

SAFE PATIENT HANDLING AND MOVEMENT IN THE PERIOPERATIVE SETTING



1998

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STUDY GUIDE

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2170 South Parker Road, Suite 400
Denver, CO 80231-5711
(800) 755-2676 www.aorn.org

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LEARNING OUTCOME

After completing this study guide and viewing the accompanying video, perioperative registered nurses (RNs) and other perioperative team members will have increased their knowledge of evidence-based guidelines for safe patient handling and movement and will be better able to implement work practices to reduce the risk for movement-related injuries.

EDUCATIONAL OUTCOMES

The participant will be able to

- recognize the high risk for work-related musculoskeletal injuries among health care professionals,
- help establish a culture of safety in the workplace,
- help implement a program for safe perioperative patient handling and movement, and
- implement use of the seven AORN Ergonomic Tools.

INTRODUCTION

Perioperative team members perform a range of tasks that place them at high risk for work-related musculoskeletal disorders and injuries.^{1,2} Team members are often required to move and position patients, equipment, and supplies.¹ Many patients under sedation or anesthesia depend entirely on team members for movement and positioning.¹ Physical work exceeding a worker's ability can lead to musculoskeletal injuries² and disorders of the muscles, nerves, tendons, ligaments, joints, cartilage, and discs of the lower back, spine, shoulders, and arms.¹ Injuries can result from overexertion, repetitive motion, lifting, pulling, pushing, awkward postures, static postures, prolonged standing, long cumulative work hours, and carrying heavy equipment.¹

The increasing prevalence of obesity among the patient population contributes to the risk of musculoskeletal disorders and injuries among health care workers.¹ During the past 2 decades, the prevalence of obesity in the United States has increased dramatically from just under 23% to almost 38%.³ More than two-thirds of US adults are overweight.³ More than one in three US adults and one in five US teenagers are obese.³ The increase in obesity is not restricted to people of any particular age group, educational level, ethnic background, or geographic location.^{4,5}

In 2016, the Bureau of Labor Statistics reported 552,600 nonfatal occupational injuries among workers in health care and social assistance professions, more than in any other sector including manufacturing.⁶ Studies have shown a high prevalence of low back pain and other work-related musculoskeletal disorders among nurses.^{1,2} Musculoskeletal disorders in nursing personnel can lead to lost productivity, lost or modified workdays, higher staff turnover, and adverse patient outcomes.²

This study guide and the accompanying video provide guidance to team members for developing, implementing, and maintaining a program for safe patient handling and movement in order to reduce the incidence and severity of injuries to patients and personnel.¹

CULTURE OF SAFETY

Perioperative team members should collaborate with their health care organization leaders to establish and sustain a culture of safety that incorporates principles of safe patient handling and movement. The primary goal is to keep patients and team members safe.¹

As part of the culture of safety, team members should report hazards, near misses, incidents, and accidents related to patient

and equipment handling as soon as possible according to the health care organization's policies and procedures. In organizations with a strong culture of safety, errors are considered learning opportunities. Any safety-related event, particularly one involving human or organizational error, provides a valuable opportunity to improve safety through feedback.¹

The health care organization should provide the number of team members and assistive devices required to safely move, position, or prep patients.¹

SAFE PATIENT HANDLING AND MOVEMENT PROGRAM

Perioperative team members should collaborate with their health care organization leaders to establish a formal, systemized safe patient handling and movement program. A formal program can reduce the risk for injuries to patients and team members and improve the quality of patient care. The health care organization should appoint an interdisciplinary team with the authority to establish, evaluate, and maintain the program. The perioperative safe patient handling program may be part of the health care organization's overall program or may be an independent program specific to the perioperative setting.¹

The interdisciplinary team should perform an initial comprehensive assessment of patient handling needs, the equipment available for patient handling, and data on adverse events to determine needs, priorities, and frequency for reassessment. The team should develop written goals, objectives, and a plan for ongoing evaluation, compliance, and quality improvement. The program should include short-term goals, long-term goals, a timeline for meeting goals, and requirements for evaluation. The team members should designate the persons who will have responsibility, authority, and accountability for implementing the plan.¹

The health care organization leaders and interdisciplinary team members should identify methods (eg, equipment, algorithms) to reduce the physical requirements of high-risk movement-related tasks. The organization should provide adequate funding to implement and sustain the program.¹

The interdisciplinary team should identify essential physical perioperative tasks and provide input for written job descriptions for team members who perform these movement- and handling-related perioperative tasks.¹

High-risk tasks specific to the perioperative setting include

- holding retractors for long periods of time,
- lifting and holding patients' extremities,
- lifting and moving equipment,
- repositioning patients on the OR bed,
- standing for long periods of time,
- sustaining awkward positions, and
- transferring patients on and off the operating room (OR) bed.¹

INSTALLATION OF EQUIPMENT

The perioperative team should collaborate with health care organization leaders on the selection, installation, and maintenance of technology and devices for perioperative safe patient handling. Installation of appropriate equipment can help to reduce injuries to patients and personnel.¹ There may be multiple teams involved in the perioperative areas.

The perioperative patient handling team should perform an ergonomic analysis of the perioperative area to determine the type of equipment needed. The team should identify high-risk tasks by reviewing injury data, conducting surveys, and interviewing perioperative team members. Appropriate types of patient handling equipment should be selected based on the ergonomic analysis.¹

Factors to consider when evaluating patient handling equipment include

- cleaning,
- ease of operation,
- efficiency and reliability,
- functionality and versatility,
- maintenance requirements,
- maneuverability,
- storage requirements, and
- workplace design.¹

EDUCATION AND COMPETENCY VERIFICATION

The perioperative team should collaborate with health care organization leaders to establish education, training, and competency verification activities in safe patient handling techniques and equipment use. Initial and ongoing education helps to develop knowledge, skills, and attitudes that improve patient safety. Education and competency verification should be specific to the role and setting for each team member.¹

Education, training, and competency verification should include

- identification of risk factors for patient handling–related injuries,
- implementation of practices for safe patient and equipment handling,
- procedures and processes for reporting injuries caused by patient handling,
- procedures for use of equipment and technology, and
- processes for patient assessment.

