

Pressure mapping: A new path to pressure- ulcer prevention

This nifty visual tool lets you see pressure before ulcers develop.

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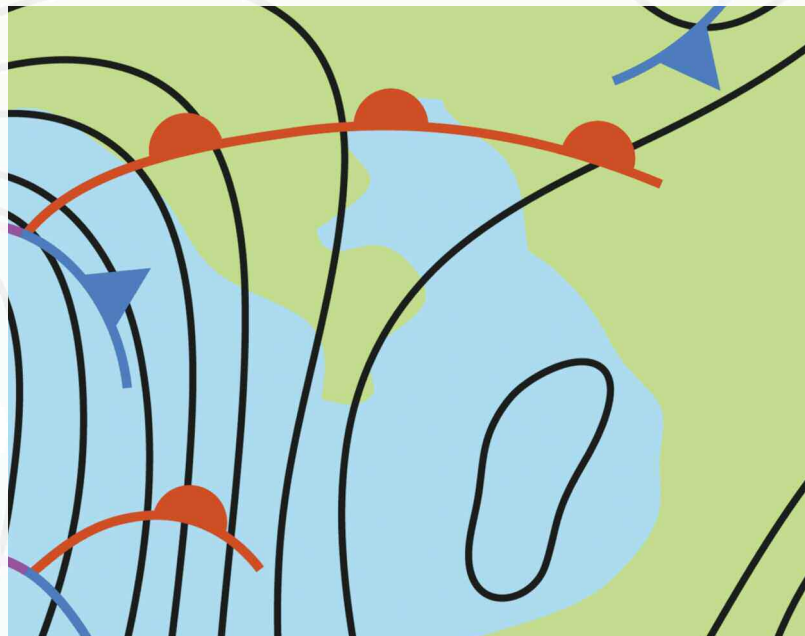
Faced with the nursing diagnosis of *Impaired skin integrity*, we've all written care plans that state our goal as "redistributing or reducing pressure." But how do we do that? Which measures do we take? And how do we know that our interventions have relieved pressure? Do we rely solely on a skin assessment? A patient's self-assessment of comfort? What if the patient can't feel pressure relief because of neurologic impairment?

The answers to these questions may be that nurses should use pressure mapping, a tool used by occupational and physical therapists to determine seat-interface pressures and by other healthcare professionals to perform foot assessments.

What is pressure mapping?

A pressure map is a computerized clinical tool for assessing pressure distribution. To use it, you place a thin, sensor mat on a wheelchair seat or a mattress surface. When your patient sits or lies on the mat, a computer screen displays a map of pressures, using colors, numbers, and a graphic image of the patient. (See *A look at pressure maps*.) Typically, the hotter colors (the reds) indicate areas of higher pressures, and the cooler colors (the blues) indicate areas of lower pressures. The display usually has several options, including a three-dimensional display of peak pressure areas and a statistical analysis.

