
PREVENTING PRESSURE INJURIES IN SEATED INDIVIDUALS



NPIAPSM
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Introduction

Any individual who can sit out of bed for any duration will use some form of seating surface. When evaluating an individual's risk of pressure injuries (PIs) and strategies to reduce the risk, it is important to consider their positioning over the full duration of the day. Many individuals will spend substantial time sitting in a chair/wheelchair; therefore, consideration must be given to the performance features (e.g. pressure redistribution and shear reduction) of seating surfaces. It is also important to recognize that individuals regularly sit on other surfaces, sometimes for extended durations and consideration should be given to these surfaces. This includes (but is not limited to) toilets and shower chairs, travel seats, and chairs used in school/work settings.

As with full body support surfaces (e.g., mattresses and integrated bed systems) standards are available for the testing and evaluation of chair/wheelchairs and seating cushions. As medical devices, standards for wheelchair quality and safety include performance characteristics, safety features, maneuverability, postural support, stability and many more. These considerations are significant in selecting a mobility device for an individual and extend beyond addressing PI risk. Various standards¹ accepted by the International Standards Organization (ISO) have been developed or informed by standards development organizations in different jurisdictions; for example, the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), European Parliament, the Australian Rehabilitation and Assistive Technology Association (ARATA), and the World Health Organization (WHO). Some of these standards and guidelines are summarized in Table 1.

Pressure redistribution and shear reduction are often addressed using a seating cushion placed on a chair/wheelchair or in advanced seating systems, in which seat cushioning is a component of the integrated system. The Support Surface Standard Initiative (S3I) of the National Pressure Injury Advisory Panel (NPIAP),² has developed terminology, test methods and reporting standards that are discussed in the guideline section on *Full Body Support Surfaces for Prevention of Pressure Injuries*.

This section of the guideline specifically addresses interventions for reducing PI risk from pressure and shear that arises in the seated position, while acknowledging that chairs/wheelchairs must also address posture, stability, mobility and other requirements, and that these factors are also integral to PI risk.

Table 1: Selected resources on standards tests and guidelines for seating support surfaces

- [ARATA list of Australian Standards for Assistive Technology Products](#)
- [European Parliament and Council regulations on medical devices \(including support surfaces\)](#)
- [ISO Wheelchair Standards](#)
- [RESNA Wheelchair and Related Seating Standards](#)
- [WHO Manual Wheelchair Guidelines for less resourced settings](#)
- [WHO Wheelchair Provision Guidelines](#)

Selecting a Seat or Wheelchair

Clinical question: What are the general considerations when selecting or changing a chair/wheelchair for an individual at risk of pressure injuries?

S1: It is good practice to consider the following factors when selecting a chair or wheelchair that meets the individual's needs for pressure redistribution and shear reduction:

- the individual's overall risk of pressure injuries,
- independence, mobility and activity needs,
- body size, shape and weight distribution,
- posture, deformity and asymmetry and its effect on pressure distribution,
- need for enhanced features (e.g. dynamic weight shifting), and
- the individual's preferences and care goals.

(Good practice statement)

Supporting information

When an individual is seated, their body weight is supported by a relatively small surface area (i.e., buttocks, thighs, and feet), leading to relatively high interface pressures^{3,4} combined with limited opportunities to redistribute body weight to other anatomical sites. This increases the risk of PIs, particularly at the ischial tuberosities, with prolonged sitting. Additionally, with posterior pelvic tilt in a sitting position there is an increase in shear forces,⁴ which increases PI risk at the sacrum and coccyx.⁵ As one measure to address these risks, an appropriate chair/ wheelchair must be selected. Individualized assessment and selection of the chair/wheelchair is required to ensure that the individual's various different needs, including but not limited to PI prevention, are addressed.⁶

Seating should be appropriate to the individual's dimensions, range of movement, functional needs and need for postural support. The chair/wheelchair should be compatible with the individual's needs for repositioning (e.g. arm support for pressure redistribution maneuvers and/or dynamic weight shifting features). Consideration must also be given to personal preferences and goals of care (e.g., comfort, increased independence, etc.).