ERGONOMIC TOOLS

Seven Ergonomic Tools were developed by AORN to assist perioperative team members in implementing work practices to minimize the risk of work-related musculoskeletal injuries. These tools are based on professional consensus and evidence from research. Each patient has unique needs for handling and movement, and team members should individualize care.¹ The perioperative RN, in collaboration with other surgical team members, should identify high-risk tasks related to movement and positioning of each patient, retraction, and equipment handling and should implement ergonomic solutions.¹

Ergonomic Tool 1: Lateral Transfer of a Patient from a Stretcher to an OR Bed

Lateral transfer is defined as horizontal or lateral movement of a patient. It includes patient transfers starting and ending in the supine position (eg, from gurney to OR bed), moving from the supine to prone position, and moving from the prone to supine position.⁷

Perioperative team members may perform lateral transfers many times during the course of a work shift.^{1,7} These transfers put team members at risk for injuries to the lower back, shoulders, and neck.^{1,7} The risk increases when team members are required to move patients who are obese or who have uneven weight distribution (eg, amputated limbs).⁷ Environmental factors, including reaching across a bed to move the patient, may force perioperative team members to assume awkward positions.^{1,7} Differences in height among team members and uncooperative patients can increase the risk for injury.⁷

AORN developed Ergonomic Tool 1: Lateral Transfer of a Patient from a Stretcher to an OR Bed (Figure 1) to help perioperative team members minimize the risk for injury. Team members should assess the patient and, based on the assessment, ensure that an adequate number of caregivers and/or assistive devices are used. There should always be a

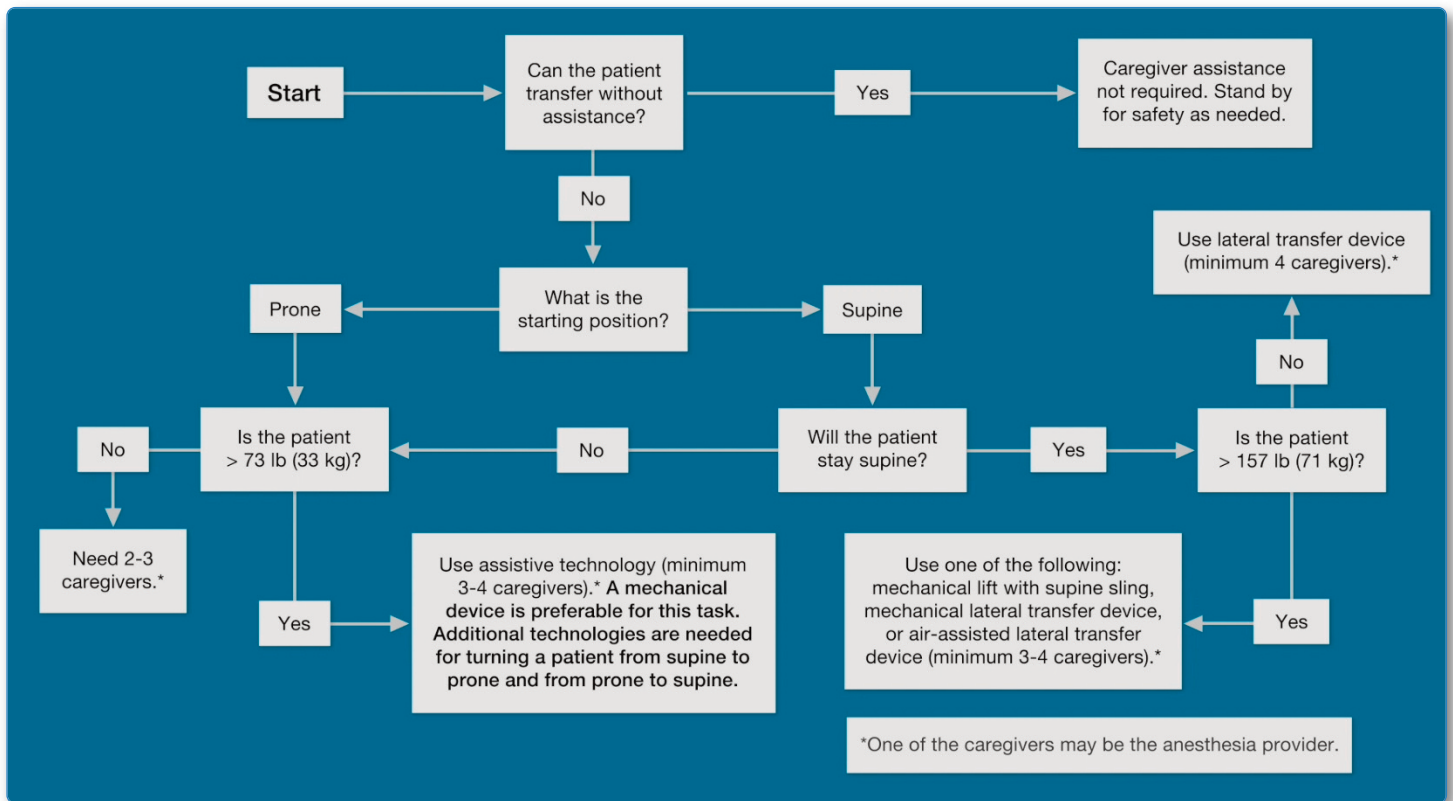


Figure 1. Ergonomic Tool #1: Lateral Transfer of a Patient from a Stretcher to an OR Bed.

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sufficient number of personnel present to maintain the patient's body alignment while minimizing the risk of injury to personnel. The maximum weights listed in this tool reflect a load-bearing capacity considered achievable for 75% of adult women in the United States.⁷

The first decision point in the algorithm addresses the ability of the patient to self-transfer without assistance. If the patient can self-transfer without help, the team should allow him or her to do so and stand by for safety as needed.^{1,7}

If the patient requires assistance, the next decision point is whether the patient will remain in the supine position for the entire transfer or if the patient will begin or end in the prone position.⁷

Supine-to-Supine Transfer

Perioperative team members often use draw sheets for supine-to-supine transfers in the OR at the beginning and end of surgical procedures. Research shows that transferring patients in this way requires team members to exert a pulling force of up to 72.6% of the patient's weight. A maximum limit of 35 lb of sustained pulling force per person has been recommended, provided the pulling distance is ≤ 6.9 ft, the

starting position of the caregiver's hands falls between his or her waist and nipple line, and the task is not performed more than once every 30 minutes. Using these numbers, a single team member should be able to safely pull a maximum of 48 lb of patient weight. The head and neck, supported by the anesthesia professional, is estimated to account for 8.4% of the patient's body weight.⁷

A single team member in addition to the anesthesia professional should be able to safely pull 53.6 lb.^{1,7} Two team members and the anesthesia professional should be able to move a patient weighing up to 104.8 lb, and three team members plus the anesthesia professional should be able to move a patient weighing up to 157.2 lb (Figure 2).^{1,7} AORN recommends using a friction-reducing sheet or slider board in addition to the required number of team members for supine-to-supine lateral transfer of patients weighing up to 157 lb.^{1,7} A mechanical lift with a supine sling, mechanical lateral transfer device, or air-assisted transfer device and three or four team members, one of whom can be the anesthesia professional, is recommended for lateral transfer of patients weighing more than 157 lb (Figure 3).^{1,7}



Figure 2. Anesthesia professional and three team members demonstrating a supine-to-supine transfer.



Figure 3. Team members using assistive technology during a supine-to-supine patient transfer.

