# Body Mechanics and Range of Motion II

# Course

#### Rationale

Health Science

### Unit V

#### Safety and Governmental Regulations

# Essential

#### **Question** How does proper body movement protect both the Health Care Worker and the patient?

# TEKS

130.204 8A, 8F 11A

#### Prior Student Learning

The student should have an understanding of healthcare regulatory agencies.

# Estimated time

3 hours

Healthcare providers must know how to properly apply the principles of body mechanics to minimize personal and client injury.

# Objectives

Upon completion of this lesson, the student will be able to:

- Explain how muscles, bones, and joints work together to provide movement
- Identify the principles of body mechanics
- Demonstrate proper body mechanics
- Demonstrate Range of Motion of the upper and lower extremities

# Engage

The National Safety Council estimates that hospital workers are twice as likely as employees of other service industries to sustain work-related, Musculo-Skeletal injuries. Have students discuss which occupations and what activities are most at risk. Nurses are most at risk, while Physical Therapists are number 2. Activities include:

- Lifting
- Bending
- Twisting

# **Key Points:**

I. Body Movement

- A. Accomplished by the musculoskeletal systems
- B. The main framework of the body is covered with muscle
  - 1. Allows movement
    - 2. The type and extent of movement is determined by the load or resistance that is moved.
    - 3. The arms and legs are like machines.
    - 4. The action of muscles pulling on a bone are like a machine called a lever.
    - 5. A lever is a rigid rod able to rotate around a point called a fulcrum.
      - a. In the body the rigid rod is the bone.
      - b. In the body the fulcrum is the joint.
    - 6. Any force applied to the lever is called the effort.
    - 7. Any force that resists the motion of the lever is called the load, or resistance.
      - a. In the body, contraction of the muscle is the effort.
      - b. In the body, the part of the body is the resistance or

load.

- 8. Types of levers in the body
  - a. First-Class Levers
    - i. The placement of the fulcrum lies between the pull and the load, as in a set of scales.
    - ii. The head being tipped backward on the atlas
      - a) the facial portion of the skull is the load.
      - b) the joint between the skull and the atlas is the fulcrum.
      - c) the muscles of the back produce the pull.
  - b. Second-Class Levers
    - i. The load lies between the fulcrum and the joint, where the pull is exerted.
    - ii. Raising of the body on the toes
      - a) the point of contact between the toes and the ground is the fulcrum.
      - b) the load is located at the ankle.
      - c) the pull is exerted by the gastrocnemius (the muscle in the calf).
  - c. Third-Class levers
    - i. The pull is exerted between the fulcrum and the resistance or load to be moved
    - ii. The flexing of the forearm at the elbow joint, as in lifting a hand weight
      - a) the load is the weight in the hand.
      - b) the pull is the biceps brachii muscle.
      - c) the fulcrum is the elbow.
    - iii. This is the most common lever in the body
- C. **Proper Posture** (the position of body parts in relation to each other) and **Body Mechanics** (using all body parts efficiently and in a careful way) are necessary in to order to limit stress and strain on the musculoskeletal system.
  - 1. Lifting, pushing, or pulling increases stress on the musculoskeletal system.
  - 2. Principles
    - a. Use the larger and stronger muscles to perform work (shoulders, upper arms, hip and thighs).
    - b. Maintain the center of gravity in the body close to the center of the support base (feet provide a support base for humans).
    - c. Keep centered within the support base the combined center of gravity of the HealthCare worker and the object or person to be moved (hold objects to be moved close to you).
    - d. Have a support base that is the appropriate size and shape

