

# Body Mechanics (Mandatory Update / Non-CE)

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## Course Introduction

### **COURSE INTRODUCTION**

The US Department of Labor cites overexertion injuries, such as muscle strains and sprains, as the most common type of work related injury, afflicting thousands of workers each year. These injuries cost workers, businesses and industry millions of dollars annually in lost workdays, lost productivity and treatment.

The majority of these disabling injuries occur to the back and trunk of the body as a result of moving heavy or bulky objects the wrong way. Heavy, bulky objects include the human body.

Healthcare workers who provide patient care, such as nurses, nursing aides and orderlies, are among those who suffer the highest rates of overexertion injuries. But these injuries can be avoided by learning to use good body mechanics to lift and move properly.

*To complete this course, you must do the following:*

- Read the Overview and Learning Objectives
- Study the Terminology
- Study the Content
- Complete the Post Test with a passing score of 80% or more

### **OVERVIEW**

This Mandatory Update outlines the essentials of good body mechanics including an understanding of the major anatomical features of the body related to body mechanics.

Specific recommendations for performing safe work-related activities are included as well as recommendations for exercises that will help increase strength and flexibility and help avoid injury. The material is organized into the following categories:

- Introduction
- Body Mechanics
- Gravity
- Posture
- Lifting
- Transferring
- General Body Mechanics
- Exercising
- Conclusion

### **PURPOSE/OVERALL GOAL**

The purpose of this program is to provide healthcare workers with an understanding of good body mechanics and how proper use of body mechanics can help to avoid injury.

Specific recommendations regarding a number of activities are made and exercises designed to increase flexibility and strength are recommended.

### **LEARNING OBJECTIVES**

*After completing this update, the learner should be able to:*

- Define body mechanics.
- Explain how the major muscle and bone groups relate to body mechanics.
- List the three principles of gravity.
- Describe correct posture.
- Demonstrate proper body mechanics techniques in several activities.
- Demonstrate exercises designed to increase flexibility and strength.

## Terminology

**Abdomen:** The front of the body between the chest and the pelvis.

**Abdominal Muscles:** Muscles within the abdominal cavity that help support the back, including the internal and external abdominal obliques, and rectus abdominus.

**Base of Support:** The width between your feet as you stand. When standing, your body balances on the base of support.

**Biceps:** The muscle group on the front of the upper arms that work with the triceps to bend and extend the arms.

**Body Mechanics:** The mechanical way muscle groups and bones work together to move at the joints.

**Bones:** The hard internal structures that form the skeleton and give humans their basic shape. Muscles attach to bones allowing parts of the body to move.

**Center of Gravity:** The point in the body where weight is equally distributed on all sides.

**Cervical:** The region at the top of the spine consisting of seven vertebrae that support the neck.

**Coccygeal:** The region at the base of the spine that consists of four vertebra fused into one bone.

**Disks, Intervertebral:** Broad, flat fibrocartilage disks between the vertebrae of the spine.

**Gluteal Muscles:** The muscles of the upper part of the back of the thigh and buttocks.

**Hamstrings:** The group of muscles on the back of the thighs that work with the quadriceps to bend and extend the leg.

**Joints:** The point at which two bones connect, usually allowing them to move.

**Ligaments:** Strong fibrous tissues that secure bones to each other.

**Line of Gravity (also called Plumb Line):** An imaginary line that passes through the center of gravity splitting the body into equal halves. In most people it runs behind the ear, through the center of gravity, through the knee and just in front of the ankle. It establishes the standard for posture and balance.

**Lumbar:** The lower mid-region of the spine consisting of five vertebrae between the thoracic and sacral regions.

**Muscles:** Specialized body tissue designed to contract and relax when stimulated. Muscles connect to bones to provide motion for the body and body parts.

**Posture:** The position of the body when standing or seated.

**Plumb Line:** See line of gravity.

**Quadriceps:** The group of muscles at the front of the thighs that work with the hamstrings to bend and extend the leg.

**Sacral:** The lower region of the spine consisting of five vertebrae fused into one bone between the lumbar and coccygeal regions.

