



Ergonomics & Musculoskeletal Disorders

Safety Challenges

Ergonomics

“A way of designing workstations, work practices, and work flow to accommodate the capabilities of workers.”

In simpler terms, it defines how the work environment affects the worker. Injuries caused by ergonomic factors are the most frequent work-related injury. These injury types include:

- Strains
- Sprains
- Repetitive motion disorders/
Cumulative trauma disorders

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Note: The information in this publication is time sensitive. Do not rely upon this document if its publication date is more than three years old. Please check the Employer Guide “Safety” section of our web site at www.saif.com/employer for a more recent, printable copy. You’ll also find a variety of other valuable safety information designed to help your business prevent injuries and control costs.

Ergonomics play a huge role in virtually every industry. How many of your employees spend time during their workday performing any of the following ergonomic motions?

- Sitting or standing
- Pushing or pulling
- Lifting, carrying or reaching
- Bending, turning or twisting
- Working in awkward positions
- Using a body part repetitively
- Driving

To understand the financial impact that ergonomics plays, statistics collected from the OR-OSHA and the State of Oregon's Department of Consumer and Business Services indicate that Oregon employers spent more than \$367 million in ergonomic related claims between 2001 and 2005. Ergonomic claims include accepted disabling claims due to sprains, strains, tears, carpal tunnel syndrome, hernia and musculoskeletal diseases caused by bending, reaching, twisting, overexertion or repetitive motion. The average cost of an ergonomic related injury for that five-year time period was \$9,989.

Understanding how ergonomics affect your workplace and employees is the first step in developing an effective ergonomics program, reducing your over-all costs and eliminating on-the-job injuries. Good ergonomics can improve workplace efficiency and productivity.

To begin the analysis, it is important that you identify the eight ergonomic risk factors in each task:

Frequency:	The number of times the employee repeats the same motion(s). Work with a cycle time of a few seconds.
Duration:	The number of hours or minutes the employee performs the task. Little "rest" time between cycles.
Force/Exertion:	The amount of energy/effort the employee uses to perform each task. <ol style="list-style-type: none"> 1. Using a pinch grip where a power grip is more appropriate. 2. Overuse of a single finger. 3. Fingers forced into hyperextension. 4. Gloves – these can increase the grip strength needed for the task.
Posture:	Any deviation from a neutral position.
Point of Operation:	Determines the body position or posture the employee utilizes to perform the task.
Mechanical Pressure:	Pressure placed on the body while the employee performs the task. An example includes the indentations in hands from using a tool repetitively.

Vibrations:	Vibrations from the equipment being used, operated or driven by or near the employee such as power tools.
Environmental Exposures:	Weather, temperature, noise, air quality, working surfaces, lighting, etc.

There are three approaches used to eliminate and reduce hazards and exposures.

1. Engineering controls
2. Administrative controls
3. Personal protective equipment (PPE)

To illustrate how you might be able to utilize these three approaches, work through the exercise listed below.

One of your employees is required to lift 25 – 50 pound bags of merchandise/ stock and stack them on shelves on a regular basis. He moves them, as needed, and re-stocks shelves or carries them to other areas of the operation for other employees. There are other employees at the facility that may or may not help with the transferring of this material. How would you address each approach to lifting and eliminate or reduce the probability of an accident?

Engineering Control:

Administrative Control:

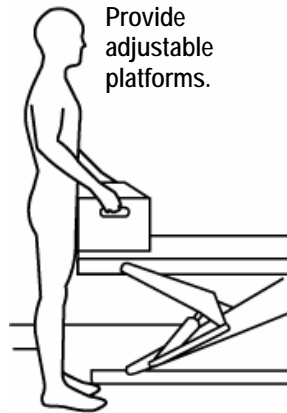
Personal Protective Equipment:

REMEMBER: The objective and principal of ergonomics is to make the job fit the person...not make the person fit the job!

There are specific ergonomic exposures that can be eliminated through training. Some generic exposures and training suggestions to address them are listed in this section.

Lifting

Lifting tasks are not inherently dangerous or unhealthy. An individual's ability to lift varies according to physical capacity, health, physical fitness and the amount of fatigue at the time of the lifting activity. There are several key factors, which can be assessed regarding the job design.