- II. Rules for proper body mechanics
  - A. Use stronger, larger muscles to perform tasks which require physical effort.
  - B. When moving a heavy object, try to push or pull it instead of lifting.
  - C. Maintain a wide base of support (feet approximately 12 inches apart).
  - D. Get help if the object feels too heavy to lift.
  - E. Lift in a smooth motion to prevent injury.
  - F. Maintain a good posture.
  - G. Avoid twisting the body; turn your whole body and face the area in which you are working.
  - H. Bend your knees, keep your back straight, spread the feet about one foot apart, and use your leg muscles while lifting.
  - I. Keep objects close to your body when lifting, moving, or carrying them.
  - J. Avoid unnecessary bending and reaching: raise the bed or over bed table to your waist level.
- III. When to use Body Mechanics
  - A. At all times that you have to lift, move, or carry an item
    - 1. In everyday daily activities: for example, while cleaning, carrying books to school and to class, or getting in and out of a car.
    - 2. In Healthcare settings: for example, while assisting a patient to a chair, picking up supplies, or positioning a patient in bed.
- IV. Ergonomics: the science of work. The science of fitting the work to the user instead of forcing the user to fit the work. (OSHA has put emphasis on developing a policy of no lifting in Long Term Care Facilities and other high-risk areas. The training program can be found at <u>http://www.osha.gov/SLTC/etools/nursinghome/index.html</u>
- V. Range of Motion: the complete extent of movement which a joint is capable of
  - A. Used when doing routine activities such as bathing, eating, and dressing; uses muscles that keep many joints in effective range of motion
  - B. The purpose of Range of Motion
    - 1. To prevent problems caused by a lack of movement
    - 2. To prevent problems caused by inactivity
      - a. Contractures: the tightening and shortening of a muscle: for example, foot drop
      - b. Muscles may atrophy (shrink) when they are not used.

c. Joints become stiff
d. Blood clots and decubitus ulcers may develop.
C. Active Range of Motion – those movements performed by the national without help
D Passive Range of Motion – a movement cannot be performed by
the patient and the health care worker moves each joint through
its range of motion
F Active Assistive Range of Motion – the natient does the
evercises with some assistance from another person
F General rules for Range of Motion
1 Use good body mechanics: raise the bed to your waist
level if the natient is in hed
2 Expose only the body part being exercised
3 Explain to the nationt what you are going to do, and teach
the patient how to do it
4 Support the extremity being exercised (place hands under
the extremity supporting the joint above and the joint
below the one you are exercising)
5 Move each joint until there is resistance but not pain
6. Move each joint slowly, smoothly, and gently.
7 Return the joint to a neutral position after the movement
8 Keep friction to a minimum
9. Repeat each exercise 3-5 times.
G. Joint Movement
1. Abduction – moving a body part away from the midline
2. Adduction – moving a body part toward the midline
3. Flexion – bending a body part
4. Extension – straightening a body part
5. Hyperextension – excessive straightening of a body part
6. Rotation – moving in a circle at a joint
7. Pronation – turning a body part downward
8. Supination – turning a body part upward
9. Inversion – turning a body part inward
10. Eversion – turning a body part outward
11. Dorsiflexion – bending backward
12. Plantar Flexion – bending forward
13. Radial deviation – moving toward the thumb side
14. Ulnar deviation – moving toward the little finger side

# Activity

- I. Complete the Body Mechanics Activity.
- II. Complete the <u>Range of Motion Activity</u>.
- III. Demonstrate principles of proper body mechanics. See the <u>Body</u> <u>Mechanics Checklist</u>. If you have a lab with beds, moving the patient up

in bed is good. If you do not have a lab with beds, have students transfer a patient (another student) from one chair to another. The instructor should demonstrate the procedure first.

IV. Demonstrate Range of Motion. See the Range of Motion Checklist.

V. Complete the Body Movement Worksheet.

#### Assessment

Body Mechanics Check Sheet Range of Motion Check Sheet Body Movement Worksheet

#### Materials

Bed and linens Chair or wheelchair Gait belt

#### Accommodations for Learning Differences

For reinforcement, students who cannot lift, move, or transfer clients will make posters to illustrate proper body mechanics.

For enrichment, students will plan care to minimize injury for an 87-year-old patient who has had a stroke and is confined to bed.

## **National and State Education Standards**

National Health Science Cluster Standards HLC10.01 Technical Skills 3 Demonstrate safety procedures to protect clients, co-workers and self.

## TEKS

130.202(c)(1)(H) Identify and analyze the principles of body mechanics and movement such as forces and the effects of movement, torque, tension and elasticity on the human body;

130.202(c)(10)(A) Identify governing regulatory agencies such as the World Health Organization, Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration and National Institute for Occupational safety and Health;

130.202(c)(10)(B)Relate industry safety standards such as standard precautions, fire prevention, safety practices in all aspects of the health science industry; and

130.202(c)(10)(C)Identify safety practices in all aspects of the health science industry.

130.204(c)(8)(A) comply with specific industry standards related to safety and substance abuse;

130.204(c)(8)(F) demonstrate skills related to activities of daily living in rehabilitation care such as range of motion, positioning and ambulation according to the health science industry standards regulatory agency standards and professional guidelines; and

130.204(c)(11)(A)Conform to government regulations and guidelines from entities such as the World Health Organization Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration and National Institute for Occupational safety and Health.