**Spinal Column:** The column of stacked vertebrae that protect the spinal cord and allow the back to bend.

**Spine:** See spinal column.

**Tendons:** Strong fibrous connective tissue at the end of muscles that connect muscles to bone.

**Thoracic:** The upper mid-region of the spine consisting of 12 vertebrae between the cervical and lumbar regions.

**Triceps:** The group of muscles on the back of the upper arms that work with the biceps to bend and extend the arms.

**Vertebra:** One of the 33 bones that make up the spinal column.

**Vertebrae:** Plural of vertebra.

## Introduction

In the course of an average day, healthcare professionals are required to stand or sit for long periods of time and lift heavy, cumbersome weight, often in awkward positions or in confined spaces. This presents situations with the potential for serious strain and injury to the back and other parts of the body. In fact, as a group, nurses and nurses aids have one of the highest rates of back injuries. But the risk of injury can be greatly reduced simply by using the proper body mechanics for any given task. This program will help you to understand the basic principles of body mechanics and show you how to benefit from good body mechanics when working in a healthcare setting.

## Body Mechanics

Anytime we stand, walk, or lift an object, we are using a highly developed mechanical system... our body.

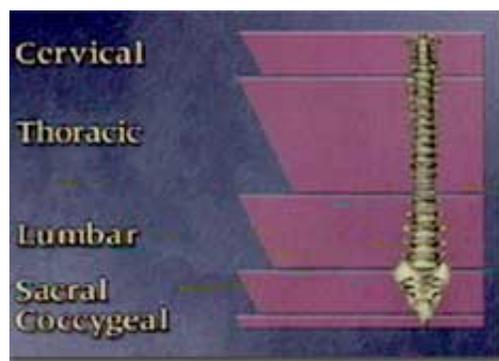
While the body is not mechanical in its form, it is mechanical in its performance. The body's framework of bones, muscles and tendons function according to mechanical laws and forces. It is important to understand how these laws and forces act on our bodies, so we can use them to our benefit and avoid injury.

An understanding of body mechanics requires a basic knowledge of the musculoskeletal system and how it works. Body mechanics can be defined as the way muscle groups and bones work together to articulate at joints in an efficient and coordinated manner.

### The Backbone

A good place to start is at the backbone.

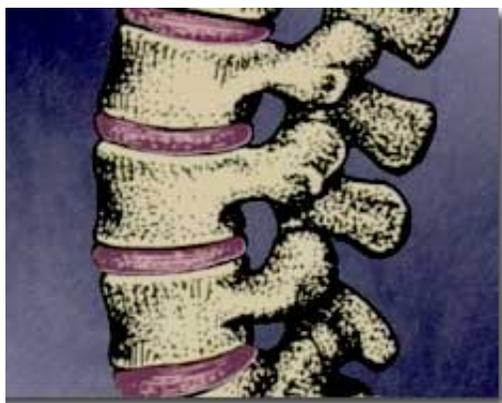
The vertebrae are divided into 5 regions: cervical, thoracic, lumbar, sacral and coccygeal. The lumbar region—and particularly the lumbosacral joint where the lumbar region joins the sacrum—is prone to work-related injuries from lifting, carrying, and moving things because it is the axis of the body when the back is bent. The lumbar region and the sacrum are also the focus of pressure when a person is seated.



The spine naturally develops four curves that are associated with the cervical, thoracic, lumbar and sacral regions.

The Coccygeal region is part of the sacral curve. These curves center the weight of the head and torso over the body's center of gravity and should be maintained whenever standing, sitting or lifting.

Vertebra are separated by intervertebral discs which consist of a firm, fibrocartilage substance with a gelatinous center. These disks act as shock absorbers for the spine and aid in its flexibility.



The spine protects the spinal cord, and works with the strong muscles of the back to provide upright support for the trunk of the body and the head.

### **Abdominal Muscles**

The abdominal muscles play a vital role in proper body mechanics that is often overlooked. It is the abdominal muscles that work with the back muscles to assist the spine in supporting the torso and head.

The abdominal muscles and back muscles are an example of muscle groups working together. Most body movements are performed by muscle groups working together in antagonistic and agonistic pairs -- one set of muscles contracts as the other set relaxes. By this coordinated action, bones are able to move at the joints. A clear example of this is found in the legs.



