure muscle torque (strength) through either a static position (isometric) or a joint's continuous range of motion (isokinetic), and correlates the results to the strength and range of motion required on the job.

Isokinetic tests require sophisticated equipment and software to measure outcomes. Isoinertial and isometric tests use simpler equipment and software. For jobs rated "heavy," according to the DOL, an isokinetic test will typically exclude up to 25 percent of applicants, where isoinertial job simulations will exclude from 4 percent to 68 percent. Costs of tests range in price as well, from \$85 (isoinertial or isometric job simulation) to \$160 (isokinetics) per test.

In addition, employers must satisfy three concerns when choosing a test:

1. Is the test valid? Does it measure the important work behaviors identified in the job analysis and can it be used to make inferences?

2. Is the testing standardized? Are the test batteries designed, administered and scored with a clear set of procedures?

3. Is the test objective? Are its measurements reliable and free from examiner bias?

The technology behind each form of screening has been exhaustively evaluated and is supported by varying levels of validity and reliability, all of which are at least marginally acceptable for ensuring predictability. The issue of objectivity has greater variability among vendors since most license their technology and batteries through local medical providers where rater objectivity may vary. The more sophisticated technology employed with isokinetics appears less affected by nonobjectivity.

Which Type Is Best?

Essentially, all forms of preemployment testing have been shown to predict (with varying degrees of success) job candidates who are more susceptible to injury due to a mismatch between the specific physical demands of a job and the physical strength and endurance of the candidate. Each test has its good and bad points; deciding which test to use means assessing availability, costs, length of time to administer the test and return results to the employer, vendor technical capability and support in the event of an Americans with Disabilities Act

Definitions

construct validity—a process that measures the basic work components required to do a job and compares those to the testing device that will measure the same demands. It considers more circumstantial evidence from studies in which the assessment or instrument was used as one of a number of measures of strength or mobility.

content validity—a process that gathers evidence to show a logical relationship between the preemployment tests and important duties or job behaviors. Work-sample tests potentially have high content validity because they sample the actual work performed in the job.

criterion-related validity—a process that shows the preemployment test is predictive of, or significantly correlated with, important elements of job performance

face validity—a process that shows a work-related assessment appears to measure what it intends to measure and is considered a plausible method to do so

isokinetic test—measures maximum muscle effort (peak torque) throughout the entire range of motion of the respective joint at set speeds

isometric test—measures maximum muscle effort (peak torque) in one static position, such as pulling against a bar with arms extended 90 degrees in front of the body

isotonic test—measures strength during a dynamic contraction of the muscles, as when lifting a box from the floor to waist height in a continuous movement

isoinertial test—measures the lifting of progressively heavier weights at a set frequency over a specific vertical range

motor ability and fitness test—measures the constructs of physical performance

validity—the extent to which a preemployment test or instrument accurately measures the essential physical work demands as identified by the job analysis, i.e., appropriateness, meaningfulness and usefulness of the specific inferences made from the test results

(ADA) challenge.

The primary debate between the work-sample and physical capability approaches involves whether work simulation of physical capability evaluations offer the more accurate and effective form of testing.

Job simulation advocates contend it approximates actual work activity, and that isolating the muscle groups to be evaluated (isokinetic) fails to permit the body to work (and be test-

ed) as a complete musculoskeletal unit. For example, a prospective employee could compensate for weak low-back muscles by utilizing leg muscles.

Physical capability advocates counter these claims. Loren Arp, president of Cost Reduction Technologies, Inc., says "a controlled speed is the only way that the body's parts can be objectively tested. If you . . . simply had the subject perform a

work-simulated lift, you could hide weak hamstrings with strong lumbar extensors. Work-sample batteries, while attempting to fully simulate actual job tasks, are still no more than 'correlations'; the same as isokinetics, unless the simulating continues for months."

Scott Minor, Ph.D., director of the Occupational Health and Injury Prevention Laboratory at Washington University and Washington University School of Medicine, in St. Louis, concurs. "There is no database evidence that actual lifting is a better predictor," he says. "Isokinetic tests permit testing of maximum effort, which provides a safety margin. Engineers build in a safety margin so a bridge (or other device) does not fatigue and fail. When work-sample providers test the actual lift, which has no safety margin, then the test must continue for a person's full work life. Otherwise who can say that although a person can do ten lifts, they can do eleven, or if they do one thousand lifts they can do one thousand and one?"

Prospective users of PCEs will have to draw their own conclusions. Although the abundance of isokinetic research in medical literature involving joint rehabilitation, combined with consistently higher MSD reductions, as referenced by vendor and employer studies, appears to favor isokinetics for validity, objectivity and reliability.

The Legal Issues

It has been more than ten years since implementation of the ADA. Its interpretations clearly indicate that there is a right way and a wrong way to implement preemployment PCEs. The ADA regulations, EEOC Uniform Guidelines on Employee Selection Procedures and case law have spelled out in detail the right way of establishing a testing program.

It is no longer necessary for corporate legal departments to provide a legal opinion as to the defensibility of conducting tests. But it is necessary that the employer ensures that the testing chosen be:

1. related specifically to the jobs to be screened;
2. targeted to the essential functions of those jobs; and
3. predictive of the worker's ability to perform the job without injury.

The vendor of the screening must provide the employer with evidence of the validity (predictability), reliability and objectivity of the chosen test battery. A review of the major national providers and distributors of preemployment PCEs appear to amply meet EEOC criteria.

Case in Point

To test these theories, we conducted a study to investigate whether preemployment physical capability screening using isokinetic technology reduced the frequency and severity of musculoskeletal disorders among workers in physically demanding jobs.

The research involved 1,277 workers engaged in heavy, manual materials handling at Gypsum Management & Supply Co., the largest privately held distributor of drywall in the United States. We followed subjects that had been physically screened to determine differences in MSD and non-MSD injuries compared to untested employees. Workers' compensation data was collected from the time the study commenced through the twenty-month evaluation period.

The results of the analysis revealed that the screened group had significantly fewer (57 percent) MSDs to the knees, shoulders and back, while the nonscreened hires were 2.35 times more likely to experience an MSD. In addition, the screened group incurred an average cost of \$52.37 per person, compared to an average cost of \$249.89 per nonscreened person, a 79 percent claims severity reduction.

Non-MSDs were also evaluated, which revealed no statistical difference in the number of injuries, but a 62 percent increase in the cost per injury for nonscreened employees. The average cost of non-MSD disorders from the screened group was \$136.05,

compared to \$358.27. Similarly, when all injuries were considered together, although there was no significant difference in the number of claims, the total cost (excluding auto accident-related injuries) was 69 percent less for screened workers.

Results and Implications

The study results show significant reductions in both occurrence (frequency) and cost (severity) of all types of injuries for prescreened hires in physically demanding jobs. Having been effectively matched to their jobs, these employees are at significantly less risk of injury and disability.

Interpretation of the data also suggests that physically matched employees become less fatigued during the course of the workday and may be less subject to mistakes that can create a severe accident or injury. These findings have broad applicability to all industrial sectors, since the screenings measured muscle and joint strength and flexibility, and not a specific job task.

The economic consequences of reducing MSDs through a relatively low-cost employment screening tool could be profound. The humanitarian consequences of reducing short-term, long-term and permanent disability among workers may be even larger.

Physically demanding jobs will remain to be filled by physically capable workers. But labor pool gaps may be created by the large-scale application of employment screening. This creates a potential social problem to be addressed by government and industry alike.

Keith Rosenblum, MS, MPA, MPH, CSP, CPEA, is director, client consulting services—casualty specialty practices, at Aon Risk Consultants in Kansas City, Missouri.

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