Texas College and Career Readiness Standards English/Language Arts Standards

- A. Understand new vocabulary and concepts and use them accurately in reading, speaking and writing
- Cross Disciplinary Standards
  - B. Problem Solving
    - 1. Analyze a situation to identify a problem to be solved
    - 2. Develop and apply multiple strategies to solving a problem

### **Body Mechanics Activity**

This gives the student an opportunity to practice some of the principles of Body Mechanics and Range of Motion before they actually work with each other.

- 1. Place a box or book on the floor. Ask the student to pick up the item. Make sure that the student bends his or her knees, keeping the back straight, and does not bend from the waist.
- 2. Give the student a container or book and ask the student to pass it to the student behind them. Make sure that the student does not twist to hand the object to the other student, but walks until he or she is facing the student.
- 3. Give the student a heavy container or book and ask the student to hold it at arm's length for 60 seconds. Then have the student hold it close to them for several minutes and ask them which is easier.
- 4. Ask students to stand with their feet together for several minutes then have them stand with their feet about 12 inches apart. Which one is easier to maintain?
- 5. Place a heavy container (one that is too difficult to lift) on a table or the floor. Ask the student to move it to the other end of the table or to a different spot on the floor. Make sure that the student pushes the object rather than lifting it.

## **Range of Motion Activity**

Have each student perform the movement while you tell them what to do. This does not need to be done in a bed. It can be done at their desks or standing up.

## Arm

Abduction – with an arm at your side, bring the arm away from the body.

Adduction – with an arm out to the side, return it to the body.

Flexion – bend the elbow.

Extension – straighten the arm.

Supination – turn the hand so the palm is up.

Pronation – turn the hand so the palm is down.

Rotation (Internal and External) – raise the arm at your side until the it is in line with the shoulder; bend the elbow at a 90 degree angle and move the forearm upward and downward.

Radial Deviation and Ulnar Deviation – move the hand from side to side at the wrist (there is not much movement).

Opposition – touch each finger to the thumb.

### Leg

Abduction – lift the leg laterally away from the body.

Adduction – return the leg toward the other leg.

Flexion – with the leg extended, lift upward.

Extension – return the leg to its original position.

Rotation (Internal and External) – turn the foot and leg toward the other leg, and then turn it out away from the other leg.

Dorsiflexion – move the foot up and back until the toes are upright.

Plantar Flexion – move the foot with the toes pointing downward.

Inversion – turn the sole of the foot toward the middle.

Eversion – turn the sole of the foot outward.

# **Body Mechanics Checklist**

Moving a helpless patient up in bed using a drawsheet

- S U
  - \_\_\_\_ 1. Ask a co-worker to help you move patient.
- 2. Identify the patient and address him or her by name as you explain what you are doing.
- 3. Introduce yourself and the one who is helping.
- 4. Wash your hands.
- 5. Provide privacy with a closed door, screen, or curtain.
- 6. Check that the bed is securely locked and lock the wheels if necessary.
- 7. Raise bed to its working height if possible.
  - 8. Flatten the head of the bed if the patient's condition allows for that.
- 9. Move the pillow from under the patient's head and position it at the head of the bed.
- 10. Position your worker or assistant on the other side of the bed, opposite you.
- \_\_\_\_\_ 11. Lower the side rails.
- \_\_\_\_\_ 12. Loosen the drawsheet on each side of the bed.
  - \_\_\_\_\_ 13. Roll the drawsheet toward the patient (students should hold the drawsheet at the hip and shoulder of the patient).
  - \_\_\_\_\_ 14. Ask the patient for help if he or she is able to.
  - 15. Place your feet about 12 inches apart, with one foot pointed toward the head of the bed and the other foot pointed toward the side of the bed. Bend your knees and keep your back straight.
  - 16. On the count of three, shift your weight from your back foot to the front foot together with your partner, and move the patient to the head of the bed. Students should stay low and not jerk their bodies upward to lift, but should support the patient and "slide" rather than lift.

