

ERGONOMICS



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Learning Objectives

By the end of this lesson, students will be able to:

- Define the terms *ergonomics* and *work-related musculoskeletal disorders*.
- Explain the risk factors for musculoskeletal injuries.
- Give at least three examples of work situations where young workers may be at risk for injury.
- Identify two ergonomic solutions to reduce the risk factors for musculoskeletal injuries.
- Describe and demonstrate the proper way to lift a load.

Time Needed: 65 Minutes

Materials Needed

- DVD: *Ergonomics Awareness*
- DVD player and TV or LCD projector (with speakers)
- Handouts: *Four Steps to Proper Lifting* (A)
Proper Lifting Evaluation (B)
Ergonomic Checklist (C)
- 2 to 3 empty boxes
- Reams of office paper
- Unsharpened pencils

Preparing to Teach This Lesson

Before you present this lesson:

1. Locate DVD on CD. Preview the DVD prior to showing to students.
2. Make copies of handouts (A) *Four Steps to Proper Lifting* and (B) *Proper Lifting Evaluation*.
3. Collect boxes for lifting exercises and two reams of office paper per student group.

Detailed Instructor's Notes

A. Introduction: Why is this subject important? (5 minutes)

1. As a warm-up discussion ask students:

What does the word "ergonomics" mean?

Ergonomics is the study of how the human body performs tasks, and how to design equipment, or organize the task, to best fit our body's abilities and limits. In the workplace, this means fitting the job to the worker.

A good example of the early use of ergonomics was in designing the cockpits of airplanes.

When you're flying miles above the earth at very high speeds, you want to make sure the con-

trols, visibility, and comfort are as good as they can be so pilots can do their work safely and make the right decisions.

In more typical workplaces, it means setting up the worksite to meet the needs of the workers. In ergonomics, the worker is the central figure. When worksites are designed to suit the needs of the worker there are fewer cases of work-related musculoskeletal disorders (WMSDs), fewer days absent, higher productivity, and more comfortable workers.

2. *Why is ergonomics important?*

Injuries that result from poor ergonomics are some of the most common and frequent kinds of injuries, and they are found in all kinds of workplaces and occupations. Many of these are musculoskeletal injuries, which we commonly refer to as strains and sprains. These often affect the back but other body parts are also involved such as hands and wrists, shoulder, neck, and knee.

The rise in the use of computers has contributed to a dramatic increase in injuries due to ergonomic factors. We don't yet know what a lifetime of working on a personal computer does to the body, because we only have about 25 years of experience. Ergonomic-related injuries can be serious and disabling.

Young people who get back injuries are more likely to have lifelong back problems, which can limit both work and recreational activities.

Using the principles of ergonomics, it is possible to reduce the risk of injury.

B. DVD and Discussion (25 minutes)

1. Explain that the class will now watch a 14-minute DVD, *Ergonomics Awareness*, created by the Washington State Department of Labor and Industries.

Ask students to keep in mind these questions while they watch the DVD:

- a. What are the key ergonomic risk factors?
 - b. What kinds of jobs have you done that involve these risk factors?
 - c. What kinds of changes can be made to protect workers from these risks?
2. Show the DVD.
 3. After showing the DVD, discuss the following questions with the class:

What are the key ergonomic risk factors?

- Working in awkward positions
- Using high hand force
- Performing repetitive motions
- Using the hand or knee to make repeated impacts
- Heavy, frequent or awkward lifting
- Exposure to moderate to high levels of vibration
- Standing too long in one position
- Mechanical pressure (leaning against a hard edge)

What kinds of jobs have you done that involve these risk factors?

- Construction: lifting, vibrating tools, awkward positions, pinch grips
 - Office work: repetitive keyboarding, lifting, sitting in one position for a long time
 - Restaurant work: lifting, standing for long periods, repetitive kitchen work
 - Other
6. Explain that the class will discuss these jobs and risks in more detail, along with possible solutions, in a later activity.

C. Experiencing Injury Risk Factors (15 minutes)

Certain body positions and postures are naturally stronger than others. Two exercises will demonstrate this for the hands/wrists and the lower back.

1: Strong and Weak Grips

Grip Strength Tug-o-War

Students pair off and compete in a tug-o-war competition using pencils. Two separate comparisons will illustrate the difference between 1) a pinch grip competing with a power grip and 2) a neutral wrist competing with a bent wrist posture. Students compare their strength using both techniques.



