

**STRENGTH TESTING IN SCHOOL DISTRICTS:  
A VALID HUMAN RESOURCE FUNCTION**

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# **STRENGTH TESTING FOR SCHOOL DISTRICTS**

## **Introduction**

The need for physical testing for workers in manual materials handling jobs has been recognized by risk managers, personnel specialists, physiologists, occupational physicians and ergonomists increasingly over the past decade. Each of these groups have independently come to recognize the benefits to both the individuals being tested and the organizations themselves. Risk managers have an interest in job safety and reducing workers' compensation costs. Personnel specialists seek to hire the most qualified individual available, reduce absenteeism and sick leave, and yet comply with state and federal EEO mandates. Physiologists and physicians seek to reduce unnecessary injuries and find ways to better predict in advance those most likely to become injured. Ergonomists seek to study individual jobs and find ways through either job redesign or job selection systems that can better match the worker to the work.

Cognizant of these issues, MED-TOX Health Services has developed a model approach to assist school districts in the use of validated strength tests for new hires.

## **Back and Overexertion Injuries and School District Employees**

Statewide statistics from 2004 reveal that police officers have the highest injury rates of any public sector occupation. Ranking second are custodians, followed by firefighters. Ranking 4th, 5th, 6th, and 7th, and 8th are building maintenance workers, teaching assistants, bus drivers, and office workers, and grounds keepers. With the exception of firefighters, all of these occupational groups are found in school districts.

The largest single category of lost work time was caused by over exertion injuries, especially those that involve lifting. Back and spine injuries were the most frequently injured body parts, accounting for a quarter of the total cases (Department of Industrial Relations, 2004). Clearly, school district personnel have an interest in reducing injury rates among their workers since they are clustered at the top of the most frequently injured public sector workers in the state.

Nationally, overexertion is described as the cause of lower back pain by over 60 percent of the people suffering from it. If the overexertion injury involved low-back pain with significant lost time, less than one-third of the patients ever return to their jobs (Chaffin & Andersson, 1991).

## **Reducing Injuries Caused by Overexertion**

Since overexertion injuries account for a significant number of all work-related back injuries to school district employee, it makes sense to reduce the potential for overexertion. Hiring workers with the adequate strength to perform the job is one way of reducing these injuries. Any approach to strength testing must meet two goals:

Provide a valid and legally defensible job analysis of the essential, frequently performed, and physically demanding tasks associated with the occupation.

Provide a physical ability test that is job-related, valid and reliable that can confidently be used in the selection of individuals for physically demanding jobs.

## **Strength Tests**

Strength tests must be chosen on the basis of safety, reliability, and validity. Validity and reliability is discussed below. Ability tests are safer than work sample tests because it is preferred to determine how much weight an applicant can lift rather than asking the applicant to lift a heavy weight. If the applicant does not have the necessary strength to lift the weight an injury may occur during the test. Using an ability test allows the district to determine whether the applicant can only lift 10 lbs. or 100 lbs. safely.

Strength tests must be designed to ensure that the ability test (selection device) is empirically demonstrated to be related to the job (APA, 1999; SIOP, 2003). Because physical ability tests can be subjected to a high standard of legal and administrative review, empirical evidence is usually necessary to show job-relatedness. A high standard of evidence is also necessary since all tests of strength show adverse impact against females (Biddle, 2005). The *Uniform Guidelines on Employee Selection Procedures* state that validity evidence is necessary when a given test has an adverse impact on a protected group (EEOC, 1978). Validity evidence typically consists of a sound quantitative job analysis and the empirical linkage of the test to critical tasks measured during the job analysis.

## **Job Analysis**

To demonstrate job relatedness, it is necessary collect job information from experienced workers. The job analysis inquiry is directed at collecting tasks from incumbents which require muscular strength. Muscular strength involves the continuous exertion of maximum muscle force for a brief period time. Tasks that involve the lifting, pulling, pushing or carrying of objects and materials require muscular strength.

Following structured group interview, workers and the MED-TOX representative go to warehouses, storerooms, school sites and other work areas to directly examine tools, equipment and materials that had been described by workers during the meeting. An industrial scale and/or force gauge are used to directly weigh as many of the relevant objects as needed. If additional materials or tools are found that are also lifted, these objects are weighed, the weights recorded, and the lifting tasks added to the task is produced for worker surveys.

In order to measure a job, one needs a measuring tool. Rating scales are the most useful measuring tools when performing job analysis activities with task inventories. Rating scales can have a number of customized features depending on the job and specific organizational needs. To validate a strength test, however, it is important to elicit from workers:

Whether or not the task is performed?

How physically demanding is the task?