1. Weight Lifted

The **amount of weight** lifted is one of the most important factors. Heavy weights increase the potential for injury and decrease the number of times material should be lifted. Remember that any weight can cause problems depending on the other factors of the lift situation. You should **limit the weight** as much as possible and use mechanical assistance to the greatest possible extent.



2. Horizontal Distance

Arms are mechanical levers. The further a load is held away from the body, the harder you must work and the greater the risk of injury...especially to the back! The amount of weight you are holding is not the only factor. Don't fight gravity. Hold all loads, regardless of weight, as close to the body as possible. This maximizes safety and makes the task easier. Your greatest ability to move a load is in pushing rather than pulling. Try to tighten your abdominal or stomach muscles to use the intra-abdominal pressure to offset the load force. Train your muscles to work together.

3. Vertical Height

The ideal height relative to a person's own body for lifting/carrying materials is at "knuckle level." (This refers to the level of the knuckles when the arms are hanging straight down at the side of the body.) Try to store or move heavy items on surfaces at this level whenever possible. Lighter items should be stored near the floor and/or above the mid-range distance from the floor. When lifting, watch your line of balance and keep it close to your center of gravity by spreading your feet at least a shoulder's width apart. Keep your back upright when lifting material up and down to avoid adding your body weight to the load.

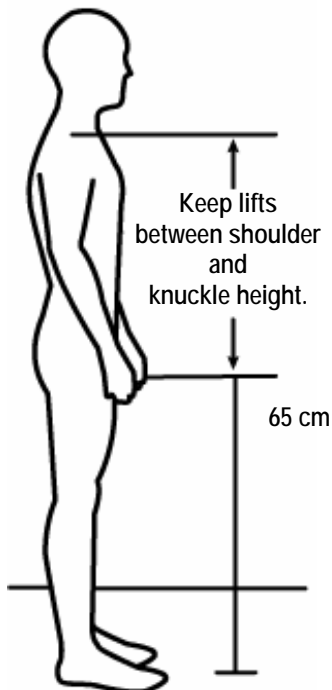


4. Distance Lifted

Always place materials that need to be lifted near the destination where they are to be moved. Make sure that the location of materials to be moved is far enough away to prevent twisting with the load.

- Move your feet, **not your torso!**
- Bend at your knees, **not at your waist!**
- Lift with your legs, **not with your back muscles!**

Keep the principles of leverage in mind at all times. Twisting and turning of the torso with a load increases the potential for injury. Lifting directly in front of the body allows all of the body's muscle groups to evenly distribute the load on the muscles and spine.



5. Frequency

Even a light load can cause fatigue if it is lifted too often or held too long. Lifting requirements of over 15 lifts per minute should be avoided for any weight.

6. Hand Holds

Difficulty holding an object decreases the amount of weight that can be lifted safely. It is best to plan the lift and get help with heavy and awkward materials.

Think Before You Lift!

1. Mental lifting first, then physical lifting:

- Size up the load
- Plan every step
- Check the pathway
- Lift properly, don't lift and twist

2. Get help, use a team lift:

- Don't hurry
- Don't take short cuts
- Load and unload carefully
- Watch your footing

3. Find a better way:

- Arrange for mechanical help
- Get a cart and push, don't pull
- Solve high load problems
- Solve repetitive problems... lift less!

Watch Your Back

Some form of back pain will affect most people at some time during their life. An achy, sore back is a warning that you have abused or over-used your back.

The spine is made up of vertebrae, discs and nerves. When discs are pressured, they may rupture. This is often referred to as a 'slipped disc', even though discs cannot actually 'slip.' The rupture puts pressure on the nerves. Back injuries can be some of the most painful due to the close proximity of the nerves connecting to the spinal cord.

What causes back pain?

Back problems typically take years to develop. Contributing factors include poor posture, excess weight, physical labor, heredity and overall nutrition and health care.

Some back pain can be attributed to acute or sudden incidents that result from lifting, carrying, sitting or twisting.

Back pain may originate from off-the-job activities and sports as well as work-related activities. A common motion such as getting into a car or lifting a small bag of groceries can also trigger back pain.