Fig. A

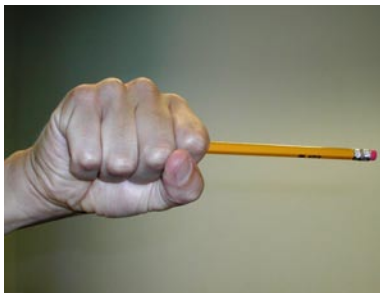


Fig. B



Fig. C

- a. The first student holds the pencil in a pinch grip as in figure A. The other student tries to pull the pencil out of the grip. Then the first student holds the pencil in a power grip, figure B. The other student again tries to pull the pencil out of the first student's hand.

Ask students:

Which was easier to pull out, the pinch grip or the power grip? Why?

What does that tell you about doing a task with the hand in a pinch grip rather than a power grip?

The power grip is the stronger grip since all of the fingers and palm are supporting the pencil.

- b. Reverse roles and have the second student hold the pencil as in B (power grip with a straight wrist). Now the first student tries to pull it out. Now hold the pencil the same way but bend the wrist forward (down) as far as you can. Student #2 now tries to pull it out again.

Ask students:

Which was easier to pull out this time, straight wrist or bent wrist?

For the student holding the pencil what did it feel like trying to hold it with the wrist bent so far?

The straight wrist is stronger, which is the neutral posture for the wrist. Holding the wrist bent and trying to grip is uncomfortable.

2. Posture, Force, and Effort

Students will lift and hold a box in four positions: without a box, close to their body, mid-way from their body, and low/away from their body. Following the directions on part 1 of Handout (A) *Four Steps to Proper Lifting*, students will assess posture, fatigue, and strength using a 1-10 scale. To set up for this activity, you will need to place two reams of office paper in each box. One ream of office paper weighs approximately five pounds.

Safety Note: Students with back or shoulder injuries should either not participate actively or lift only one ream of paper.



D. Practice Safe Lifting: Lifting Loads at the Pizzeria (20 minutes)

1. Divide students into groups of 2-4. Present them with this scenario:
You have a new job working in the kitchen of a pizzeria. Every morning boxes of ingredients are delivered to the back door of the kitchen. One of your job duties is to move these boxes into the kitchen. At the end of your shift, you also have to empty all the trash cans and carry the garbage to the dumpster behind the shop. After three weeks on the job, you have noticed that your back has started to feel sore and tired by the end of your shift.
Give students copies of Handout A, *Four Steps to Proper Lifting* and B, *Proper Lifting Evaluation*.
2. Give each group two or three empty boxes. Tell them their task is to practice lifting and moving the boxes using the techniques from the handout. After reading *Four Steps to Proper Lifting*, each person takes a turn lifting the boxes and moving them to a location you specify. The other students in the small group use the safe lifting checklist from part two of Handout B, *Proper Lifting Evaluation* to evaluate the lift.
3. After everyone is done and you get back together as one group, discuss how it felt to use the proper lifting techniques. The students may say that it feels funny bending the knees

and lifting with the legs. Emphasize that many lifting tasks are not as straightforward as lifting compact boxes. Materials are often bulky, odd-shaped, and too heavy for any one person to lift safely. Sometimes what you're lifting is a person, as in a hospital or nursing home. Here lifting with your knees may be impossible. Therefore it's very important to look for solutions that go beyond proper body movement to protect the health of your back. There are ways to change the workplace or the task to make lifting easier. Ask the students to think of some of these types of changes.

Some examples:

- Store boxes off the ground so they are at a height between the knees and the shoulders, in order to avoid high or low lifts.
- Have orders delivered in smaller (lighter) boxes.
- Use two people to lift.
- Use cranes, dollies, or other lifting devices.



Leave students with the message that good back care is important on and off the job, but it's always important to look at the job and equipment as well as what you can do yourself to protect your back.

Note: If students suggest wearing back belts, tell them that NIOSH (the National Institute for Occupational Safety and Health) does not recommend them. Back belts do not specifically protect the back and may even be hazardous themselves. They may give people the false impression that they can lift more than they should. Following safe lifting techniques is always essential.

E. Optional Activity: Analyzing a task for ergonomic hazards. (15 minutes)

1. Divide the class into groups of three or four. Assign each group one of the jobs mentioned in the previous discussion or a job shown below. Give students Handout C, the *Ergonomics Checklist*.
2. Ask each group to identify all the possible ergonomic risks involved in that job, using the checklist. Suggest that one person in the group mime different aspects of the job, so that the others can observe and identify possible risks. Ask each group to report back the following information:
 - All ergonomic risk factors
 - At least three possible changes that could be made to address those risks.
3. Bring the class back together. Ask each group to report back on their findings.
4. Review key points.