Supine-to-Prone or Prone-to-Supine Transfer

During supine-to-prone patient transfers, the anesthesia professional typically maintains the patient's airway and supports the head and neck while other caregivers lift and roll the patient. One or more team members are usually responsible for receiving or "catching" the patient. Team members then position the patient on appropriate supports. This process places considerable strain on team members, particularly those designated to receive the patient.⁷

A maximum lifting limit of 22.2 lb per person is recommended. The anesthesia professional is estimated to support 8.4% of the patient's body weight. Using these numbers, two team members in addition to the anesthesia professional should be able to safely transfer a person weighing up to 48.5 lb from supine to prone position, and three team members should be able to transfer a patient weighing up to 73 lb. Three or four team members using assistive technology should transfer patients weighing more than 73 lb.^{1,7}

Additional Considerations

Devices used to assist lateral transfer should be long enough to fully support the whole length of the patient's body.^{1,7} There should be a sufficient number of team members present to maintain the patient's body alignment, support the extremities, and maintain the airway.¹ The suggested weight limits apply under ideal conditions.⁷ They should be reduced if a team member's arms are fully outstretched or above mid-chest height, if the lift happens close to the floor, or if a team member is required to assume an awkward position.⁷ Team members should not attempt to position a patient on his or her side simultaneously with a lateral transfer.⁷ It is preferable to perform these positioning maneuvers as two separate steps.⁷ Team members should lock the wheels of the OR bed, stretcher, or patient bed before attempting a lateral transfer (Figure 4).¹ Locking the wheels reduces the risk for falls.¹ The destination surface should be lower than the starting surface because it is easier to move a patient "downhill."¹



Figure 4. Team member locking the wheels of the patient's stretcher before moving the patient.

Ergonomic Tool 2: Positioning and Repositioning the Supine Patient on the OR Bed

After lateral transfer from a gurney to the OR bed, it is often necessary for team members to reposition the patient from the supine position to a different surgical position. This usually requires lifting, pushing, or pulling, which can lead to low back and shoulder injuries. AORN developed Ergonomic Tool 2: Positioning and Repositioning the Supine Patient on the OR Bed (Figure 5) to provide guidance for minimizing injuries to perioperative RNs and other team members during repositioning. Recommended weight limits represent loads considered achievable by 75% of adult women in the United States (eg, 22.2 lb lifting, 35 lb sustained pulling).⁸

The first decision point in the algorithm is to determine the required surgical position. This tool was developed for the

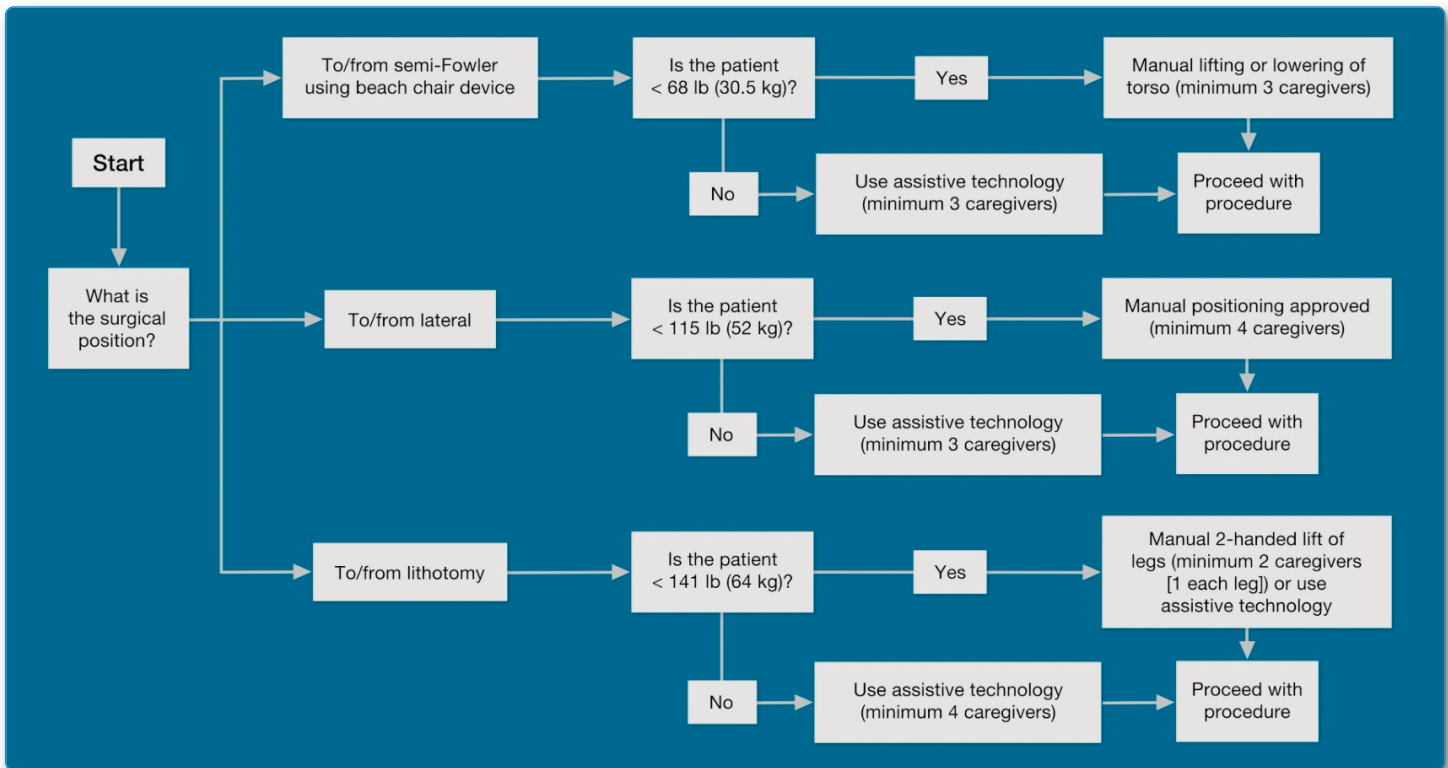


Figure 5. Ergonomic Tool #2: Positioning and Repositioning the Supine Patient on the OR Bed.

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semi-Fowler, lateral, and lithotomy positions. The second decision for the perioperative RN is to assess the patient's weight to determine the number of team members required for safe positioning and whether assistive devices are needed.⁸

Semi-Fowler Position

Three or more team members, one of whom can be the anesthesia professional, should be able to manually position a patient weighing 68 lb or less. Assistive technology and a minimum of three team members should position a patient weighing more than 68 lb. An automatic positioning system on an electric OR bed is one example of an appropriate assistive device. For purposes of calculating weight limits, the upper body, including head, neck, torso, and upper extremities, is estimated to account for 68.6% of the patient's total body weight. An additional 20 lb is added to account for the weight of equipment.⁸

Lateral Position

A minimum of four team members, one of whom can be the anesthesia professional, should be able to manually move a patient weighing 115 lb or less into the lateral position. Two team members plus an anesthesia professional should be able to position a patient weighing 76 lb or less. The anesthesia professional supports the head and neck, estimated at 8.4% of

the patient's body weight, during positioning. Assistive technology and minimum of three team members are recommended to position patients weighing more than 115 lb.⁸



Figure 6. Two team members lifting a patient's legs to position in lithotomy.