Who does it affect?

At some point, back pain affects an estimated eight out of ten people. It is one of our society's most common medical problems. Work absences due to back pain occur in up to 5.62% of the population.

In the United States alone, the annual productivity losses from chronic backache are approximately \$28 billion or \$1,230 per male worker and \$773 per female worker.

How can we prevent back pain?

Most back problems are preventable. Use these reminders with your employees:

1. Use good posture
2. Exercise your stomach (abdominal) muscles and your back muscles
3. Lift with your legs
4. Avoid twisting
5. Push, don't pull
6. Store heavy items on shelves or tables which will reduce the need to bend to the floor

Back Care Training Test

Employee Name: _____

Training Date: _____ Deadline for Test Completion: _____

Return Test To: _____

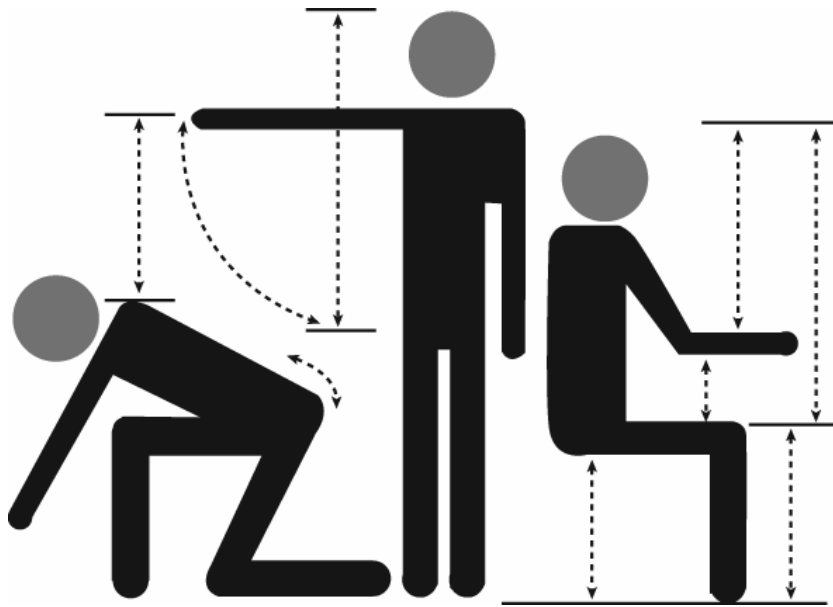
This test must be completed by each employee following training. You may obtain information from your supervisor, safety director or safety committee. Please answer the following questions by checking the correct answer(s). (Hint: There may be more than one correct answer to each question.)

1. How many people will suffer from back pain at some time in their life?
 10% 25% 50% 80% 100%
2. Most back problems are preventable.
 True False
3. The spine is made up of vertebrae, discs and nerves. Discs may be injured and are commonly referred to as "slipped discs." Discs can actually slip.
 True False
4. Which of the items below can cause you to injure your back?
 Sitting Excess Weight Twisting Carrying Lifting Poor Posture
5. The only muscles you use to lift are located in your back.
 True False
6. Heavy items should always be placed on the floor and light ones should always be placed up high.
 True False
7. When moving a rolling cart, it is better to pull than push.
 True False
8. Once you have back pain, you will never get over it.
 True False
9. Items too big or heavy for one person to move should be left until you can get help.
 True False
10. The only place you can hurt your back is at work.
 True False

Employee Signature: _____

Date Completed: _____

Management Ergonomics Checklist



Ergonomics is the study of people at work.

The goal of ergonomics is to maximize the productivity and efficiency and minimize human suffering due to accidents or chronic excessive stress. An ergonomics program can be as complex as the design of an entire manufacturing plant, or as simple as the “quick-fix” adjustment of a chair height. This checklist looks at specific areas of ergonomics in the workplace, and it is not intended as a complete coverage of the subject.

Task Design Work Space – Questions to ask.