Construction work: fastening down roofing material

The following OSHA and State of Washington L&I-DOSH-WISHA codes correspond to information in this unit:

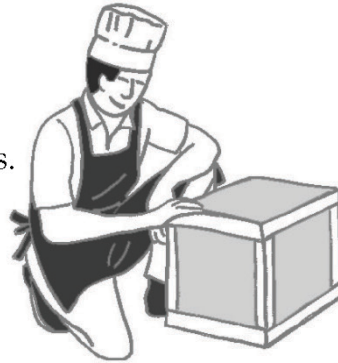
L&I DOSH WISHA WAC 296-126-096 Lifting

Four Steps to Proper Lifting

FOUR STEPS TO PROPER LIFTING

1. SIZE UP THE LOAD

- Use a hand truck if possible.
- Get help if you need it.
- Check for slivers, nails, exposed staples.
- Use gloves if necessary.
- Make sure you have a clear path to where you are moving it to.



2. LIFT

- Bring the load as close to you as possible before lifting.
- Lift with your legs, not your back.
- Keep your head up, your back straight and bend at your hips.



3. MOVE

- Keep the load close to your body.
- Look where you are going.
- Shift your feet to turn, don't twist your body.



4. GET SET AND LOWER

- When setting a load down, let your leg muscles carry it down.
- Make certain your fingers and toes are clear before setting the load down.







Proper Lifting Evaluation | Part 1

Posture, Force & Effort

Each partner will take turns lifting and holding the box in different positions. Use the Physical Effort Rating Scale to fill out the table. For each position, provide the Physical Effort Rating and write down where in your body you felt discomfort or fatigue after holding the position for 15 seconds.

Physical Effort Observations

Position	Partner # 1	Partner #2
<p>No box Pretend as if you have a box to lift and follow the basic procedure. Stand for 15 seconds before lowering.</p> 	<p>Rating: Discomfort/fatigue:</p>	<p>Rating: Discomfort/fatigue:</p>
<p>Box held close Lift and then hold the box close, about 1-2" in front of your body at waist level. Do not allow the box to touch or rest on your body. Hold for 15 seconds and then lower the box.</p> 	<p>Rating: Discomfort/fatigue:</p>	<p>Rating: Discomfort/fatigue:</p>
<p>Box held at the middle distance with slight bend in elbows Lift and then hold the box 8-10" in front of you with elbows bent. Hold for 15 seconds and then lower the box.</p> 	<p>Rating: Discomfort/fatigue:</p>	<p>Rating: Discomfort/fatigue:</p>
<p>Box held low and far away Hold the box in front of you, about 10-12" off the ground. Hold for 15 seconds and then lower the box.</p> 	<p>Rating: Discomfort/fatigue:</p>	<p>Rating: Discomfort/fatigue:</p>

Physical Effort Rating Scale

Use this scale to answer the questions above.

- 10 Very, very difficult
- 9 Very difficult
- 8 Difficult
- 7 Somewhat difficult
- 6 A little difficult
- 5 Moderate effort
- 4 Little effort
- 3 Very little effort
- 2 Easy
- 1 No effort

Safety Note: If lifting and holding the box with two reams of paper is too heavy for you, feel free to remove one ream of paper from the box.

SAFE LIFTING CHECKLIST | PART 2











Watch your fellow students lift the boxes. See if they follow the safe lifting method. Help them if they miss a step.







Did they...	Yes	No
Know where the boxes will be placed?		
Check for obstacles and clear a path before moving the material?		
Check the weight of the load before lifting it?		
Have two or more people lift (or use a lift device) if necessary?		
Avoid twisting while carrying?		
Keep the load as close as possible to the body?		
Lift with the legs and not with the back?		
Lift the load slowly, avoiding fast jerky movements?		
Use their leg and back muscles by bending their knees when setting the load down?		

Comments:

ERGONOMICS CHECKLIST

Does the job include any of the following?		Yes	No	Not Sure
	Repetitive bending or turning the wrist in any direction.			
	Frequent reaching forward, behind, or out to the side with one or both arms stretched out.			
	Repeating the same motion over and over.			
	Frequent pinching, pulling or using force.			
	Lifting above shoulder height.			
	Wearing gloves that are too big or too small.			
	Lifting with forceful throwing			
	Exertion of force in awkward postures (to the side, overhead, extended reaches).			
	Lifting objects off the floor.			
	Handling or hard-to-grasp tools or equipment. (Poor handhold? Items difficult to reach?)			

(continued, next page)

Does the job include any of the following?		Yes	No	Not Sure
	Regularly pressing hands or arms on sharp edges			
	Hand tool vibration			
	Cold temperatures			
	Pace of work set by machines			

Adapted from Massachusetts Department of Public Health