Lithotomy Position

A minimum of two team members, one for each leg, is sufficient to manually position the legs of a patient weighing less than 141 lb (Figure 6). A minimum of four team members, two for each leg, or assistive technology is recommended for positioning patients weighing 141 lb or more. Examples of assistive technology include support slings and specially

designed OR beds. Each lower extremity, including the thigh, calf, and foot, is estimated to comprise 15.7% of the patient’s body weight. For a patient weighing 141 lb, the estimated weight of each lower extremity is 22.1 lb, just under the 22.2 lb recommended limit for lifting.⁸

Ergonomic Tool 3: Lifting and Holding the Patient’s Legs, Arms, and Head While Prepping

Prepping the skin before a procedure is an important component of surgical antisepsis. Adequate preparation of an extremity usually requires a perioperative team member to hold up the extremity so that prep solution can be applied to the skin around the entire circumference of the extremity. A single perioperative RN might be able to hold and prep an extremity by himself or herself if the weight does not exceed the recommended maximum of 11.1 lb for a one-handed lift. A patient with very small extremities might fall within this weight limit, or the prep might include only the distal part of the extremity (eg, hand, foot). More commonly, one team member holds the extremity while another applies the prep solution (Figure 7). Devices can also be used to hold the extremity while a team member applies the prep solution, but the extremity must usually be lifted for at least a short time to allow application of the prep solution to the skin contacting the device.⁹



Figure 7. Team Member holding arm while RN circulator is performing preoperative skin antisepsis.

The perioperative RN must hold the extremity away from his or her body during prep to prevent contamination. The RN might have to assume an awkward position to accomplish this, and the RN’s arms will often be extended. The size of the extremity, the position that must be assumed to hold it, and the length of time it must be held all influence the risk for injury. Holding large extremities or holding extremities for extended periods can lead to shoulder, arm, and back injuries. Ergonomic Tool 3: Lifting and Holding the Patient’s Legs, Arms, and Head While Prepping (Figure 8) was developed to provide perioperative team members with guidance for

Ergonomic Tool #3. Lifting and Holding the Patient’s Legs, Arms, and Head While Prepping								
Patient Weight	Body Part	Body Part Weight		Lift 1-Hand	Lift 2-Hand	Hold 2-Hand ≤ 1 minutes	Hold 2-Hand ≤ 2 minutes	Hold 2-Hand ≤ 3 minutes
≤ 40 lb (≤ 18 kg)	Leg	< 6 lb	(< 3 kg)					
	Arm	< 2 lb	(< 1 kg)					
	Head	< 3 lb	(< 1 kg)					
40-90 lb (18-41 kg)	Leg	< 14 lb	(< 6 kg)					
	Arm	< 5 lb	(< 2 kg)					
	Head	< 8 lb	(< 4 kg)					
90-140 lb (41-64 kg)	Leg	< 22 lb	(< 10 kg)					
	Arm	< 7 lb	(< 3 kg)					
	Head	< 12 lb	(< 6 kg)					
140-190 lb (64-86 kg)	Leg	< 30 lb	(< 14 kg)					
	Arm	< 10 lb	(< 4 kg)					
	Head	< 16 lb	(< 7 kg)					
190-240 lb (86-109 kg)	Leg	< 38 lb	(< 17 kg)					
	Arm	< 12 lb	(< 6 kg)					

Figure 8. Ergonomic Tool 3: Lifting and Holding the Patient’s Legs, Arms, and Head While Prepping.

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acceptable lifting limits based on both weight and duration of holding.⁹

For development of this tool, patient weights were divided into 10 weight classes. For calculation of the weights for individual extremities, lower extremities were estimated to account for 15.7% of the patient's body weight, upper extremities for 5.1%, and the head, including the neck, for 8.4%. The tool incorporated a maximum recommended lifting weight of 11.1 lb for a one-handed lift and 22.2 lb for a two-handed lift. These recommended limits were considered achievable by 75% of women in the United States. For determining acceptable holding durations, muscle endurance was estimated to decrease by 48% after 1 minute, 65% after 2 minutes, and 71% after 3 minutes.⁹

To use this tool, the perioperative RN determines the patient's weight class, the extremity to be held, whether the extremity will be lifted with one hand or two, and the length of time the extremity must be held. White squares in the table indicate acceptable parameters for lifting and holding. Shaded squares indicate the need for more than one team member or use of an assistive device. For example, a single RN could lift the leg of a 135 lb patient with two hands (white square) but not with one hand (shaded square). A single RN could hold the arm of a 185 lb patient with both hands for up to 1 minute by himself or herself, but not for 2 or 3 minutes (Figure 9)⁹.



Figure 9. Team member using both hands to hold a patient's arm while the RN circulator is applying the preoperative skin antiseptic solution.

Ergonomic Tool 4: Solutions for Prolonged Standing

Perioperative team members are often required to stand for long periods of time and maintain static postures during surgical procedures. The need for scrubbed personnel to maintain the integrity of the sterile field can limit opportunities to relieve uncomfortable positions, sit, or significantly shift weight. Prolonged standing has been associated with leg pain and fatigue, spinal compression, chronic venous insufficiency, varicose veins, increased risk of carotid atherosclerosis, impaired circulation, and leg swelling.¹⁰