- Are awkward positions or reaching tasks avoided as much as possible?
- Is static (prolonged muscle contraction with no movement) muscular work avoided?
- Are repetitive motions at a high rate avoided?
- Does the task offer a variety of different working distances affecting eye focusing?
- Are clamps or supports for the work piece available to avoid static work?
- Are elbow, wrist, arm, foot, and backrests provided where needed to avoid static work?
- Are peak loads of muscular effort avoided?
- Are parts or tools supplied in a correctly pre-adjusted manner?
- Are they supplied in a logical sequence?
- Are they within a comfortable reaching area for distance and height?

- Is it possible to carry out work with:
 - Arms and elbows in a neutral position (hanging loosely and close to the body)?
 - Wrists in a straight position?
 - Neck straight or less than a 15-degree angle?
 - A relaxed, correct posture?
 - No excessive leaning over?
 - No excessive standing?
 - No excessive twisting or stretching of the back?
 - No repetitive hand, arm or shoulder movements in awkward positions?
 - No "clothes-wringing" motions of the wrists?
- Is the height of the work surface adjustable for multiple operators?
- Does the operator have the option of standing or sitting?
- If a seat is used, is it comfortable?
- Is the seat suited to the task?
- Does the seat have adjustable height and backrest?
- Is the seat non-slippery?
- Is the chair stable on the floor at all times?
- Is the workspace adequate for the smallest and largest employees for reach and clearance?
- Is lighting and visibility adequate?
- Is individual task lighting provided where economically possible?
- Is the lighting bright enough?
- Is it evenly lit?
- Is direct and/or reflected glare minimized?
- Is there sufficient contrast for good visibility?

Manual Material Handling/Machinery and Tools

- Are unnecessary distances eliminated when moving materials?
- Are unnecessary activities eliminated when moving materials?
- Are walkways dry and unobstructed?
- Are they level and wide enough?
- Are outside walkways designed for different weather conditions?
- Is proper footwear worn?
- Is there firm footing with no slick surfaces?
- Is material handling automated or mechanized as much as practical?
- Are tasks that impose extreme lifting requirements (even if infrequent) avoided?
- Is the weight reduced to a minimum?
- Is the frequency of lifts reduced?
- Is the (horizontal) distance between the object and body minimized?
- Are the lifts confined within the knuckle-to-shoulder zone?
- Are mechanical lifting aids provided?
- Is training on lifting and safe work practices provided?
- Is excessive twisting, pushing, pulling and carrying eliminated?
- Does the machinery or equipment operate smoothly?
- Is awkward body positioning avoided?
- Is it equipped with easy access and egress (steps, ladders, grab bars) for both the smallest and largest employee?
- Is tool or equipment vibration minimized?
- Is moving machinery equipped with rear-side mirrors?
- Does the equipment operator have full visibility?

Hand Tools

Are hand tools:

- Powered where feasible?
- Well-balanced and easy to hold?
- Designed to give support to the guiding hand?
- Equipped with handles shaped to contact as much of the hand and fingers as possible?
- Equipped with a grip span between thumb and forefinger of less than four inches?
- Designed to eliminate sharp edges or ridges which might impair circulation or exert pressure on the nerves?
- Designed to eliminate pinch points?
- Designed to keep vibration to a minimum?
- Designed to direct air exhaust away from the hand?

Cumulative Trauma Disorders

Risk Factors

Cumulative Trauma Disorders (CTDs) [also known as musculoskeletal disorders (MSDs) and repetitive strain injuries (RSIs)] are a type of medical problem that develop over time, rather than from one particular incident. Cumulative trauma can produce injuries to the back, knees and feet, however, the largest number of CTDs occur in shoulders, arms, wrists and hands.

There are risk factors in many jobs that can lead to the development of a CTD. A worker exposed to one risk factor may develop a CTD. Exposure to a combination of risk factors, on and off the job, increases the odds.

The primary risk factors are:

Repetition:	short cycle time, or many repetitions
Force:	tight pinch grip or power grip, overuse of a single finger
Working out of neutral body positions:	reaching behind/overhead, or wrists bent
Stationary body positions:	holding muscles or joints in a fixed position
Temperature:	below 50 degrees
Vibration:	any worker using a power hand tool is at risk

Less obvious things can also combine with the primary risk factors to increase an individual's chance of developing a CTD. These are called secondary risk factors.