How far the object is carried?

How often the task is performed?

How important the task is to the job?

What is the relationship between accuracy and efficiency and job performance?

Workers' complete the task inventory. Employee ratings are then statistically examined to determine the most critical and physically demanding tasks.

### **Work Sample Development**

Having determined which strength tasks are critical for the job, it is next necessary to determine which tasks are suitable for utilization as work samples. Ideally, the tasks selected should be among the most demanding tasks workers are expected to perform. Additionally, other criteria should be considered including:

*Safety to incumbents.* Tasks selected should be safe to perform in a testing situation. Some tasks might not be dangerous to experienced workers, but could be to a novice.

*Reasonable time to administer.* The tasks selected for work sample development should be those which can be completed in a reasonable amount of time.

*Unambiguous scoring and clarity of results.* Tasks selected should be amiable to an unambiguous scoring or rating system. There should be no disagreement as to what constituted various levels of performance. Subjective ratings on "style of lifting" or "ease of lifting" are less suitable when objective measures are possible.

*Simplicity.* The tasks selected should be as simple as possible from both the point of view of instruction to incumbents and administration of the work sample.

*Independence from training and experience.* The tasks selected should be dependent upon strength and not "tricks of the trade" for success. Novice and experienced individuals with the same level of strength should have the same score.

*Commonality.* The tasks selected should be commonly performed by as many workers as possible.

Critical tasks that meet the criteria can be categorized in a variety of ways. For example, all tasks involving the use of a wheelbarrow might form a group or task set. Alternatively, all tasks that involve work at particular work site, or all tasks performed while repairing heavy equipment could form other sets. The nature of the job and tasks performed typically lend themselves to the selection of appropriate task sets. These sets are important because they help organize the work and ensure that a variety of lifting tasks can be used to construct work samples. An example of a task set might be:

#### **Five Gallon Container (Paint, Joint Compound, Floor Sealer) Tasks**

1. Lift/carry a five gallon can of floor sealer (approx. weight 46.3 lbs. ).
2. Carry a five-gallon bucket of paint (55.4l bs.).
3. Stack a shipment of joint compound (51 lbs.) that has been delivered.
4. Lift a five gallon bucket of paint into the back of a vehicle (55. 4 lbs.).
5. Lift a five-gallon bucket of paint up onto a stack of other five-gallon paint buckets (55.4 lbs.).

Work samples may then be developed from this set of common critical tasks such as:

### **Five-Gallon Bucket Stack**

Approach a row of four numbered five-gallon buckets of material. Stack the #3 buck on top of bucket #4 and then stack bucket #2 of bucket #3. Next take bucket #1 and place it on top of bucket #2. Immediately take bucket #1 to a truck bed 15 feet away and set it down. Immediately pick it up and carry it back to its original starting location. Repeat this process with bucket #2 and bucket #3. When bucket #3 has been set on the ground, all the buckets are in their original starting position. Bucket #4 never moves.

In our studies this work sample has worked particularly well. The correlation coefficient between performance on this work sample and measured strength is .50. Other work samples used for school district workers have included lifting a bus battery ( $r = .66$ ), holding a bus starter ( $r = .79$ ), loading building materials into a wheelbarrow and transporting it a short distance ( $r = .63$ ), and evacuating a child off a bus (.71). In all, MED-TOX has validated physical ability tests for the following school district occupations:

Bus Drivers  
Instructional Assistants  
Custodians  
Building Maintenance Workers

Warehouse Workers  
Bus Equipment Mechanics  
Grounds Maintenance Workers  
Food Service Workers

Examples of work samples from various MED-TOX studies include the Five-Gallon Bucket Stack pictured below.



A work sample used to measure the ability to move building materials was the wheelbarrow transport in which workers utilized a wheelbarrow to transport building materials.



Bus equipment mechanics are required to lift bus batteries when changing them out of stalled buses.



## Selecting Appropriate Static Strength Tests

MED-TOX has used the Jackson Strength Evaluation System (JSES) in several projects with many school districts and has found it to be a valid and reliable predictor of the ability to perform lifting, push, pulling, and carrying tasks.

The JSES has three qualities that make it ideal for employment testing. It has been shown to be safe, reliable ( $r = .97$ ), and practical. Results are obtainable within 15 minutes. The JSES is widely recognized as a reliable and valid indicator of the amount of muscular strength possessed by individuals. At the present time many industrial medical clinics and employers are obtaining the JSES. The test is relatively inexpensive (it can be obtained for less than \$5,000), it is practical, safe and portable. More than 36,000 California school district job applicants have already been tested for employment using the JSES.