Implementation considerations

- Consider an individual's posture over a 24-hour period, including where they sleep, sit, stand and walk.⁷ Involve a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.), particularly for individuals who spend significant periods of time in seated positions (e.g., independent wheelchair users).
- Select a chair/wheelchair based on an assessment of the individual's functional ability and needs (including environmental and lifestyle needs, comfort, and personal preferences).^{6,9} This includes assessing the individual's ability to weight shift in various seated positions.
- Balance the need for preventing PIs with promotion of mobilization and activity. Some support surfaces or seating positions (e.g., tilt and recline) can reduce mobility and egress from the chair.
- Re-assessment of the individual's needs over time is recommended due to changes in their weight, dimensions, functional ability and other factors that will influence the choice of wheelchair/chair.⁶
- Select appropriately configured equipment that is fitted to the individual's body measurements, functional considerations, and environmental context.^{6,8,9} This includes, but is not limited to:
 - A chair/wheelchair that is sufficiently wide for the individual's girth while still providing postural support and efficient propulsion. Check clearance at the sides/arms to avoid the risk of PIs.
 - Consider the height of the chair/wheelchair arms. They should provide support, be an appropriate height to enable standing and/or pressure redistribution maneuvers and should not impede egress from the chair.
 - Backrests should be reviewed and prescribed in conjunction with the seating cushion to ensure optimal postural support, comfort, function, pressure redistribution and shear management.
- Consider the resources available and potential funding sources. Work with the collaborative care team to access avenues for socioeconomic support.

Additional considerations for individuals in community settings

- Consider the level of assistance the individual requires for repositioning, and the features available on chairs to assist in repositioning (e.g., dynamic weight shifting) and egress from the chair (e.g., riser recliner chairs). Involve a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.) who can assess the home environment.

Selecting a Seating Support Surface

Clinical question: Should a pressure redistribution seating support surface/cushion versus a non-pressure redistribution seating surface be used to prevent PI occurrence in individuals?

S2: We recommend using a seating support surface with pressure redistribution properties for individuals at risk of pressure injuries when in a seated position.

(Strong recommendation, moderate certainty of evidence)

Evidence summary

A meta-analysis of five RCTs¹⁰⁻¹⁴ showed that using a seating surface with pressure redistribution characteristics was associated with a non-significant lower rate of PI occurrence (relative risk 0.86, 95% confidence interval (CI) 0.74 to 1.01, $p = 0.06$) compared with non-pressure redistribution seating surfaces. This was a difference of 64 fewer PIs per 1,000 individuals treated [from 118 fewer to 5 more]. There is moderate confidence that this effect estimate represents a true effect and that a seating surface with pressure redistribution properties would lead to a reduction in PI occurrence. The evidence was downgraded for risk of bias and indirectness. The studies reported on a range of different pressure redistribution cushions, including contoured foam, a gel cushion, and a skin protection cushion, used in either a wheelchair¹⁰⁻¹⁴ or seat¹⁴ by older adults in aged care. In all the studies, the comparator was a foam cushion with no pressure redistribution properties. The adverse events appear to be minimal if the

cushion is selected, fitted and used according to the manufacturer's guidance. Based on the available evidence and the opinion of the Consumer and Expert Panel Groups and the Guideline Governance Group, using a pressure redistribution cushion is probably acceptable and feasible. However, there are variable costs associated with accessing and fitting a pressure redistribution cushion, and there is no evidence on the cost effectiveness. The Guideline Governance Group made a strong recommendation because the risk of harm in not using a seating support surface with pressure redistribution features for individuals at risk of PIs is very high.

Implementation considerations

- Select a pressure redistribution support surface (i.e., a seating cushion) based on the individual's dimensions, functional needs, posture and stability, and comfort. Involve a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.), particularly for individuals who spend significant periods of time in seated positions (e.g., independent wheelchair users).
- Advise individuals who spend prolonged periods in a chair/wheelchair to use a pressure redistribution cushion with other seating, for example when traveling (e.g., in motor vehicle, airplane, train, etc.).¹⁵
- Consider individual allergies or sensitivities to seating materials.
- Consider the resources available and potential funding sources. Work with the collaborative care team to access avenues for socioeconomic support.