- The environment
 - available light
 - noise level
- Organizational factors
 - working overtime
 - not taking scheduled breaks
 - working a second job
 - production incentive increases

These risk factors can lead to microscopic damage to soft body tissue. Nerves and muscle tendons are particularly susceptible to this type of injury. Nerve compression syndromes, such as Carpal Tunnel Syndrome, and tendinitis are the most common problems.

In many cases, the critical factor appears to be inadequate recovery time between muscular contractions.

Muscle Use + Insufficient Rest = Inflammation and Injury

The individual worker may have some physical factors that can contribute to the development of a CTD. Some “human risk factors” are:

- Medical conditions, such as diabetes, rheumatoid arthritis, gout, and lupus.
- Age and gender (older employees and women tend to be more susceptible)
- Body size and conditioning (overweight or out-of-shape)
- Smoking and alcohol consumption
- Off work activities and hobbies

Symptoms of a CTD may vary according to the specific diagnosis. They may include:

- A general mild aching sensation
- Pain on movement
- Numbness
- Loss of dexterity
- Loss of grip strength
- Loss of movement

When a worker develops a CTD, early diagnosis and treatment are the key to a successful outcome. It is important for management to be aware of the risk factors that can lead to developing a CTD, and to **encourage early reporting of symptoms**. A CTD, once developed and left untreated, will continue to progress in severity, and may lead to long-term disability.

Treatment

The first component of treatment is resting the affected area. This may include splinting, or supporting the area, as is done in cases of carpal tunnel syndrome, with a wrist splint. It is also important that the worker understand how to “rest” the area. This may include:

- Modification of the job or postures required to do the job.
- Lifestyle changes. For example, stopping a hobby (such as crocheting or fishing) temporarily during the treatment of hand problems.

The mainstay of treatment with medications for CTDs is nonsteroidal anti-inflammatory drugs (NSAIDs). Ibuprofen and naproxen are examples of these over the counter medications. Some points to remember about these medications:

- All are very similar
- They can cause gastrointestinal upset and ulcers
- They should be taken with food

- The older a person is, the more side effects they may experience
- Long-term therapy can impair kidney and liver function
- Physical therapy is generally ordered for stretching and strengthening

Ergonomics & Prevention

Any CTD control program needs to include ergonomics as a key component if it is to be successful.

The goal of ergonomics is to fit the job to the person, rather than fit the person to the job.

Ergonomics is a proactive approach to solving problems before they occur. Early intervention reduces the severity of CTDs, allows for identification of risk factors, and provides an opportunity to control or eliminate the contributing factors.

To control or eliminate problems leading to CTDs, it is essential that both management and the individual employee take part in a program that includes engineering and administrative controls.

Engineering control examples:

- evaluating the workplace
- tool and equipment evaluation

Administrative control examples:

- job rotation
- stretching and flexibility program

The four components of an effective program for prevention and control of CTDs as outlined by OSHA are:

Work site analysis	it's goal is to reduce the individual's exposure to adverse ergonomic risk factors by identifying the problem areas
Hazard prevention & control	provides an opportunity to control or eliminate the contributing risk factors
Health care management	early CTD identification and management of the medical issues
Education and training	employee training on identifying risk factors, ergonomics and prevention

Employee feedback is an important component of the CTD control program. The employee can provide information about any discomfort that he or she may experience doing a task.

Carpal Tunnel Syndrome

Carpal tunnel syndrome is the most common of the cumulative trauma disorders.

Carpal Tunnel Syndrome may develop when the median nerve is compressed or squeezed at the wrist. While there is no one specific cause for CTS, work activities involving the hands can contribute to its development.

One or more of the following work activities may be risk factors for its development:

- Repeated rapid movements of the hand and wrist.
- Tasks done while the hand or wrist is held in a bent or awkward position.
- Using a “pinch-grip”.
- Extreme force involving the fingers, hand, and wrist.
- Pressure on the hand, especially the palm, for long periods.
- Exposing the hands to cold temperatures, for long periods.
- Wearing gloves that don't fit.
- Using tools that require great effort to grasp.
- Low frequency vibration to the hand.