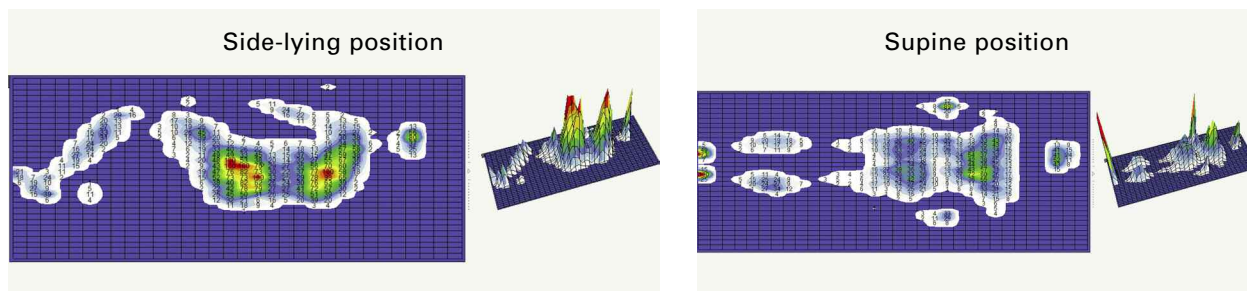
Pressure mapping does have some



drawbacks, including inconsistencies in the ways manufacturers report and display the pressures, differences in measurable peak pressures among manufacturers, and sensor accuracy and drift. Still, these visual displays provide key data that can augment nursing assessment of the areas of potential tissue damage. Plus, patients can benefit from the visual feedback. When they see the pressures on the screen, they can identify areas of concern and modify their position accordingly. There is also an economic benefit because Medicare and many insurance companies do not reimburse for the extra costs of treating preventable conditions, including pressure ulcers.

A look at pressure maps

The two large maps show areas of differing pressures with a patient in the side-lying and supine positions. Red represents higher pressures; blue represents lower pressures. The screens also show three-dimensional displays of peak pressure areas.



Courtesy of Vista Medical Ltd, Winnipeg, MB, Canada.

Pressure-mapping successes

Research has shown that pressure mapping is a reliable means of assessment, but more research is needed to determine its ability to predict pressure-ulcer development. Here are short summaries of recent research.

- In 2005, occupational therapists used pressure mapping to assess the wheelchair cushions of 40 patients and found that 19 of them should have been using a different seating surface.

Researchers recommended that wheelchair-bound individuals shift their posture at least every 8 minutes.

- A 2006 study used pressure mapping to assess seated postural control in children and found the tool useful in evaluating seating stability.
- Using pressure-mapping technology, researchers found that elevating a wheelchair-bound patient's feet and reclining his wheelchair by 30 degrees reduced

interface pressure and the risk of pressure-ulcer development.

- While researchers have used pressure mapping to test wheelchair surfaces, wheelchair positioning, and client angles in wheelchairs in the past several years, few studies have looked at pressure mapping in bedbound individuals. In one study where researchers used pressure mapping on a bed surface, the authors recommended that pressure mapping be used in combination with other measures such as transcutaneous oxygen measurements. Both measures can provide useful biofeedback to help determine the efficacy of pressure-relief strategies.
- In 2012, Kim, Wang, Ho, & Bogie, who used pressure mapping in combination with transcutaneous oxygen readings, surmised that healthy individuals adapt to pressure load because they have adaptive blood flow that compensates for the increased pressure, unlike some individuals, who are at higher risk for developing pressure ulcers because they lack adaptive blood flow. To date, it has not been determined who adapts to pressure and who doesn't, so it's still a good idea to reduce pressure load for patients.
- Researchers in a 2009 study used pressure mapping to determine how often individuals shift their posture, and found

Guidelines for pressure-mapping sessions

A pressure-mapping clinician will conduct the sessions, following guidelines similar to those below. Make sure the equipment is calibrated and functioning properly. To verify reliable assessments, document service and calibration.

1. Wash your hands before and between sessions and use protective wraps for the pressure-mapping surface (a thin bag is recommended).

Gloves are recommended.

2. Map the patient in his normal position with the normal surface. For seating surfaces, the patient should be squared with the seat and the wheelchair seat shouldn't be hammocked. A normal, replicable position is best.

3. Keep the patient as close to the map as possible. Clothing should be consistent from one session to the next.

Even slight wrinkles in clothing or bed linens can alter the image.

4. Use the same orientation for the pressure-mapping surface each time.

5. Document each session, noting the patient's positions and clothing to make the next session easier. Use the results of the baseline session for later comparison.



that nondisabled subjects change their posture about 7.8 times an hour to relieve subcutaneous tissue pressures. These researchers recommended that wheelchair-bound individuals shift their posture at least every 8 minutes to maintain tissue viability.

