

Enhancing Safety Through Ergonomics



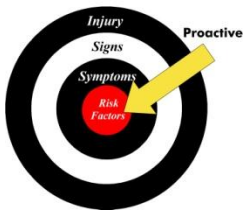
Targeting Risk Factors

Definition of Risk Factors: Actions or conditions found to contribute to worker discomfort or development of Musculoskeletal Disorders

MAIN RISK FACTORS

- Awkward Posture
- Forceful Exertion
- Repetitive Motion
- Vibration

Targeting Risk Factors



Look Out for Risk Factors!
Risk for injury increases when multiple risk factors are present.

Neutral Posture

Hand/ Wrist, Neck, Shoulders, Back

Neutral postures have aligned joints with minimal stress/strain on muscles, tendons, ligaments, nerves, and bones.



When sitting, **back** is fully supported and breastbone is lifted

When standing, **back** has a small hollow in the lower back, breastbone is lifted, and buttocks are slightly tucked in



Hands, wrists and **forearms** are straight, in-line, and parallel to the floor

Head is level or bent slightly forward, facing forward, and balanced in line with torso

Shoulders are held back slightly and relaxed with the upper arms hanging at the side of the body

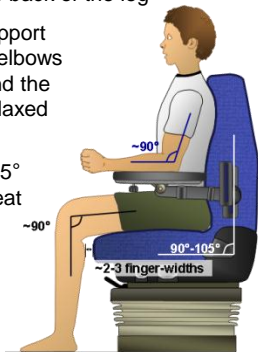
**Good posture comes with awareness.
Examine your posture often and
correct it when necessary!**

Seating

Adjustable seating is vital to attaining neutral seated posture.

Adjustments should be made so:

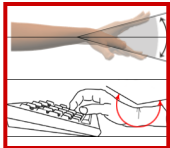
- The seat pan height is at knee level when standing
- There is a 2-3 finger-width gap between the seat pan and the back of the leg
- The armrests support the arms so the elbows are about 90° and the shoulders are relaxed
- The backrest creates a 90° - 105° angle with the seat pan



Adjustability is key to improving comfort and allowing neutral posture!

Awkward Posture Hand/Wrist

Holding your hand or wrist in awkward postures compresses tendons and nerves, which may cause inflammation and pain.



Using a keyboard with an improper incline causes the wrist to bend **up or down** (extension/ flexion)



Using manual tools, such as a screw driver or a wrench, causes the wrist to twist from **side to side** (radial/ulnar deviation)

Grip strength decreases when non-neutral postures are used.

Solutions

- Choose tools and devices that allow the wrist to remain in neutral posture
- Use power tools to reduce manual twisting of wrist
- Adjust armrests to support forearm
- Adjust height of the work area or the worker to reduce extension or flexion
- Change orientation of work target
- Adjust slope of workspace or keyboard to reduce extension



Keep it straight! Keep it strong!

Awkward Posture Shoulder

Extreme reaching increases the stress on muscles and tendons possibly leading to inflammation. Inflammation can increase the pressure on nerves and blood vessels causing pain and reducing blood flow to muscles.



Reaching overhead
compresses the nerves
and reduces strength



Reaching forward
reduces the strength of
the shoulder and may
result in back flexion

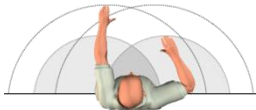


Reaching backward
causes hyperextension of
the shoulder

**Awkward back and neck postures
often occur with awkward shoulder
postures.**

Solutions

- Place worker on platform, in a trough or sunken floor so working targets are near elbow height
- Provide variable height workstations to accommodate workers of different stature
- Place extra step on bottom of access ladders to minimize shoulder reaching when getting on equipment
- Eliminate barriers that prevent getting close to target, i.e. make cutout in workstation
- Avoid storing materials above shoulder height to reduce overhead reaching
- Use a tool to retrieve hard to reach items
- Minimize reaching, staying within the normal reach envelope (gray region)



Keep your work close to you!

Awkward Posture

Neck

Holding the neck in awkward postures can lead to discomfort and fatigue.



Working with **neck bent forward** (flexion) compresses the front of the spinal discs



Twisting the neck causes unbalanced forces on one side of the neck and upper back

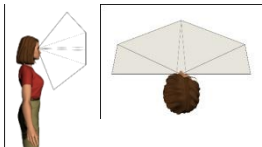


Looking up with **neck bent backward** (extension) compresses the back of the spinal discs

Adjusting your body to view a target can create awkward postures.

Solutions

- Periodically bend the neck forward after bending backward and vice versa to equalize pressure on the discs
- Use slanted work surfaces to reduce viewing angle
- Use extra side and rear view mirrors on vehicles to reduce twisting and bending
- Place item on a fixture that allows the item to be moved to optimum viewing angle
- Adjust the height and angle of equipment or workstation so that focus is at eye level
- Redesign workstation such that monitors and equipment are within the vision envelope horizontally and vertically



Adjust your work, not your body!

Awkward Posture

Back

Using awkward back postures may lead to more discomfort and fatigue than neutral posture.



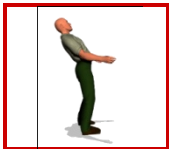
Bending forward

(flexion) results in high stress levels acting on the lower back muscles and the front of the spinal discs



Stooping and twisting

causes high unbalanced forces on one side of the back



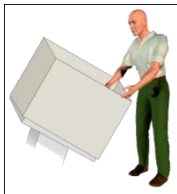
Bending backward

(extension) results in high compressive forces on the back of spinal discs

Twisting the back reduces lifting capacity.