## Field Testing and Data Analysis

A sample of experienced workers is typically chosen for test validation. The sample should consist of individuals from various ages, racial groups and both genders. Of course, many organizations will not have a significant number of females for testing nor will they have individuals employed who cannot perform the job. Without representatives from these groups, it is more difficult to set a defensible cut-off score. Therefore, we suggest that administrative and clerical workers participate in field testing as well.

Field-testing consists of a brief medical screening, informed consent, an explanation of the testing, and height and weight measurements. Next the participants are administered the JSES. Participants exert a constant force for three seconds on the four tests, which used the lifting bar, and for four seconds using the hand dynamometer in accordance with the manufacturer's instructions. The electronic monitor connected to each load cell records the amount of force exerted in pounds of force.

For the Grip Strength test, participants squeeze on the hand dynamometer first with the dominate hand and then with the non-dominate hand.



During the Arm Lift, participants stand erect with palms up, their elbows against their side, and forearms at a 90-degree angle to pull up on the lifting bar.



The Shoulder Lift also requires the participants to stand erect but with their palms down.



The worker is then instructed to pull up on the bar as if lifting a jackhammer.

The Torso Pull requires the participants to sit on the ground with their legs extended and their feet flush against the lifting platform, which is placed against a wall. Participants pull back with the arms and legs extended.



The fifth and final test is the Leg Lift. In this test it is leg strength that is measured.



Three trials are conducted for each participant, with the average of the last two trials used as the score. The sum of the pounds lifted in all five tests forms the composite score.

Next, the participants perform the simulations. The simulations consist of actual work samples of the job. Several events such as the Five-Gallon Bucket Stack described above will have been constructed. Participants are given ample time to rest between events and may decline testing at anytime. Two timers use stopwatches to record the time it takes for each participant to complete each work sample. Times are averaged for both stopwatches and recorded as the score.

Participants are instructed **not** to run or to perform the work at an unnatural pace. Participants are asked to envision a day in which they had a lot of different tasks to perform. When one task was completed, other important tasks are to follow. Participants are instructed to work at what might be considered a heavier than average pace, but not one that was unrealistic or unrepresentative of the pace at which they might work on a busy day.

Following testing, participants estimate their personal fitness level, the minimum level of performance that they would consider acceptable for each work sample, how realistic each work sample is, and additional questions that are utilized to assist in setting the cut-off score.

### **Statistical Analysis**

Reliability of the JSES is assessed by comparing the scores of the two recorded trials on each test. Reliability typically varies from a low of .94 to a high of .97.

Correlation coefficients are computed for all tests to determine their interrelationships and lack thereof. Multiple regression analysis is used to derive equations to predict the performance of individuals on the work sample test who have only taken the JSES.

Validity is assessed by statistical analysis as to how well each regression equation is predictive of work sample performance. A perfectly predictive equation would have an  $R^2$  of 1. 0 and an  $R^2$  of 0. 0 would indicate that the equation had no ability to predict at all.

### **Passing Levels (Cut-off scores)**

Setting cut-off scores is a particularly complex area of test construction. MED-TOX utilizes multiple forms of evidence to arrive a cutoff level that is consistent with business necessity. The cut-off scores permit the selection of qualified workers, are based on the results of the task analysis, and on the performance of currently employed workers and their judgements as to what constitutes acceptable performance. As each test validation situation is unique, no perfect formula can be offered in advance here.

### **Transportability Studies**

Because the initial validation work has been completed, there is no need to repeat the validation process for individual school districts that wish to start a new testing program. Work by the North Bay Schools Insurance Group, the Sacramento Schools Insurance Authority, and the Contra Costa County Schools Insurance Group has resulted in a transportable test that should be equally useful for any California school district. To date, more than 36,000 school district job applicants have been tested using the Jackson Strength Evaluation System. Each month a new district or employee group is brought into the testing program.

## **Implementation**

School districts use different methods of implementation. In Sonoma, school districts use designated medical providers to administer the tests. In Contra Costa and Sacramento counties, tests are administered by the insurance JPA. In Sacramento, the Schools Insurance Authority has three large testing rooms that are testing more than 100 job applicants a week for school districts in Sacramento and El Dorado County.

## **Conclusion**

Strength testing job applicants is the single most cost effective intervention an employer can make to reduce workers' compensation and other injury-related costs. The relationship between musculoskeletal injuries and lack of strength has been repeatedly demonstrated (Chaffin, 1991). Stronger and fit workers are more productive and sustain far fewer back injuries than weak and unfit workers.

Strength tests permit the selection of individuals most likely to be able to perform the tasks without undue risk of injury to themselves and to screen-out persons who do not possess sufficient physical ability to adequately perform the job.

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