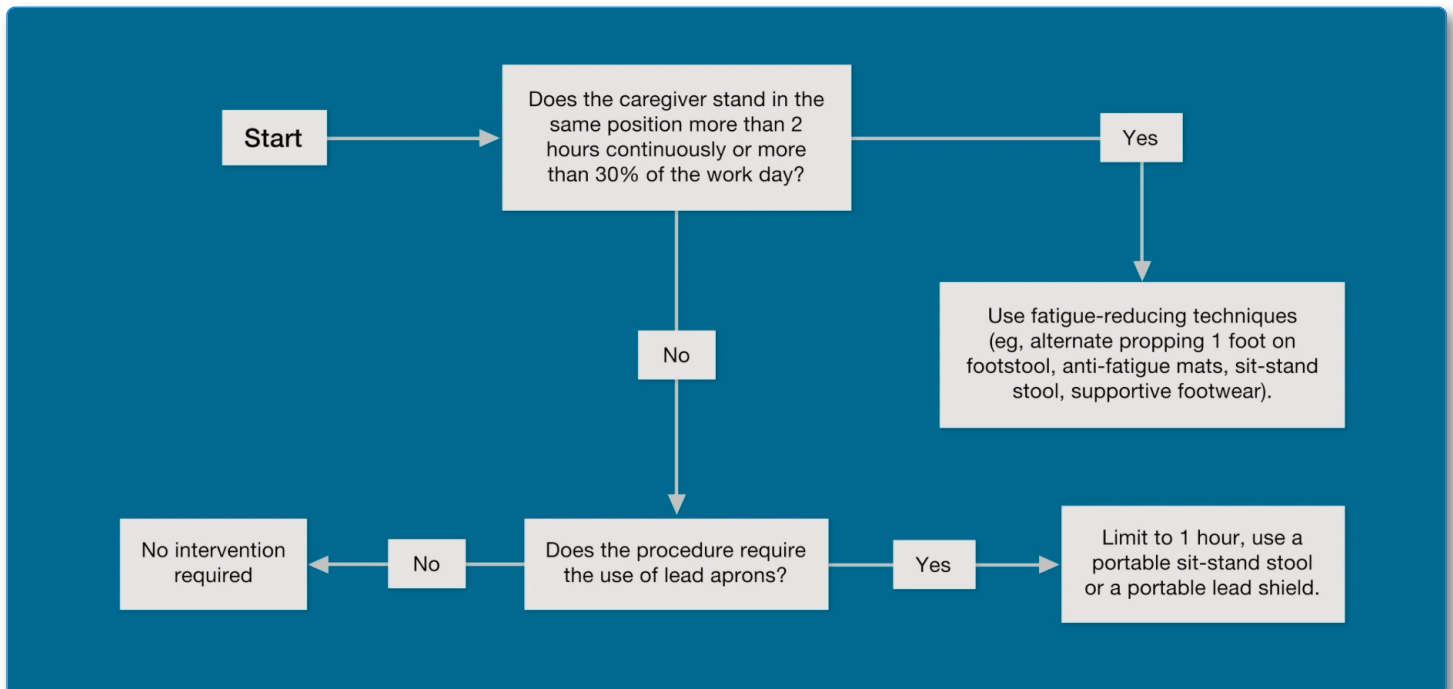


Figure 10. Ergonomic Tool 4: Solutions for Prolonged Standing.

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Discomfort and fatigue in the feet and legs are among the earliest and most common effects of prolonged standing. Pain can also occur in the hips, lower back, and neck. Standing for more than 4 hours per day can increase the risk for lower back pain. Prolonged standing can also lead to joint damage, arthritis, degeneration of tendons and ligaments, plantar fasciitis, and heel spurs.¹⁰

Ergonomic Tool 4: Solutions for Prolonged Standing (Figure 10) was developed to provide guidance to perioperative team members for minimizing adverse effects associated with prolonged standing.¹⁰

Interventions are recommended for team members who are required to stand in the same position for 2 or more hours, for more than 30% of the workday, or while wearing a lead apron. Interventions might include propping alternating feet on foot stools, using antifatigue mats, using sit/stand stools, and limiting standing times. Regular contraction and relaxation of muscles can also be beneficial.¹⁰

Antifatigue mats can be used to mitigate the effects of standing on hard flooring materials commonly used in ORs (Figure 11). Holes or small bumps incorporated on the top of the mat or foam on the bottom cause slight postural sway and induce minor activation of leg muscles. Anti-slip and regular soft mats may not incorporate these antifatigue features. Very soft mats (eg, thick foam rubber) should be avoided because they may increase the risks associated with prolonged standing and promote leg and back fatigue. Mats should have tapered edges that do not slide and an antiskid coating on top to minimize the risk of slipping or tripping. Shoes with insoles incorporating antifatigue features might be considered as an alternative to mats. Antifatigue mats that are a part of the standing stools can be used by shorter team members. Infection control must be considered when selecting mats for the OR.¹⁰



Figure 11. Ergonomic Tool 4: Solutions for Prolonged Standing
Sit/stand stools allow team members to alternate sitting and standing (Figure 13). This facilitates flexibility in body positions, increases the number of muscles used during

prolonged tasks, distributes loads to different parts of the body, reduces strain on individual muscles and joints, improves blood flow, and decreases muscle fatigue.¹⁰



Figure 12 Sit-stand Stool.
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Proper footwear can help mitigate the adverse effects of prolonged standing (Figure 13). Footwear should firmly grip the wearer's heel to prevent slippage, maintain the natural shape of the foot, enclose the toes with adequate space for movement, and incorporate cushioned insoles with arch support. Flat shoes and shoes with heels higher than 2 inches should be avoided. Shoes with laces facilitate optimization of fit.¹⁰



Figure 13. Proper footwear.

Team members should position themselves at an appropriate height for the OR bed whenever possible. The optimal height will vary depending on the role and height of the team member. Finding an ergonomically reasonable compromise for all team members can be challenging, particularly if there are large differences in height. The optimal OR bed height for an individual is generally considered to be the level of the waist, the elbow, or 5 cm above the elbow (Figure 14). This height may vary with the length and design of the instruments used, with the type of surgery, or with surgical technique.¹

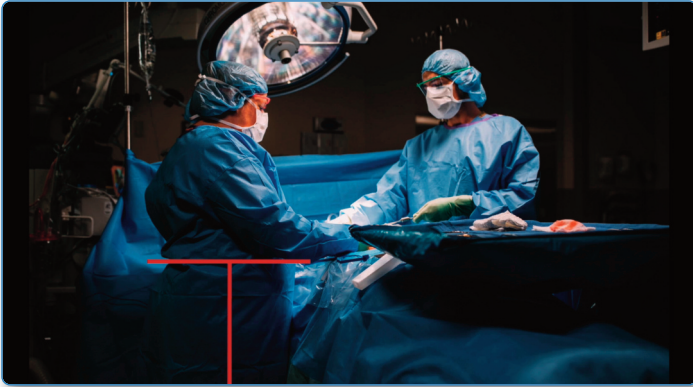


Figure 14. Correct height of the OR bed for the surgeon and other team members.

When team members are required to wear lead aprons, two-piece lightweight aprons are recommended, and standing time should be limited to 1 hour. Use of a sit-stand stool or a portable lead shield are also acceptable options.¹⁰

Perioperative team members should consider additional ergonomic interventions if required to stand for a prolonged period. Team members should stand as close as possible to the patient when lifting or moving and should avoid awkward positions whenever possible. The team member should not work with his or her neck flexed more than 30 degrees or rotated for more than 1 minute at a time. Regularly stretching and relaxing muscles can also reduce stress and strain (Figure 16).¹⁰

It is important for team members to maintain the integrity of the sterile field and to observe infection prevention measures when using interventions to reduce strain.¹⁰



Figure 15. Scrubbed team member stretching neck muscles during a long surgical procedure.