### **The Legs**

Because we spend most of our time either standing or walking, the muscles in the legs are some of the most powerful. When we bend a leg, the hamstrings on the posterior thigh contract, bringing the tibia, fibula and foot toward the femur. Simultaneously, on the anterior thigh, the quadriceps relax, and the leg flexes at the knee. The quadriceps pass over the knee and are attached to the tibia by the patellar tendon.

Conversely, when the quadriceps contract, the tibia is brought away from the femur as the hamstrings relax and the leg is extended at the knee.

Along with the gluteal muscles of the buttocks, the quadriceps and hamstrings work together to keep the tibia and femur in proper alignment, and provide us with the power to walk, run, stand and lift effectively.



## **The Arms**

The final group of muscles to discuss are those in the arms. The biceps and triceps are the most powerful muscles in the arms.

Conscientious use of the arms when lifting, pushing and pulling can greatly reduce the stress and strain put on the back and legs.

As we have seen, muscles must work together for the body to move. By understanding how the body's mechanical framework is designed to function, we can know which muscle groups are best suited for any given task and can use them in the appropriate way. Otherwise we risk injury, and sometimes permanent damage, by putting too much stress on muscles, tendons and bones.

## **Gravity**

To complete our understanding of body mechanics, we need to know how our bodies are affected by gravity.

To keep an upright stance, humans must constantly work to maintain their balance. Using proper body mechanics will keep the bones and muscles of the body properly aligned and help us maintain balance with a minimum amount of effort.

There are three principles of gravity that affect body mechanics. These are:

- Center of Gravity
- Line of Gravity
- Base of Support

### **Center of Gravity**

This is the point in a body where weight is equally distributed on all sides. In most people this point is located in the pelvis about level with the second sacral vertebra.

### **Line of Gravity**

The line of gravity is an imaginary line that passes through the center of gravity splitting the body into equal halves. In most people this line runs behind the ear, through the center of gravity, through the knee and just in front of the ankle. When your body's posture corresponds to this line, your body is in balance. Sometimes this is called the plumb line.

### **Base of Support**

The base of support is the width of your stance. This is the base that stabilizes your body. You can gain a more stable balance by widening your stance to increase your base of support -- and by lowering your center of gravity. Changing your position in either or both of these ways will help you maintain your balance. These changes also improve your body mechanics when lifting heavy objects.

With a basic understanding of body mechanics, we can use this knowledge to move and relax in efficient ways that

put the least amount of stress and pressure on the bones and muscles.

## Posture

Because we use our bodies constantly, even in the most simple task, such as standing, can affect our overall health, energy level and effectiveness. Therefore, our posture is the first place to practice good body mechanics.



### Standing

There is really only one way to stand properly that naturally aligns the body correctly in a way that is relaxed and comfortable.

When standing properly, the head is held squarely erect, not tilted to any one side.

The natural curves of the spine are maintained and the torso is not leaning in any direction. The arms are relaxed at the sides.

The abdomen is held up and in to help support the back. The hips are straight with the buttocks taut. Each leg supports an equal amount of body weight and the knees are forward, slightly flexed. The feet are even and spread slightly apart, about the width of the shoulders, with the toes pointing forward.

Because healthcare professionals are on their feet so much of the time, the value of maintaining correct posture cannot be overestimated. When proper body mechanics are used to stand and walk, you will have more energy and less fatigue because unnecessary stress on any one muscle group is eliminated.



### Sitting

There is no activity that puts more continuous pressure on the lumbar region of the lower back than sitting. Therefore it is essential that we use good body mechanics to align our body properly when sitting.

The head should be held squarely erect, with the spine straight. Your body weight should be evenly distributed on your buttocks and thighs with the hips flexed at a 90 degree angle. Your knees should also be flexed at a 90 degree

angle and level with your hips or elevated very slightly above them.

Your knees should be clear of your chair. There should be no pressure on the nerves and blood vessels behind the knee.

Keep the feet flat on the floor to help support the weight of the legs. A footrest can be used for comfort.

It is essential to keep your back straight when seated. Sit back into your chair, let it support the lumbar region of your back. Always avoid bending at the waist.

Bending forward at the waist just 20 degrees increases the pressure on the lumbar region by 90%.

