To learn more about Ergonomics and SPHM refer to the Sections 1 and 5 in the Safe Patient Handling and Mobility: A Toolkit for Program Development 2025 at: https://www.nvha.net/safe-patient-handling-and-mobility-toolkit/ where

Ergonomics Best Practices for Safe Patient Handling & Mobility (SPHM)

This tool provides examples of basic ergonomics techniques that caregivers can use to reduce awkward and static postures and forceful exertion when performing patient care tasks.

Although SPHM technology can significantly reduce the force exerted and other risk factors for WMSDs when performing patient handling and mobility tasks, risk factors such as awkward postures may still occur when using SPHM technology e.g., work height is not raised when placing and removing slings or friction reducing devices under a patient.

The best work practice tips provided are not all inclusive and they are *not* a substitute for using SPHM technology to reduce caregivers' risk of injury. Follow the manufacturer's instructions for correct use of SPHM technology to minimize caregiver exposure to biomechanical risk factors for WMSDs.

Use Ergonomic Principles to Help Save Your Back

It's still important to use good body mechanics when using SPHM equipment and slings and when performing any care task.

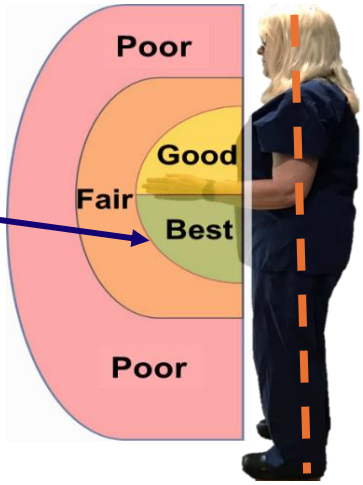
Common Causes of Poor Posture When Performing Patient Care Tasks:

- Bed height too low
- Reaching up & over bed rails
- Working past mid-line of the patient e.g., when turning patient. This close position to the patient can also be a trigger for combative behavior by some patients

Working in a non-neutral back posture increases forces on the spine and with repeated exposure increases the risk of back injury. PLUS—it takes longer to complete the task—the risk of task error is greater, and you get tired more quickly!

Safe Posture & Body Mechanics

- Neutral posture when standing is when your ears, shoulders, hips, knees, and ankles are aligned; as if a string were running from the top of the head, down through the torso to the legs, then to your feet.
- In neutral posture, the body is in its strongest, most balanced position.
- Work tasks should be performed in the primary work zone e.g., between knuckles to waist and close to the front of the body to reduce reaching away from the body, bending and twisting of the back.
- Stable base = Feet hip width apart with staggered stance.



Work in Upright Posture

For in-bed care tasks*. Raise the bed/surface (if adjustable) so work height is **between knuckle and waist height** for all caregivers who will perform a care task – this allows 90% of caregivers to work in upright posture.

Work height = Caregiver hand position when performing work tasks

Knuckle height = distance from knuckles to floor when arms are straight by side of body.

Work height should be a few inches:

- Lower than waist height when exerting force/lifting upwards during a task and
- Higher than waist height when performing tasks requiring precision e.g., performing wound care, starting an I.V. etc.

*Bed will be lower if patient is mobilizing to edge of bed for rehab tasks/standing transfer.

Work height is different from bed/surface height. With larger patients, bed height will be lower to allow caregivers to use upright postures.

Use Ergonomic Principles to Help Save Your Back

It's still important to use good body mechanics when using SPHM equipment and slings and when performing any care task.

Minimize Reach Distance

To maintain neutral spine posture and protect your back and shoulders don't use a ***log rolling*** technique and ***avoid*** reaching past midline of the patient or the bed/surface when performing care tasks as much as possible. *(**Note**-patients with spinal precautions still need to be turned manually using a specific technique to minimize spinal movement)*.

To turn a patient to place a friction reducing sheet, air assist mat, sling, bed linens or to perform other care tasks using neutral postures - use a *'Tip and Tuck'* technique *(unless clinically contraindicated)* e.g.,

- If turning patient to their right side - bend the patient's left leg and place their left arm over their chest (if clinically able/allowable). Have the patient assist as much as possible.
- Gently push the patient towards coworker if patient cannot assist. *Gently* roll the patient with your hands on their shoulder and knee or hip. Have the patient assist as much as possible.
- Use a "tip and tuck" technique - tip the patient slightly on their side (vs. full turn if not needed) and tuck friction reducing sheet, or linens etc., under the patient. Pushing down on a mattress can help placement.
- For larger patients, you may have to 'tip' or turn them for access - have more staff assist as needed.