Ergonomic Tool 5: Tissue Retraction During Surgery

Retraction during a surgical procedure provides the exposure necessary for a surgeon to work. Scrubbed team members assisting the surgeon are often called upon to provide retraction manually using specially designed instruments or their own hands. Providing retraction can involve standing, flexion of the trunk and neck, and non-optimal arm positioning for extended periods of time. Fatigue and discomfort can result.¹¹

Ergonomic Tool 5: Tissue Retraction During Surgery (Figure 16) was developed to provide recommendations for perioperative team members to minimize adverse effects related to retraction during surgery.¹¹

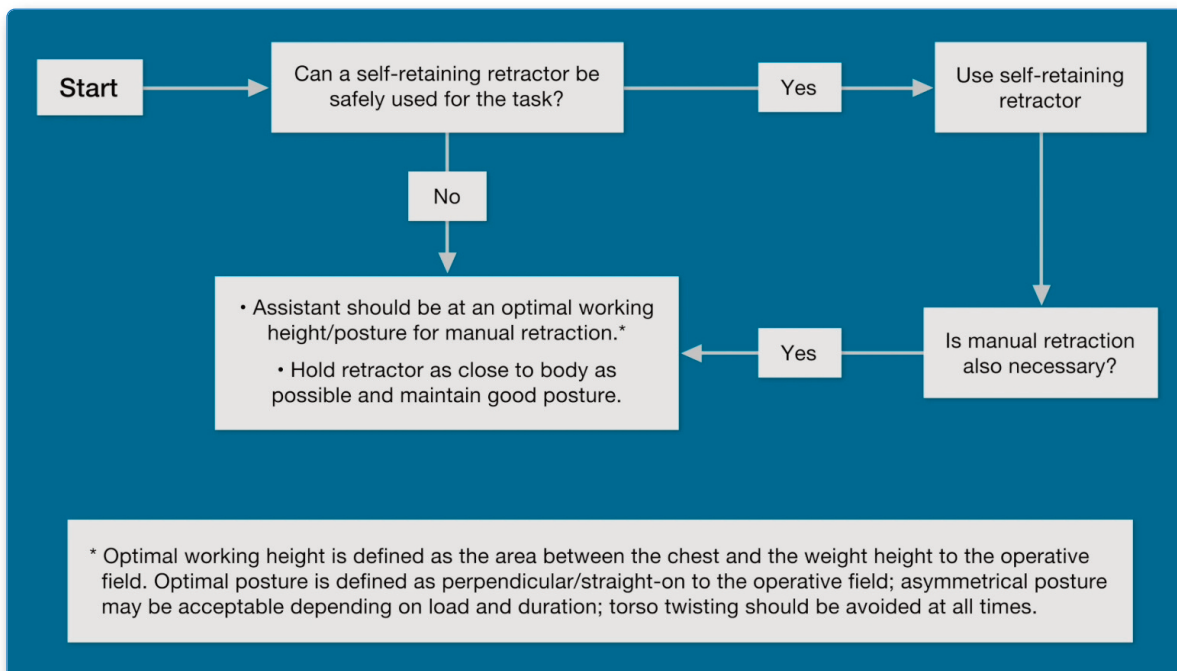


Figure 16. Ergonomic Tool 5: Tissue Retraction During Surgery.

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Factors to consider when determining the type of retraction required include the patient's physical characteristics and the surgical procedure. The selection of retractors should be at the surgeon's discretion. Self-retaining retractors should be used whenever it is safe to do so (Figure 17). Arm rests should be used whenever possible and should be large enough to allow the team member's arms to be repositioned. Team members should avoid using their hands to retract whenever possible. Using hands for retraction increases the risk for injuries from sharp instruments. Assistive devices should be used to hold body parts weighing more than 35 lb.¹¹

Scrubbed team members providing retraction should be at an optimal working height and assume an optimal posture (Figure 18). The surgical field should be located between the team member's chest and waist. Step stools might be needed to allow shorter team members to work at an optimal height. Team members should stand perpendicular to or facing straight into the operative field. The torso should not be twisted. The neck should not be flexed more than 30 degrees or rotated to either side for more than 1 minute at a time. Retractors should be held as close to the body as possible and should be pulled toward the body. Reaching or pulling away from the body can cause increased muscle strain and fatigue.¹¹

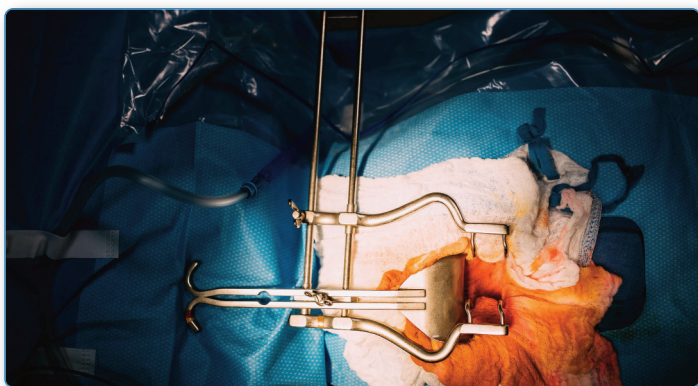


Figure 17. Self-Retaining Retractor.

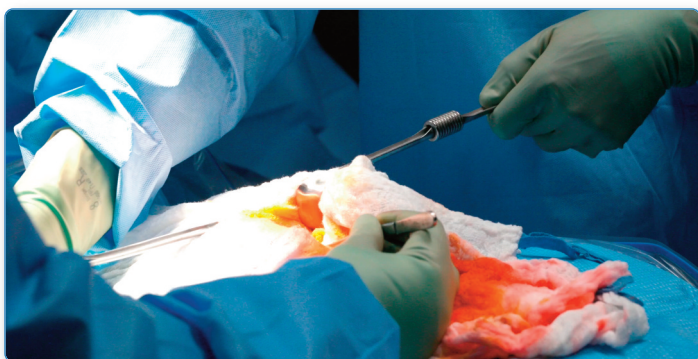


Figure 18. Hand-held Retractor.