By positioning your work closer to you, you eliminate the need to bend forward, and take pressure off your back. Whenever possible, support your forearms on a desk, chair armrests or in your lap. This takes additional pressure off your back. By using correct body mechanics to support your body when sitting, you will be able to sit longer and more comfortably without causing back pain and injury.

## Lifting

It has been estimated that eight out of ten people will suffer lower back pain, primarily due to poor body mechanics. Few things can injure your body as quickly or severely as lifting too much weight or lifting incorrectly. Such activity can cause hernias, ruptured discs and permanent back injury.

Use your knowledge of body mechanics to lift properly, without damaging your back.

If you need to lift an object off the ground, widen your stance and squat down to lower your center of gravity.

Keep your back straight and tighten your abdominal muscles. Grasp the object and bring it as close to you as possible.

Then, use the power of the quadriceps and gluteal muscles to extend your legs to lift. Never lift with the back muscles. They are being used to keep your body erect and support your spine. Using them to lift will over-stress the back and can lead to disc injury and other serious problems.



Consider this: bending at the waist just 20 degrees to pick up a 44 pound object will increase the pressure on the lower back by 120 percent. Also, picking up a weight at arm's length multiplies the weight's stress on the body 7 to 10 times due to leverage.

For this reason, even if the object seems light, always use the legs and gluteal muscles to lower and raise yourself and the object. Keep the back straight and the object close to your body.

## Transferring

Whether you are a physical therapist working in a long term care setting, or a home healthcare nurse, as a health

care professional, you will be required to lift and move patients and residents. But factors such as limited space, limited assistance, resistance from the person you are moving, and the awkwardness and weight of the human body, combine to present situations where injury to the back and body can easily occur.

Therefore, to avoid undue stress and possible injury to the back and other parts of the body, it is imperative to always use transfer techniques that apply proper body mechanics.

Before beginning any transfer, make sure you are wearing comfortable clothes with a loose fit, and footwear that will not slip.

Be sure that the floor is dry and the area is clear of obstacles.

Always explain to the patient or resident how you will make the transfer and have them assist you as much as possible.

Whenever necessary, have someone assist you in the transfer.



### **Bed to Chair Transfers**

When moving a resident or patient from a bed to a wheelchair, position the wheelchair close to the bed, on the patient's strongest side and lock it at a slight angle.

Have the patient sit on the edge of the bed. The patient's feet should be flat on the floor in a shoulder-width stance to provide a good base of support. Footwear that will not slip on the floor should be worn.

Explain what you are about to do and secure a transfer or gait belt around the patient's waist.

Place yourself in front of the patient, and block the patient's leg closest to the chair with your foot and leg.

Your other leg should be slightly behind and spread in a stance that provides a solid base of support and control of the lift.

Grasp the sides of the transfer belt and keep your head and back straight while bending at the knees.

The patient should lean toward you, and hold your forearms if possible. Do not allow the patient to hold onto your neck or shoulders.

With your back straight, lift with your legs to bring the patient to a standing position. Keep the patient as close to you as possible.

Now, pivot on the balls of your feet or side-step and position the patient to the chair.

Keep the patient close to you, and gently lower the patient into the chair, bending at the knees, not the back. This basic technique can also be used for chair to chair, chair to commode and chair to bed transfers.



## **Bed to Gurney Transfers**

Bed to gurney transfers require the assistance of another person and are best done with a lift or draw sheet. If a lift sheet is not available, using the actual bed sheet is safer than attempting to lift the patient without a sheet.

Begin by positioning the patient on the lift sheet and as close to the edge of the bed as possible.

Raise or lower the bed and gurney to equal heights. Position the gurney against the side of the bed, and lock the wheels.

While keeping your back as straight as possible, reach over the gurney and grasp the lift sheet.

Be sure to hold the corner of the pillow as well as the lift sheet to give support to the patient's head during the move.

Your assistant should grasp the sheet in the same manner and be prepared to push as you pull.

The assistant may find it easier to place one or both knees on the patient's bed to avoid leaning over excessively.

Using a three count, lift and pull the patient onto the gurney while your assistant lifts and pushes.

Several short lifts may be preferable to attempting one large movement.