Minimize Static Loading

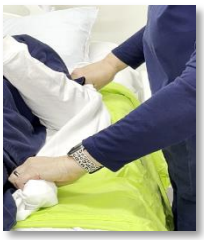
When working in a prolonged sitting or standing position e.g., holding a limb or patient on their side, set work height to stay upright and minimize reaching when holding a static posture. Take microbreaks (small movements) every minute if or so, to regain neutral posture and give muscles a quick rest; keep moving when possible.

Reduce Grip Forces

- Grip force and overall hand/arm physical exertion is increased when using a pinch grip (fingers and thumb) to grasp draw or slider sheets. Grip force is increased further exerted more if an object is gripped using a bent wrist (non-neutral) posture.
- Instead use a power (or whole-hand) grip to distribute the load to all muscles of the hand and keep wrists straight. A palm-up grip is stronger than a palm-down position and helps keep elbows close to the body while maintaining a more neutral shoulder posture.
- Work height should be set to avoid using the upper body/shoulders to perform a sliding (*not lifting*) move. Place bed in Trendelenburg (if tolerated by patient) to reduce exertion.
- Wearing poorly fitted gloves can also increase force exerted.
- If gripping is prolonged, take microbreaks.

Pinch Grip-Weaker

Power Grip (*Whole Hand*)-Stronger



Palm Down-Weaker

Palm Up-Stronger

Best Work Practices When Moving Beds/Stretchers & Other Wheeled Equipment

1a. For beds and stretchers with a '*Drive*' mechanism - Check battery indicator mechanism to ensure there is enough power to use the Drive system. If insufficient power plug in to charge.

1b. For beds/stretchers/wheeled equipment with no 'Drive' mechanism - Try to start a pushing task with the wheels in alignment to reduce forces required to initiate the push (and make sure brakes are not engaged).

For all beds/stretchers and wheeled equipment including patient lifts

2. Raise bed and stretcher so that hand height when pushing is about elbow height or just below to reduce awkward body postures and force exerted when pushing. Use handles if present.

3. Use two hands when maneuvering a bed/stretcher/lift etc. Do not maneuver a bed/stretcher/lift using one hand/arm.
4. Keep elbows close to your body and feet shoulder width apart.
5. Push vs. pull whenever possible.
6. Face the bed/stretcher. Point toes in the direction you are moving to avoid twisting your back.

7. Tighten abdominal muscles slightly before beginning to push. You should be able to breathe and talk but maintain some tightness in abdomen to help stabilize lower back. (***For beds/stretchers/ wheeled equipment with no 'Drive' mechanism*** **only)**
8. Put one foot in front of the other. Bend knees slightly and shift your body weight from the back leg to the front leg to start moving the bed/stretcher.

9. Keep your body close to the bed/stretcher and stand upright while pushing.
10. Move load with your whole body by walking forward, rather than planting feet and pushing with your arms only.
11. Avoid leaning against the bed/stretcher or pushing it with your knees of thighs.

12. Avoid jerky movements or trying to forcefully 'lift' a bed/stretcher/lift when pushing over thresholds or around corners. Allow enough turning radius, slow down and take small steps when entering and turning corners to avoid twisting and increasing the load on your back. To reduce twisting the back, try to *avoid* placing a leg and foot across midline of the torso (adducting the hip) when stepping forward.
13. Shift your body weight from front to back leg to stop moving a bed/stretcher. (***For beds/stretchers/wheeled equipment with no 'Drive' mechanism*** **only)**

Best Work Practices When Moving Beds/Stretchers & Other Wheeled Equipment

Other Tips

- Use any pause in motion e.g., waiting for an elevator to stretch hands and relax shoulders - this helps to decrease muscle fatigue from static postures of the arms/hands etc., used when pushing a bed/stretcher.
- Use the the steering mechanism (if present) to help decrease "sideways drift" when appropriately to reduce push force when moving a stretcher or bed.
- If there is a 2nd staff person traveling with you and the patient have them guide the bed/stretcher around corners and in/out of elevators etc., by grasping the foot end of the bed using 2 hands.
- Maintain clear visibility when pushing any wheeled equipment to avoid using awkward postures e.g., twisting.
- Plan your route before moving the load.
- When maneuvering in small spaces e.g., treatment rooms – move clutter, trips hazards/cords etc that can impede movement; ensure the entry and exit path is clear before moving a bed/stretcher into and out of the space.
- Ensure batteries on powered equipment and casters on all wheeled equipment are maintained.

Photos courtesy of Alpha Modalities LLC & HumanFit LLC.