Ergonomic Tool 6: Lifting and Carrying Supplies and Equipment in the Perioperative Setting

Perioperative team members are frequently required to lift and carry heavy objects and supplies during the course of their workday. This can lead to lower back and shoulder injuries. The weight of objects, the degree of reach required to pick them up or place them, how close to the body they are carried, and the duration and frequency of required lifting all influence the overall risk for injury.^{1,12}

Ergonomic Tool 6: Lifting and Carrying Supplies and Equipment in the Perioperative Setting was developed to assist team members in evaluating tasks related to lifting and carrying and to help them take steps to mitigate the related risks. The OR-related lifting tasks were evaluated using the Revised National Institute for Occupational Safety and Health (NIOSH) Lifting Equation (RNLE).^{1,12}

In the RNLE, a recommended weight limit (RWL) is calculated for a specific set of conditions. It is defined as a load weight that nearly all healthy workers could handle for up to 8 hours with recovery time and not increase their risk for injury. It is assumed that the person lifting is using two hands. Healthy workers are defined as workers free of adverse health conditions that would increase their risk for musculoskeletal injury.^{1,13}

The RWL is calculated as follows:

$$RWL = LC \times HM \times VM \times DM \times AM \times FM \times CM^{1,13}$$

- LC – Load Constant: the maximum recommended weight when lifting under ideal conditions; set at 51 lb (23 kg)
- HM – Horizontal Multiplier: how far from the body the hand grips are located
- VM – Vertical Multiplier: vertical height of the hands above the floor
- DM – Distance Multiplier: difference in height between the object before it is lifted and after it is placed
- AM – Asymmetric Multiplier: measure of body twist during the lift
- FM – Frequency Multiplier: frequency of required lifting
- CM – Coupling Multiplier: measure of the quality of the gripping method during the lift¹³

The Lifting Index (LI) provides a relative estimate of the level of physical stress associated with a particular lifting task. The LI is calculated as the actual weight of the load divided by the RWL.^{1,13}

Ergonomic Tool #6. Lifting and Carrying Supplies and Equipment in the Perioperative Setting		
Lifting Task	Lifting Index	Level of Risk
3,000 mL irrigation fluid	< 0.2	
Sand bags	0.3	
Linen bags	0.4	
Lead aprons	0.4	
Custom sterile packs (eg, heart or spine)	0.5	
Garbage bags (full)	0.7	
Positioning devices off shelf or rack (eg, stirrups)	0.7	
Positioning devices off shelf or rack (eg, gel pads)	0.9	
Hand table (49 x 28 inches); largest hand table, used infrequently	1.2	Light shading
Fluoroscopy board (49 x 21 inches)	1.2	Light shading
Stirrups (2—1 in each hand)	1.4	Light shading
Wilson frame	1.4	Light shading
Irrigation containers for lithotripsy (12,000 mL)	1.5	Light shading
Instrument pans	2.0	Heavy shading

No shading Minimal risk—Safe to lift
Light shading Potential risk—Use assistive technology as available
Heavy shading Considerable risk—1 person should not perform alone or weight should be reduced

Figure 19. Ergonomic Tool 6: Lifting and Carrying Supplies and Equipment in the Perioperative Setting.

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Ergonomic Tool 6 (Figure 19) provides the LI for common perioperative tasks. Lifting tasks with no shading represent minimal risk. Tasks with light shading represent potential risk, and use of assistive technology is recommended when available. Tasks with dark shading represent considerable risk. A single team member should not perform a task that presents considerable risk. He or she should seek help, or the weight should be reduced. The LI for a lifting task not found in the tool can be calculated using the RNLE.¹

Tables of coefficients for calculating the RNLE and a more detailed analysis of the math involved can be found in the Guideline for Safe Patient Handling and Movement¹ published by AORN and in the Applications Manual for the Revised NIOSH Lifting Equation published by NIOSH.¹³

Ergonomic Tool 7: Pushing, Pulling, and Moving Equipment on Wheels

Perioperative team members are often required to push or pull heavy equipment (eg, beds, supply carts, heavy wheeled equipment) around and between ORs. Pushing and pulling can create significant shear forces in the back that can lead to injuries.¹⁴

Ergonomic Tool 7: Pushing, Pulling, and Moving Equipment on Wheels (Figure 20) was developed to provide guidance to perioperative team members about the number of individuals recommended for performing specific tasks. The tool includes a list of common pushing and pulling tasks, the estimated force needed for each task, and the maximum recommended distance each device should be pushed.¹⁴

Unshaded items in the tool represent minimal risk. Items with light shading represent potential risk. For tasks with potential risk, assistive technology is recommended when available. Items with dark shading represent considerable risk. A single team member should not perform tasks that present considerable risk. He or she should seek help, or the weight should be reduced.¹

The estimates in the tool are based on having the hands positioned 3 ft or more from the ground and performing a pushing or pulling task not more often than once every 30 minutes. Positioning the hands lower than 3 feet or performing the task more often than once every 30 minutes decreases the maximum sustained pushing force generated.^{1,14}

Ergonomic Tool #7. Pushing, Pulling, and Moving Equipment on Wheels					
OR Equipment	Pushing		Maximum Push Distance		Ergonomic Recommendation
Electrosurgery unit	8.4 lbF	(3.8 kgF)	> 200 ft	(60 m)	
Ultrasound	12.4 lbF	(5.6 kgF)	> 200 ft	(60 m)	
X-ray equipment portable	12.9 lbF	(5.9 kgF)	> 200 ft	(60 m)	
Video towers	14.1 lbF	(6.4 kgF)	> 200 ft	(60 m)	
Linen cart	16.3 lbF	(7.4 kgF)	> 200 ft	(60 m)	
X-ray equipment, C-arm	19.6 lbF	(8.9 kgF)	> 200 ft	(60 m)	
Case carts, empty	24.2 lbF	(11.0 kgF)	> 200 ft	(60 m)	
OR stretcher, unoccupied	25.1 lbF	(11.4 kgF)	> 200 ft	(60 m)	
Case carts, full	26.6 lbF	(12.1 kgF)	> 200 ft	(60 m)	
Microscopes	27.5 lbF	(12.5 kgF)	> 200 ft	(60 m)	
Hospital bed, unoccupied	29.8 lbF	(13.5 kgF)	> 200 ft	(60 m)	
Specialty equipment carts	39.3 lbF	(17.9 kgF)	> 200 ft	(60 m)	
OR stretcher, occupied, 300 lb (136 kg)	43.8 lbF	(19.9 kgF)	> 200 ft	(60 m)	
Bed, occupied, 300 lb (136 kg)	50.0 lbF	(22.7 kgF)	< 200 ft	(30 m)	Minimum 2 caregivers required
Specialty OR beds, unoccupied	69.7 lbF	(31.7 kgF)	< 100 ft	(30 m)	
OR bed, unoccupied	61.3 lbF	(27.9 kgF)	< 25 ft	(7.5 m)	Recommend powered transport device
OR bed, occupied, 300 lb (136 kg)	112.4 lbF	(51.1 kgF)	< 25 ft	(7.5 m)	
Specialty OR beds, occupied, 300 lb (136 kg)	124.2 lbF	(56.5 kgF)	< 25 ft	(7.5 m)	
No shading	Minimal risk—Safe to lift				
Light shading	Potential risk—Use assistive technology as available				
Heavy shading	Considerable risk—1 person should not perform alone or weight should be reduced				
* lb F: A unit of force equal to the mass of 1 lb with an acceleration equal to 1 gravitational constant (32 ft/s ²). Acceleration due to gravity equals 9.8 meters per second squared (9.8 m/s ²) or 32 feet per second squared (32 ft/s ²).					