Cushion properties and features

- Select a pressure redistribution cushion within appropriate weight limitations.
- Consider the shear force reduction properties of the cushion and cover, keeping in mind these may be influenced by the individual's clothing, positioning in the chair/wheelchair and support.¹⁶
- Consider the heat dissipation properties of the cushion and cover. Select a cushion and cover that permit air exchange to minimize temperature and moisture at the buttock interface. Where possible, select a stretchable/breathable cover that fits loosely on the top surface of the cushion and is capable of conforming to the body contours.

Condition and function of the cushion

- Inspect the pressure redistribution cushion before use to ensure proper functioning, including being inflated to a pressure that is appropriate to the weight and shape of the individual based on the manufacturer's instructions.¹⁷ Check the cushion for bottoming out when the individual is seated, including when they are performing functional tasks. Regularly reinspect the cushion throughout the day as it may require reinflation.
- Regularly inspect cushions to ensure that they retain pressure redistribution characteristics. Teach independent wheelchair users to inspect and maintain pressure redistribution cushions and covers according to the manufacturer's information. Check and follow the manufacturer's recommended timeframe for use before replacement, maintenance and cleaning requirements.
- Evaluate the stability of individuals who are seated on pressure redistribution cushions. Weigh the benefits of off-loading against the potential for instability and shear based on the construction and operation of the cushion.
- Do not use ring or donut-shaped seating cushions. The edges of these devices create areas of high pressure that may damage tissue, impair circulation and create edema.^{18,19}

Additional considerations for individuals at high risk of pressure injuries

- Assess the relative benefits of using an alternating pressure air (active) cushion for individuals who are seated in a chair/wheelchair for prolonged periods, particularly if they are unable to perform pressure redistribution maneuvers.²⁰

Repositioning the Individual in a Seated Position

Pressure and shear forces are important considerations in seated individuals, particularly those who spend extended time sitting out of bed and have a high risk of PIs due to reduced mobility, asymmetrical/unsupported postures, and/or reduced sensory perception, such as individuals with SCI, other neurological conditions, cognitive deficits, and older adults. Consideration should be given to the:

- Time spent in a seated position
- Support surface and features of the chair/wheelchair
- Way in which the individual is positioned and supported
- Strategies to reposition when in a seated position.

Clinical question: Should time sitting out of bed be limited versus unlimited duration sitting out of bed for individuals at risk of PIs who are seated?

S3: We suggest that duration of sitting out of bed should be limited at much as possible for individuals at risk of pressure injuries who cannot reposition themselves while seated.

(Conditional recommendation, very low certainty of evidence)

Evidence summary

One RCT²¹ showed that limiting sitting out of bed to sessions of two hour duration was associated with a significantly lower rate of PI occurrence (6.7% versus 63%, RR 0.11, 95% CI 0.03 to 0.42, p=0.001) compared with no limitation on the duration of sitting out of bed. This was a difference of 560 fewer PIs per 1,000 individuals treated [from 611 fewer to 365 fewer]. There is very little confidence that this effect estimate represents a true effect. The evidence was downgraded due to a high risk of bias and imprecision. The study²¹ was conducted in older adults following orthopedic surgery who were at risk of PIs, and some participants experienced undesirable effects (e.g. chest infection); however, this was generally when the participants spent no time sitting out of bed. No formal indication of resource requirements or cost effectiveness analyses were reported. The Consumer Panel Group noted that for individuals at long term PI risk, limiting time sitting out of bed interfered with ability to engage in work and social life, and a balance was required between psychosocial needs and preventing PIs. **The Guideline Governance Group noted that the most appropriate duration for sitting out of bed is based on an individual assessment. Ability to self-reposition is an important consideration when determining how long an individual at risk of pressure injuries should spend seated out of bed.**

Implementation considerations

- Refer individuals who spend prolonged periods in a chair/wheelchair to a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.).
- Integrate the use of different positions between the bed and the chair/wheelchair. For example, consider the position the individual will be in if they remain in the bed. Sitting in a supported position out of bed may offer reduced PI risk versus sitting with the head of bed at above 30-degrees. Some powered bed systems may offer smooth transitions between lying and sitting with appropriate positioning to reduce pressure and shear. See the guideline section *Repositioning for Preventing Pressure Injuries* for further recommendations.
- Limiting time sitting out of bed for individuals in the post-operative period, newly admitted to rehabilitation, first time sitting out of bed after prolonged illness and older adults who cannot reposition to a maximum of two hours/session is shown to reduce the risk of developing a PI.²¹
- Encourage individuals who spend time in seated position out of bed to implement weight shifts and pressure relief maneuvers and when available, to use dynamic positioning features of the chair/wheelchair.

