

*According to data obtained by the Bureau of Labor Statistics, work-related musculoskeletal disorders (often referred to as MSDs) account for 30 percent of lost workdays in the United States each year. These disorders also account for one out of every three dollars spent on workers' compensation. To reduce the frequency and severity of MSDs in the workplace, it is important to eliminate the risk factors that are known to contribute to their development. Extensive research has identified these, and the most common are summarized below.*

### Awkward Postures

Body postures determine which joints and muscles are used in an activity and affect the amount of force or stresses that are generated or can be tolerated. For example, more stress is placed on the spinal discs when lifting, lowering or handling objects when the back is bent or twisted than when the back is straight. Tasks requiring repeated or sustained twisting of the wrists, knees, hips or shoulders create increased stress on those joints. Activities requiring frequent or prolonged work over shoulder height can be particularly stressful.

### Forceful Exertions

Tasks that require forceful exertions (e.g., lifting, pulling and pushing) place higher loads on the muscles, tendons, ligaments and joints. Prolonged or frequent activities with high amounts of force can cause fatigue and ultimately lead to musculoskeletal problems, if there is inadequate time for rest and recovery. Force requirements may increase with:

- Increased weight of the load being handled or lifted
- Increased bulkiness of the load being handled or lifted
- Positioned in an awkward posture
- Increased speed or acceleration of movement (e.g., jerkiness)
- Presence of vibration (e.g., localized vibration from powered hand tools)



- Use of the index finger and thumb to forcefully grip an object (i.e., a pinch grip compared to a power grip)
- Use of small or narrow tools that limit grip capacity

### Repetitive Motions

If motions are repeated frequently and for long periods of time, such as an 8-hour shift, a build-up of fatigue and muscle tendon strain can occur. Tendons and muscles can often recover from the effects of stretching or forceful exertions if there is sufficient time between exertions. Repetitive motion is especially dangerous when combined with other risk factors, such as awkward postures or forceful exertions.

### Duration

Duration refers to the amount of time a person is exposed to a risk factor. Tasks that require the use of the same muscle groups for long periods of time increase the likelihood of both localized and general fatigue. In general, the longer the period of continuous work, the longer the recovery time required.

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## Contact Stress

Repeated or continuous contact with hard or sharp objects such as non-rounded desk edges or unpadded, narrow tool handles, may create pressure over one area of the body (e.g., the forearm or sides of the fingers) and reduce nerve function and blood flow.

## Vibration

Exposure to local vibration occurs when part of the body comes into contact with a vibrating object, such as a power hand tool. Exposure to whole-body vibration can occur while sitting or standing in vibrating environments or objects, such as operating heavy-duty vehicles or large machinery.

## Other Conditions

Workplace conditions that can influence the presence and magnitude of these risk factors include:

- Temperature extremes (either hot or cold)
- Insufficient recovery time
- Machine or assembly line paced work
- Unfamiliar or unaccustomed work

## Eliminating Risk Factors

The best way to control ergonomic risk factors is to observe employees performing their jobs, document any risk factors that are present and develop methods to eliminate them. Checklists of ergonomic risk factors are a good way to ensure that all of them have been considered during the observation. If risk factors are present, determine their magnitude, duration and frequency. For example, if an employee lifts a heavy object (forceful exertion), determine how much the object weighs, how long it takes to perform the lift and how often the lift is required. The more information that is obtained about the job, the easier it will be to develop solutions and justify changes to eliminate the risk factors.

The three common methods used to control ergonomic risk factors are:

- **Engineering controls**—Changes to the process, workstation layout, tool designs or material

handling techniques to reduce or eliminate hazardous conditions.

- **Administrative controls**—Changes in work practices and management policies, such as longer breaks, job rotation, adjusting work pace and employee training.
- **Personal equipment**—Equipment such as wrist braces and antivibration gloves. There is much discussion as to whether personal equipment is effective in reducing exposure to MSDs, so it should be used as a last resort.

Engineering controls are the only type that actually eliminates the hazard. Administrative controls and personal equipment acknowledge that a risk factor is present, but do not eliminate its source. For this reason, engineering controls are the most preferred method of eliminating risk factors. Administrative controls and personal equipment should be used only after all other control measures have been exhausted.

## Evaluating Control Effectiveness

A follow-up evaluation is necessary to ensure that the implemented controls have reduced or eliminated the risk factors and that no new risk factors have been introduced. The follow-up assessment should use the same format as the initial evaluation that documented the risk factors. If the hazards have not been reduced or eliminated, more work should be done.

## For Additional Information

**National Institute for Occupational Safety and Health:** [www.cdc.gov/niosh](http://www.cdc.gov/niosh)

- Elements of Ergonomics Programs

**Occupational Safety & Health Administration:** [www.osha.gov](http://www.osha.gov)

- Ergonomics