Figure 20. Ergonomic Tool 7: Pushing, Pulling, and Moving Equipment on Wheels

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For equipment and tasks not specifically listed in the tool, the perioperative RN should compare the effort required to push the object with the effort required to push an empty standard hospital bed. If pushing the object requires more effort than a standard bed, then additional team members or a powered device should be used. Commercially available instruments (eg, strain gauge, force meter, precision spring) can be used to measure the pushing or pulling forces required to move an object. A table of initial and sustained pushing forces for many common OR objects is provided in the Guideline for Safe Patient Handling and Movement.¹

Pushing is ergonomically preferable to pulling. Whenever possible, team members should push, rather than pull, equipment (Figure 21).^{1,14}

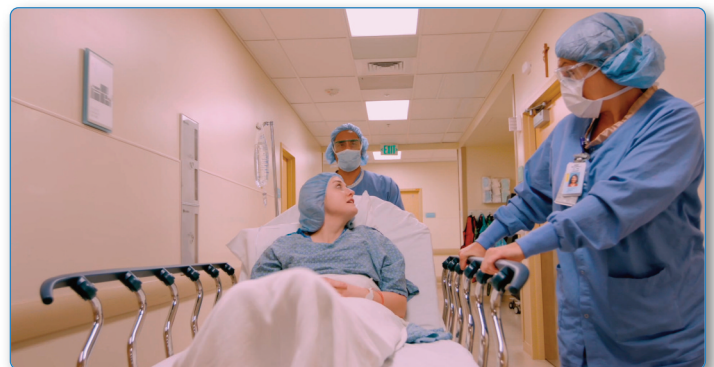


Figure 21. Two team members pushing a patient's bed.

FALL REDUCTION

Perioperative team members should participate in their health care organization's fall reduction program by including an evaluation of the patient's mobility and risk for falling in the

preoperative assessment. Identification of risks for falling is the first and most important step for fall prevention.¹

Risk factors for falls specific to the perioperative environment include

- anesthetic agents,
- lack of familiarity with the environment,
- preoperative medications,
- sensory deficits related to removal of hearing aids or glasses, and
- use of elevated stretchers and OR beds.¹

Patients may be at risk for falling during the following events:

- change of position of the OR bed;
- lifting, holding, or maneuvering of extremities;
- placement into or removal from positioning devices (eg, stirrups);
- positioning or repositioning on an OR bed or specialty bed (eg, fracture table);
- transfer to or from the OR bed; and
- transfer to or from a stretcher or wheelchair.¹

The preoperative fall risk assessment should include an assessment of the patient's

- age,
- ability to follow directions,
- ability to move independently,
- history of previous falls,
- level of consciousness,
- medications,
- physical limitations,
- presence of external devices (eg, catheters, drains), and
- sensory impairments.¹

The perioperative RN should use a standardized mobility assessment tool to provide an objective evaluation.¹

ACCOMMODATION OF INJURY

The health care organization and the perioperative team should provide an injured employee with reasonable accommodations for post-injury return to work.¹

Perioperative team members should report any physical limitations or restrictions after an injury to their employer and should provide supporting medical documentation and clearance to return to work according to the health care

organization's policies. Medical documentation helps to identify physical limitations, discomfort, or occupational restrictions.¹

The health care organization should implement and sustain a process to facilitate return of employees to work after injuries. The organization should establish a process for matching team members' physical capabilities to job demands.¹

SUMMARY

Work-related physical tasks in the perioperative setting put team members at risk for musculoskeletal disorders and injuries. These injuries can lead to lost productivity, lost workdays, and adverse patient outcomes. Establishing a culture of safety, implementing a standardized program for safe patient handling and movement, and following the guidance provided in the seven AORN Ergonomic Tools can reduce the risk for injuries among perioperative team members and improve outcomes and satisfaction for perioperative RNs and the patients for whom they care.

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POST-TEST

SAFE PATIENT HANDLING AND MOVEMENT IN THE PERIOPERATIVE SETTING

Multiple choice. Please choose the word or phrase that best completes the following statements.

1. According to the Bureau of Labor Statistics, which industry sector had the highest number of nonfatal occupational injuries in 2016?
 - a. Construction
 - b. Health care and social assistance
 - c. Manufacturing
 - d. Retail trade
 - e. Transportation and warehousing
2. A load-bearing capacity considered achievable by which of the following percentage of workers in the United States was used to calculate the weight limits recommended in AORN's seven Ergonomic Tools?
 - a. 50% of adult women
 - b. 50% of adult men
 - c. 75% of adult women
 - d. 75% of adult men
 - e. 90% of adult women and men combined
3. What is the maximum sustained pulling force per person recommended in AORN's Ergonomic Tools?
 - a. 11.1 lb
 - b. 22.2 lb
 - c. 35 lb
 - d. 47 lb
 - e. 59 lb
4. According to the recommendations in AORN Ergonomic Tool 1: Lateral Transfer of a Patient from a Stretcher to an OR Bed, how many team members in addition to the anesthesia professional are needed to laterally transfer a patient weighing 157 lb without assistive technology?
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
5. What is the maximum recommended weight limit per person for a two-handed lift in AORN's Ergonomic Tools?
 - a. 11.1 lb
 - b. 22.2 lb
 - c. 35 lb
 - d. 47 lb
 - e. 59 lb
6. According to Ergonomic Tool 2: Positioning and Repositioning the Supine Patient on the OR Bed, what is the minimum number of team members needed to move a 115-lb patient from the supine to the lateral position without assistive technology. One of the team members can be the anesthesia professional.
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
7. According to Ergonomic Tool 2: Positioning and Repositioning the Supine Patient on the OR Bed, what is the minimum number of team members needed to place the legs of a 150 lb patient into lithotomy position without assistive technology?
 - a. 1
 - b. 2
 - c. 3
 - d. 4
 - e. 5
8. When calculating the recommended limits in Ergonomic Tool 3: Lifting and Holding the Patient's Legs, Arms, and Head While Prepping, muscle endurance was estimated to decrease by how much after 2 minutes of holding?
 - a. 11%
 - b. 27%
 - c. 33%
 - d. 48%
 - e. 65%

9. Recommendations in Ergonomic Tool 5: Tissue Retraction During Surgery to minimize adverse effects related to retraction during surgery include which of the following?
 - a. Keeping the neck flexed more than 30 degrees
 - b. Maintaining the height of the OR bed below waist height
 - c. Pulling retractors toward the body
 - d. Using hands for retraction whenever possible
10. Ergonomic Tool 6: Lifting and Carrying Supplies and Equipment in the Perioperative Setting includes which of the following factors in its calculation of recommended weight limit?
 - a. Frequency of required lifting
 - b. Number of floors up or down which the object must be carried
 - c. Horizontal distance the object must be carried
 - d. Walking speed

POST-TEST ANSWERS

SAFE PATIENT HANDLING AND MOVEMENT IN THE PERIOPERATIVE SETTING

10. a
9. c
8. e
7. d
6. d
5. b
4. c
3. c
2. c
1. b