These activities can be found in a wide variety of jobs. Although it is not known how wide spread the problem of Carpal Tunnel Syndrome is today there is an increasing number of injuries related to Carpal Tunnel Syndrome reported by workers.

Some individual medical conditions can cause tissues in the narrow tunnel to swell. This swelling causes compression of the median nerve. Additional individual factors for the development of Carpal Tunnel Syndrome include:

- Rheumatoid arthritis
- Endocrine disorders (e.g., diabetes)
- Acute Trauma (e.g., bruises, burns, lacerations)
- Vitamin B-6 deficiency
- Wrist size and shape
- Gender (5 times more frequent in women)
- Pregnancy
- Oral contraceptives

Symptoms

- Recurring numbness and tingling in the thumb and first three fingers. This is usually worse at night, and a person may wake out of a sound sleep with these symptoms. The symptoms are usually relieved by shaking and rubbing the hand.
- Weakness in the hand. The dominant hand is most often symptomatic.
- The affected hand feels clumsy.
- Pain may radiate up the arm into the elbow or shoulder.

Diagnosis

- Physical history and examination by a medical practitioner.
- Diagnostic tests: Phalen and Tinel
- Phalen: Compression of the median nerve. A positive test is produced if numbness and tingling of the fingers in the median nerve distribution occurs.
- Tinel: A positive test occurs when percussion of the median nerve results in numbness and tingling along the nerve e distribution.
- Electrodiagnostic evaluation (nerve conduction studies) may be done if a course of conservative therapy is unsuccessful.
- Early diagnosis and treatment of Carpal Tunnel Syndrome is an important step towards preventing permanent nerve or muscle damage. Mild CTS can progress into severe CTS if untreated.

Mild

- Symptoms present for less than one year
- Symptoms are intermittent
- A normal sensory exam
- Mild abnormal nerve conduction study.

Moderate

- Constant numbness
- Abnormal sensory exam
- Increased motor latency

Severe

- Numbness and weakness
- Abnormal sensory and motor exam
- Abnormal electromyogram
- Thenar atrophy (wasting of the fleshy tissue on the lateral side of the palm, at the base of the thumb)

Treatment

- Treatment begins with conservative therapy.
- The best early treatment for CTS is rest from the activities that caused the problem. If caused by work activities, a change in work practices is recommended.
- Wrist-splint. This is a soft, cast-like wrapping around the hand, wrist and forearm. Its purpose is to keep the wrist from bending.
- Anti-inflammatory drugs. These help reduce the swelling in the carpal tunnel and help take the pressure off the median nerve.
- Steroid injections into the wrist may be used following the initial course of conservative therapy. They are used to reduce the swelling in the carpal tunnel.
- Surgery may be recommended following a course of conservative therapy. Surgery involves an outpatient procedure.
- During the surgery, the carpal ligament is cut. This offers symptom relief by allowing more room for the structures passing through the carpal tunnel.
- If a worker's carpal tunnel syndrome is work-related, the job or tool design must also be changed. Otherwise, even after successful treatment, the same problem can occur again.

Industry Specific Ergonomics

The Occupational Health and Safety Administration (OSHA) and The National Institute of Occupational Safety and Health (NIOSH) developed voluntary industry-or-task-specific guidelines and resources for a select number of industries. Injury and illness incidence rates and available best practices were considered in their development.

OSHA (www.OSHA.gov)

Ergonomics for the Prevention of Musculoskeletal Disorders; Guidelines for **Nursing Homes** (2003)

NIOSH (www.cdc.gov/niosh)

Manual Material Handling

NIOSH Publication No. 2007-131: Ergonomic Guidelines for Manual Material Handling. April 2007.

Farm Workers

NIOSH Publication No. 2001-111: Simple Solutions: Ergonomics for Farm Workers. February 2001

Soft Drink Beverage Delivery

DHHS (NIOSH) Publication No. 96-109. Ergonomic Intervention for the Soft Drink Beverage Delivery Industry. July, 1996

References:

National Institutes of Health: (www.nih.gov)

National Institute of Arthritis and Musculoskeletal and Skin Diseases:
(www.niams.nih.gov)

Chicago Institute of Neurosurgery and Neuroresearch: (www.cinn.org)

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