Solutions

- Use tool extenders or reaching devices
- Remove barrier to improve access to materials
- Provide adjustable handles on carts
- Provide adjustable platforms for workers
- Avoid working or storing materials below knee level and above shoulder level
- Place tools/equipment in front to reduce twisting
- Use a tilter to adjust the height and angle of equipment



**Lift, twist, or bend makes it hard
for you to mend!**

Static Posture

Working in the same posture reduces blood flow to the muscles and nerves.



Standing for long periods of time can cause sore feet, muscle fatigue, and low back pain

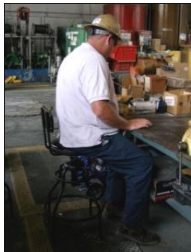


Sitting for prolonged periods may cause blood to pool in the legs, pressure points on the thighs, and low back pain

Staying in one posture, even neutral posture, is bad when sustained for long periods of time.

Solutions

- Eliminate static postures by using a holding device to position parts and tools
- Use anti-fatigue matting and/or foot rests for prolonged standing
- Use seating with adjustable lumbar support, arm rests, and foot rests
- Alternate standing and sitting by using a sit-stand stool or adjustable workstation
- Allow for movement and minibreaks to reduce static postures



Keep on the move!

Forceful Exertions

As force exertions increase, fatigue and possibly injury, occur more quickly.



Forceful **pulling/pushing** creates significant forces in the shoulders, low back, and spinal discs



Forceful **shoveling** creates large forces in the arms, shoulders, neck, and back



Hammering produces high impact forces acting on the upper body and back

Overexertion injuries occur quickly and heal slowly.

Solutions

- Decrease size and weight of container
- Add wheels/change to bigger wheels and place ramps over thresholds to reduce effort when pushing/pulling carts
- Install permanent handles for better coupling
- Use lubricants to reduce friction
- Use customized/redesigned hand trucks for specific tasks
- Use a vise to keep materials from slipping when applying force
- Select tools that reduce manual exertions
- Use two people for heavy/awkward loads
- Use a hoist to lift heavy materials
- Use a vacuum to clean up spillage



Work smarter – not harder!

Repetitive Motion

Repetitive motions that involve the same joints and muscle groups can cause fatigue, inflammation, and discomfort.



Repeated pushing of pedals at extreme angles does not allow adequate recovery time for the lower leg muscles



Turning a switch or operating a joystick for prolonged periods of time can result in compression of nerves and tendons



Repeated use of a hand tool can result in overuse injuries of the arm, wrists, and shoulders

The more repetitions the longer the recovery time.

Solutions

- Decrease the number of pieces handled
- Order parts preassembled
- Change the work rate
- Decrease/eliminate the number of steps each worker performs
- Have worker pack or put away whatever he/she processes to allow for recovery
- Use several dedicated tools rather than one adjustable tool to reduce adjustment frequency
- Change work organization - spread similar work throughout different shifts and allow breaks - job rotation
- Use power tools whenever possible



**Be efficient –
Take the work out of work!**

Vibration

Workers can be exposed to whole body vibration or hand-arm vibration. Vibration affects muscles, tendons, ligaments, blood vessels, and nerves.



Prolonged operation of heavy equipment exposes workers to **whole body vibration**, which may lead to back, neck, and digestive problems



A worker can be exposed to **hand-arm vibration** by direct contact with a vibrating source, which may cause muscle/joint stiffness, numbness, and tingling sensation

Jolts from riding on rough roads increase vibration exposure and risk for acute injury.

Solutions

- Keep roadways smooth with proper maintenance and reduce vehicle speed
- Improve vehicle seating suspension system and provide sufficient seat padding
- Perform frequent tool maintenance and bit replacement
- Select tools with vibration dampening, vibration absorbing grips or handles made from high-friction materials
- Change tool rotation speed or gears to produce higher frequency vibrations that can be dampened by anti-vibration gloves
- Minimize grip forces to reduce vibration transmission i.e. use tools with larger handle diameter or use tool support



Put a damper on bad vibrations!

Designing Lifting Tasks

Lifting objects incorrectly can create excessive forces on the back muscles and spinal discs and may lead to injury.

- Bring the object close to the body and lift with both hands
- Lift with smooth motions; jerking increases the risk of injury
- Do not twist; step to turn
- Use a lifter to raise object to working level
- Slide instead of lifting objects
- Change shape of container or packaging of materials to allow better coupling
- Use lighter weight materials, i.e. fiberglass versus steel
- Install dividers to evenly distribute loose parts and to prevent shifting loads
- Use bulk materials that require the use of mechanical assist devices

Know your limits!

Lift safely alone or as a team!

Selecting Hand Tools

- Choose a tool that allows you to work with a straight wrist and reduced grip force
- Choose a tool that can be used in your dominant hand



Tools with angled handles are better for horizontally applied forces



Tools with straight handles are better for vertically applied forces



Use tools that require a power grip - maximum power grip strength is about 4 times the maximum pinch grip strength

Pick the right tool for the job!
Pick the right place for your work!

Risk Factor Report Card

RISK FACTOR REPORT CARD

Name: _____

1. Work Area / Job Title: _____

2. Describe task: _____

3. Check all risk factors that apply:

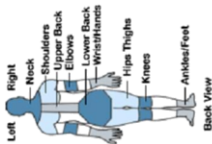
- Poor Posture
- Repetitive Work
- Vibrating Tools
- Static Position
- Forceful Gripping
- Heavy Lifting/Carrying
- Bouncing/Jarring
- Heavy Shoveling

Other risk factors: _____

5. Comments/suggestions: _____

6. Plant/Mine Name: _____

4. Place X on affected areas.



Report risk factors before signs and symptoms occur!

Remember – It's up to you to **TAKE ACTION!**



For more information visit:
www.cdc.gov/niosh