# **Body Mechanics Checklist**

Transferring a patient from one chair to another

S U

- 1. Identify the patient and address him or her by name as you explain what you are doing.
  - \_\_\_\_\_ 2. Introduce yourself.
- \_\_\_\_\_ 3. Wash your hands.
  - 4. Provide privacy with a closed door or screen.
  - 5. Place the chair the patient will be transferred into against a wall, or have a student hold the chair so that it will not slide. If a wheelchair is used, make sure that the wheelchair is locked and the footrests are up.
    - 6. Position the chair so that it is at a right angle to the place where the patient is sitting.
      - 7. a. If no gait belt is available: Place your hands around the patient's waist and ask the patient to push with their hands on the arms of their chair, or the seat if the chair has no arms. On the count of three, bend your knees and assist the patient to a standing position; pivot with the patient until the patient can feel the new chair against his or her legs; and lower the patient into the new chair as you bend your knees, keeping your back straight.
      - 7. b. If a gait belt is available, apply the gait belt around the patient's waist, making sure the buckle is to the side of the patient. Grasp the gait belt on each side; ask the patient to push with their hands on the arms of their chair, or the seat if the chair has no arms. On the count of three, bend your knees and assist the patient to a standing position; pivot with the patient until the patient can feel the new chair against their legs; and lower the patient into the new chair as you bend your knees, keeping your back straight.
      - 8. Make sure the patient is comfortable with their hips against the back of the chair, their knees at right angles to the floor, and their feet on the floor.
      - 9. Cover the patient's lap with a sheet or bath blanket

# Performing Upper Range of Motion Checklist

The patient may be sitting in a chair or laying in a bed; each exercise is repeated 3-5 times. This is done on one side, and can be done on the other side after the first arm is finished.

S U 1. Introduce yourself, identify the patient, and explain what you will be doing. \_\_\_\_ 2. Provide privacy and lock the wheels of the bed, if a bed is being used. \_\_\_\_\_ 3. Wash your hands. 4. Start with the shoulder nearest to you. \_\_\_\_\_ a. Support the patient's arm by placing one hand at the elbow and the other at the wrist. b. Flex the shoulder by raising the arm in front of the body, and then above the \_\_\_\_\_ head. c. Extend the shoulder by bringing the arm back down to the side. \_\_\_\_ d. Abduct the shoulder by moving the arm straight out to the side. \_\_\_\_\_ e. Adduct the shoulder by moving the arm back to the body. 5. Exercise the elbow nearest to you. \_\_\_\_ a. Support the patient's arm by placing one hand at the elbow and the other at \_\_\_\_ wrist. b. Flex the elbow by bending the forearm and hand up to the shoulder. \_\_\_\_ c. Extend the elbow by moving the forearm and hand down to the side. \_\_\_\_ d. Pronate by turning the palm of the hand down. \_\_\_\_ e. Supinate by turning the forearm and hand so the palm is up. \_\_\_\_ 6. Exercise the wrist nearest to you. \_\_\_\_\_ a. Support the patient's wrist by placing one hand above it and the other hand \_\_\_\_ below it. b. Flex the wrist by bending the hand down toward the forearm. \_ \_\_ c. Extend the wrist by straightening the hand. \_\_\_\_\_ d. Hyperextend the wrist by bending the top of the hand back toward the forearm. \_\_\_\_\_ e. Move the hand at the wrist toward the thumb side (radial deviation). \_\_\_\_ f. Move the hand at the wrist toward the little finger side (ulnar deviation). \_\_\_\_ 7. Exercise the fingers and thumb on the hand nearest you. \_\_\_\_\_ a. Support the patient's hand by placing one hand at the wrist. b. Flex the fingers to form a fist. \_\_\_\_\_ c. Extend the fingers to straighten them. d. Perform opposition by touching the thumb to the tip of each finger. \_\_\_\_\_

## Performing Lower Range of Motion Checklist

The patient must be lying down to do this. This is done on one side of the body and can be done on the opposite side after the first leg is finished.