- A 2010 study that used pressure mapping to determine differences between spine boards found that when comparing rigid and soft spine boards and vacuum mattresses, lower tissue interface pressures were associated with less discomfort.
- Researchers have used pressure-mapping technology to find that a minimum tilt angle of 30 degrees is required to alleviate pressure at the ischial tuberosities and sacrum for wheelchair-seated individuals with motor complete spinal cord injury.
- A 2006 study by Turpin and other researchers recommended that, based on pressure-mapping analysis, turning was not needed for patients on a continuous lateral turning bed. Since that time, controversy has arisen, suggesting that caution is required when recommending that turning isn't needed for patients on specialty beds. In 2007, Pompeo advocated that patients on turning beds should continue to be turned, arguing that "no pressure" is always better than

"low pressure," and that caregivers should always visually check patients with every turn, looking for incontinence and evidence of skin breakdown.

Assessment and repositioning

Current guidelines on assessment and repositioning come from several sources. A report called "Best Practice Recommendations for the Prevention and Treatment of Pressure Ulcers: Update 2006" says that



More measures to check for pressure

If your agency or facility does not have access to pressure-mapping tools, check with your support surface supplier. Many support surface companies have pressure-mapping tools they can bring to you to test their equipment, while others may have pressure-mapping research and studies regarding their equipment.

You can also use this quick check for adequate pressure reduction:

1. Place your hand palm up, with fingers outstretched, between the support surface and underlying surface or frame.

2. The support surface should have about 1 inch of uncompressed support surface between the clinician's hand and the patient's body. If less than 1 inch of support surface is felt, then the patient has bottomed out and the support surface is inadequate.

3. Perform the test under bony prominences at various degrees of head-of-bed elevations and positions.

Consider using the inexpensive Harris Mat (Foot Imprinter) to determine diabetic foot pres-

ures: Ask the patient to step on the mat, which makes an ink impression of the foot onto a piece of paper. The tracing shows areas of high pressure and unequal weight distribution on the bottom of the foot; the tracing can be kept as documentation and for future comparisons. An added advantage is that seeing the pressure areas often motivates patients to wear their orthotics.

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pressure should be assessed on all surfaces a patient comes in contact with and notes that computerized pressure mapping is one way to assess those surfaces.

Other guidelines on pressure reduction come from the National Collaborating Centre for Nursing and Supportive Care in the United Kingdom. These guidelines recommend assessing a patient's support sur-

terminated by the individual's tissue tolerance, level of activity and mobility, and general medical condition, as well as the overall treatment objectives, support surface in use, and assessments of the individual's skin condition.

Using pressure mapping

For now, universal, evidence-based guidelines for pressure mapping don't exist. More research on and experience with pressure mapping is needed. But you should be aware of typical manufacturer's recommendations, which the pressure-mapping clinician will follow. (See *Guidelines for pressure-mapping sessions*.)

Be prepared for a session that may take 30 minutes or more. A 2005 study found that interface pressures in wheelchair users continued to fluctuate for up to 8 minutes after the patients were seated. So obtaining good pressure readings may take some time.

Before the procedure, tell the patient how long the pressure-mapping session will take. Explain that he will be able to view the results on a computer screen. During the procedure, you may be asked to help the pressure-mapping clinician

Be prepared for a session that may take 30 minutes. Be sure to explain the test and the results to your patient.

faces and positioning needs on a regular basis. One key point in several guidelines is that patients need repositioning, regardless of the bed or seating surface. No bed or seating surface replaces repositioning.

Repositioning frequency should be de-

with the necessary positioning. Be sure to explain the test and the results to your patient. After the session, follow up by answering any patient questions and carefully documenting the session.

Information from a pressure-mapping session may lead to immediate changes in the patient's activity level as well as his bed or wheelchair surface. For example, if the results of the session indicate that a new cushion must be ordered, the patient may be confined to bed while waiting for it.

Benefits of mapping

Pressure mapping can provide you with valuable, visual information that augments your assessment of the patient's skin and the potential for skin breakdown, sparing your patient from the complications of pressure ulcers.

If you don't have access to pressure mapping equipment where you work, see *More measures to check for pressure.*

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