## **Transfer Aids**

The lifting techniques we have just seen are examples of several transfer methods that incorporate the proper use of body mechanics to lift and move patients.

In addition to these, there are mechanical lifts and devices to facilitate patient transfers that greatly reduce or eliminate the amount of manual effort required to effect a patient transfer.

These include mechanical lifts, roller boards, sliding boards, flexible patient movers and slings, and pivoting turntables.

The time it takes to use any of these devices is greatly off-set by the time it would take to recover from the injuries they can prevent.

## **General Body Mechanics**

There are some general rules of good body mechanics that should always be kept in mind.

- Always try to push or pull an object. Avoid lifting when you can.
- When pushing, extend your arms out and shift your weight forward with your back straight so that your body weight helps push.
- When pulling towards you, lean back with your back straight, to make your body weight work for you. Keep your legs in a wide stance, one behind the other and use your arms to pull the object to you.
- When moving something, clear away any obstruction so you can make your move in the most safe, direct and efficient way.

- When you do need to lift a heavy object, ask for help whenever possible. Do not try to lift or move too much weight by yourself.
- When carrying an object, keep it close to your body, near your center of gravity. This transfers more of the weight to the large muscles in your legs.
- Always avoid twisting your torso. Instead, pivot on the balls of the feet.

Remember, when you use the principles of good body mechanics, you work better, play better, and perform at your highest level. Because you are working with the body's natural design, you will be able to prevent injury and stay healthy.

## Exercising



Because working in a healthcare environment can sometimes be physically demanding, it is a good idea to stay in good physical shape. Exercising at home will help you avoid injuries and generally increase your flexibility, strength and stamina. It is recommended that you exercise three times a week. This will greatly benefit you not only on the job but in the normal daily activities that everyone experiences.

### **FLEXIBILITY EXERCISES**

These exercises will help to keep you limber and avoid injury.

#### **Lower Back Rotation**

The Lower Back Rotation stretches the muscles and joints of the lower back. Lie on your back with the knees bent. Then drop both knees to one side while turning your head to the opposite side. Hold this position for a count of five. Return your head and knees to their original position and repeat four more times. Then, turning to the opposite side, repeat this exercise five more times.

#### **Single Leg Pull**

The Single Leg Pull helps stretch the muscles in the hips, lower back and buttocks. Lie on your back with one leg bent and the other leg extended flat. With your hands, slowly pull the bent knee to the chest while keeping the extended leg and lower back pressed to the floor. Hold for a count of five. Return to your beginning position and repeat four more times. When you've done one leg, repeat the exercise five times with the other leg.

#### **Straight Leg Raise**

The Straight Leg Raise stretches the muscles of the hips and hamstrings and strengthens the quadriceps. Lie on your back with one leg bent and the other leg extended flat. Slowly raise the extended leg until your thighs are next to each other, while keeping your lower back pressed against the floor. Hold for a count of five, then slowly lower the leg back to the floor. Repeat four more times, then switch to the opposite leg.

### **STRENGTHENING EXERCISES**

These exercises will strengthen specific muscle groups and make it easier to perform daily tasks.

## **Pelvic Tilt**

The Pelvic Tilt strengthens the muscles of the lower back and can be performed at home or at work. Stand with your back against a wall. Press the small of your back flat against the wall without bending at the knees or hips. Hold it for a count of five and relax. Repeat four more times.

## **Wall Slide**

The Wall Slide strengthens the muscles of the lower back, hips and legs, and can also be performed at home or at work. Stand with your back against a wall. Slide down the wall until your body is in a seated position. Hold for a count of five. Then use your legs to slide your back up the wall. Repeat four more times.

## **Partial Curl**

The Partial Curl strengthens the abdominal muscles that help support the back. Lie on your back with both knees bent. Cross your arms loosely over your body. Tuck your chin in and tighten your abdominal muscles. Curl half way up and hold for a count of five. Relax, and repeat the exercise four more times.

## **Conclusion**

Injury on the job can be a traumatic and debilitating experience. It may result in loss of work for the injured person and may necessitate treatment. Work time lost due to injury can also be detrimental to the place where the person works and can put additional pressure on coworkers. Use of proper body mechanics can greatly reduce the incidence of job injuries and improve the ability of every person to work safely and efficiently.