S U 1. Introduce yourself, identify the patient, and explain what you will be doing. \_\_\_\_\_ \_\_\_\_\_ 2. Provide privacy and lock the wheels of the bed. 3. Wash your hands. \_\_\_\_ 4. Uncover the leg nearest you and exercise the hip. a. Support the patient's leg by placing one hand under the knee and the other hand \_\_\_\_\_ under the ankle. b. Abduct the hip by moving the entire leg out to the side. \_\_\_\_\_ c. Adduct the hip by moving the leg back toward the body. \_\_\_\_ d. Flex the hip by bending the knee and moving the leg toward the abdomen. \_\_\_\_\_ e. Extend the hip by straightening the knee and moving the leg back to the bed. \_\_\_\_\_ f. Medially rotate the hip by turning the leg toward the midline. \_\_\_\_ g. Laterally rotate the hip by turning the leg toward the side. \_\_\_\_\_ 5. Exercise the knee nearest to you. \_\_\_\_ a. Support the patient's leg by placing one hand under the knee and the other hand \_ \_ under the ankle. b. Flex the knee by moving the lower leg back toward the thigh. \_\_\_\_ c. Extend the knee by straightening the leg. \_\_\_\_ 6. Exercise the ankle nearest you. a. Support the patient's foot by placing one hand under the foot and the other hand \_\_\_\_\_ behind the ankle. b. Dorsiflex the ankle by moving the toes and foot up toward the knee. \_\_\_\_ c. Plantar flex the ankle by moving the toes and foot down away from the knee. \_\_\_\_\_\_ · \_\_\_\_\_ d. Rotate the ankle clockwise and then rotate the ankle counterclockwise. \_\_\_\_ \_\_\_\_\_7. Exercise the toes on the foot nearest you. a. Rest the patient's leg and foot on the bed. \_\_\_\_\_ b. Abduct the toes by moving then away from each other. \_\_\_\_\_ c. Adduct the toes by moving them together. d. Flex the toes by curling them down toward the bottom of the foot. \_\_\_\_\_ e. Extend the toes by straightening them. \_\_\_\_

### Movement of the Body Worksheet

- 1. The movement in the body is accomplished by the \_\_\_\_\_ System.
- 2. The arms and legs are like a machine called a \_\_\_\_\_\_.
- 3. An example of a first-class lever is \_\_\_\_\_
- 4. Draw a picture or diagram of a first class-lever. Label the fulcrum, the effort, and the load.
- 5. An example of a second-class lever is \_\_\_\_\_
- 6. Draw a picture or diagram of a second-class lever. Label the fulcrum, the effort, and the load.
- 7. An example of a third-class lever is \_\_\_\_\_\_
- 8. Draw a picture of a third-class lever. Label the fulcrum, the effort, and the load.

- 9. The most common lever in the body is \_\_\_\_\_
- 10. What is the importance of using correct body mechanics?
- 11. List 5 rules of body mechanics and give an example of when each could be used in a healthcare setting.

12. The healthcare worker should use the muscles of the arms and legs to lift, and not the muscles of the back. Briefly explain why.

- 13. Match the terms on the left with the correct definition on the right.
  - 1. Abduction
- 2. Pronation
- 3. Posture
- 4. Flexion
- 5. Atrophy
- 6. Inversion
- 7. Range of Motion
- 8. Body mechanics
  - 9. Adduction
- 10. Base of support
- 11. Supination
- 12. Ergonomics
- 13. Extension
- 14. Rotation
- 15. Radial deviation

- a. shrink (as a muscle)
- b. the feet
- c. movement toward the midline
- d. moving in a circle
- e. the position of body parts in relation to each other
- f. the science of fitting the work to the worker
- g. movement toward the thumb side
- h. the complete extent of movement of which a joint is capable
- i. turning a body part downward
- j. bending at a joint
- k. straightening a joint
- I. turning a body part inward
- m. moving a body part upward
- n. movement away from the midline
- o. using the body in a careful and efficient way

## Key to worksheet

- 1. The Musculoskeletal System
- 2. A lever
- 3. The joint between the skull and the atlas of the spinal column
- 4. The fulcrum is the joint at the atlas and the vertebra, the effort is the contraction of the muscles in the back, and the load is the head
- 5. Raising the body on the toes
- 6. The point of contact of the foot with the floor is the fulcrum, the effort is the contraction of the gastrocnemius, and the load is the foot
- 7. Flexing the forearm at the elbow
- 8. The fulcrum is the elbow, the effort is the contraction of the biceps, and the load is the hand or its contents
- 9. A 3<sup>rd</sup> class lever
- 10. To protect yourself from being injured especially musculoskeletal injury and to protect the patient from injury
- 11. Any five of the principles listed in the key points examples will vary
- 12. The strongest muscles are in the arms and legs; the back muscles are not as strong
- 13. Matching
  - 1. n
  - 2. i
  - 3. e
  - 4. j
  - 5. a
  - 6. I
  - 7. h 8. o
  - 0. U 9. C
  - 9. C
  - 11.m
  - 12.f
  - 13.k
  - 14.d
  - 15.g