References & Resources

Accident Compensation Corporation. (2012). ACC6075 moving and handling people guidelines. Accident Compensation Corporation New Zealand. https://www.acc.co.nz/assets/provider/acc6075-moving-and-handling-people-guidelines.pdf

Belbeck, A., Cudlip, A. C., & Dickerson, C. R. (2014). Assessing the interplay between the shoulders and low back during manual patient handling techniques in a nursing setting. International Journal of Occupational Safety and Ergonomics, 20(1), 127-137.

Caboor DE, et al. Implications of an adjustable bed height during standard nursing tasks on spinal motion, perceived exertion and muscular activity. Ergonomics. 2000;43(10):1771-1780.

Callihan, M., Somers, B., Dinesh, D., Aldred, L., Clamp, K., Treglown, A., ... & Szukala, E. (2023). Proof of concept testing of safe patient handling intervention using wearable sensor technology. Sensors, 23(12), 5769.

Chaffin, D. B., Andersson, G. B., & Martin, B. J. (2006). Occupational biomechanics. John wiley & sons.

Gonzalez CM, Howe CM, Waters TR, Nelson A. Recommendations for turning patients with orthopaedic impairments. Orthopaedic Nursing. 2009; 28(2S): S9-S12.

Gordon, Claire C. et. al (2014). 2012 Anthropometric Survey of U.S. Army Personnel: Methods and Summary Statistics.

Hoozemans, M. J., Kingma, I., de Vries, W. H., & van Dieën, J. H. (2008). Effect of lifting height and load mass on low back loading. Ergonomics, 51(7), 1053-1063

Hwang, J., Ari, H., Matoo, M., Chen, J., & Kim, J. H. (2019, November). Effects of patient turning devices on muscular demands of caregivers. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 63, No. 1, pp. 1069-1072). Sage CA: Los Angeles, CA: SAGE Publications.

Ji, X., Littman, A., Hettiarachchige, R. O., & Piovesan, D. (2023). The effect of key anthropometric and biomechanics variables affecting the lower back forces of healthcare workers. Sensors, 23(2), 658.

Knibbe JJ, Knibbe NE. Static load in the nursing profession; the silent killer?. Work. 2012; 41 Suppl 1:5637-5638

Kodak's Ergonomic Design for People at Work. 2nd edition (2004). John Wiley & Sons, Inc.

Kotowski, S. E., Davis, K. G., & Marras, W. S. (2022). Patient handling through moving of the beds and stretchers. International Journal of Industrial Ergonomics, 87, 103252.

Larson RE, Murtagh EM, Rice MS. Forces involved when sliding a patient up in bed. Work. 2018; 59(3): 439-448.

Larson, R. E., Ridge, S. T., Bruening, D., Johnson, A. W., & Mitchell, U. H. (2022). Healthcare worker choice and low back force between self-chosen and highest bed height when boosting a patient up in bed. Ergonomics, 65(10), 1373-1379

Lee, Y. J., & Aruin, A. S. (2015). Effects of asymmetrical stance and movement on body rotation in pushing. Journal of biomechanics, 48(2), 283-289.

Marras WS. The Working Back: A Systems View. John Wiley & Sons. 2008.

Owlia, M., Kamachi, M., & Dutta, T. (2020). Reducing lumbar spine flexion using real-time biofeedback during patient handling tasks. Work, 66(1), 41-51

Pedersen, M. T., Essendrop, M., Skotte, J. H., Jørgensen, K., Schibye, B., & Fallentin, N. (2007). Back muscle response to sudden trunk loading can be modified by training among healthcare workers. Spine, 32(13), 1454-1460

Rice, M. S., Woolley, S. M., & Waters, T. R. (2009). Comparison of required operating forces between floor-based and overhead-mounted patient lifting devices. Ergonomics, 52(1), 112-120.

Shahvarpour A, Shirazi-Adl A, Mecheri H, Larivière C. Trunk response to sudden forward perturbation - Effects of preload and sudden load magnitudes, posture and abdominal muscle preactivation. Journal of Electromyography and Kinesiology. 2014; 24: 394-403.

Smith, J., Simpson, P., & Fray, M.(Eds) (2023). HOP7: The guide to handling of people. Person-centered practice National Back Pain Association.

Waters TR. When is it safe to manually lift a patient? American Journal of Nursing. 2007; 107(8): 53-58.

Wiggermann, N., Zhou, J., & McGann, N. (2021). Effect of repositioning aids and patient weight on biomechanical stresses when repositioning patients in bed. Human factors, 63(4), 565-577.

US Department of Defense Design Criteria Standard Human Engineering. MIL-STD 1472H (2020). https://quicksearch.dla.mil/qsdocdetails.aspx?ident_number=36903