- Coordinate the timing of sitting in an upright position with other care needs (e.g., sitting upright during and after bolus enteral feeding).

Seating on other surfaces beyond a chair/wheelchair

- Avoid leaving an individual seated on a bed pan, commode or toilet for longer than necessary. Consider a continence review and management plan to limit the time required sitting on a toileting device.
- Consider the need for a pressure redistribution commode/shower chair.

Assessment

- Regularly evaluate the individual's functional ability, psychosocial needs, quality of life, values and preferences and ability to do what is important to them when developing a seating regimen, particularly for individuals who live with long term pressure injury risk (e.g., individuals with spinal cord injury or other neurological conditions, older adults, etc.).²²
- Perform regular skin and risk assessments when an individual is seated out of bed to determine the most appropriate duration of seating sessions.

Clinical question: Should more frequent repositioning versus less frequent repositioning be used to prevent PI occurrence in individuals at risk who are seated?

Clinical question: Should weight shifting interventions versus usual care/a comparator intervention be used to prevent pressure injury occurrence in individuals at risk who are seated?

S4: It is good practice to frequently reposition individuals at risk of pressure injuries who are seated out of bed. Teach and encourage independent chair/wheelchair users to reposition as often as possible by performing pressure redistribution maneuvers and weight shifts that redistribute pressure as much as possible.

(Good practice statement)

Supporting information

The optimal method and frequency of repositioning when seated has not been ascertained through comparative studies. Observational evidence shows that posture declines as time spent in a chair/wheelchair increases in duration.²³ Measures of skin and tissue perfusion indicate that the ischemic response can commence after as little as ten minutes in a seated position with a pressure redistribution cushion.²⁴ Studies have demonstrated that redistributing body weight by performing intermediate or full body leaning or push-ups can increase skin tissue perfusion.^{25,26} These factors are variable between individuals, indicating that an individualized approach is required.

Implementation considerations

- Refer individuals who spend prolonged periods in a chair/wheelchair to a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.). A collaborative multidisciplinary approach promotes consideration of all the individual's needs.
- Involve the individual and their informal carers in decisions around repositioning frequency.^{27,28} Discuss benefits, risks and strategies to meet the individual's needs.
- Consider the individual's functional ability and lifestyle (e.g., employment, lifestyle activities, etc) when developing a seating regimen.²²
- Consider sensory or cognitive impairments that may impact the individual's ability to self-reposition.

Additional considerations for individuals who can self-reposition

- Encourage self-repositioning by scheduling repositioning into the daily routine where possible,²⁹ for example encouraging incidental movement or natural breaks in activities.
- Assess and monitor individuals who are self-repositioning to ensure their self-repositioning techniques (e.g., pressure redistribution maneuvers, transfers, etc.) effectively offload pressure points and avoid shear and friction.
- Pressure redistribution maneuvers should be individualized according to strength and skill.^{25,30}
- Encourage variation in the type of pressure redistribution maneuvers used.³¹

Additional considerations for individuals who are independent wheelchair users

- Encourage independent wheelchair users to maintain their functional activity. Functional activities of living produce weight shifts that unload pressure at the buttocks.³²
- Consider using interface pressure mapping systems to provide individuals with real time feedback on the need to reposition and the effectiveness of their pressure relieving techniques.³³ Independent wheelchair users often over-estimate their repositioning and pressure relieving activity.³⁴

Clinical question: What are the general considerations when positioning an individual at risk of pressure injuries in a seat?

Clinical question: Should tilt-in-space (dynamic) seating versus non-dynamic seating be used to prevent pressure injury occurrence in individuals at risk who are seated?

S5: It is good practice to position seated individuals in such a way that reduces pressure, shear and friction. This includes:

- **selecting a chair or wheelchair that provides support and maintains stability,**
- **selecting a reclined seated position in which the individual's legs are elevated and supported so the heels are free from the support surface or, if reclining is not appropriate or possible, ensuring that the individual's feet are well-supported, and/or**
- **using dynamic weight shifting (tilt and recline).**

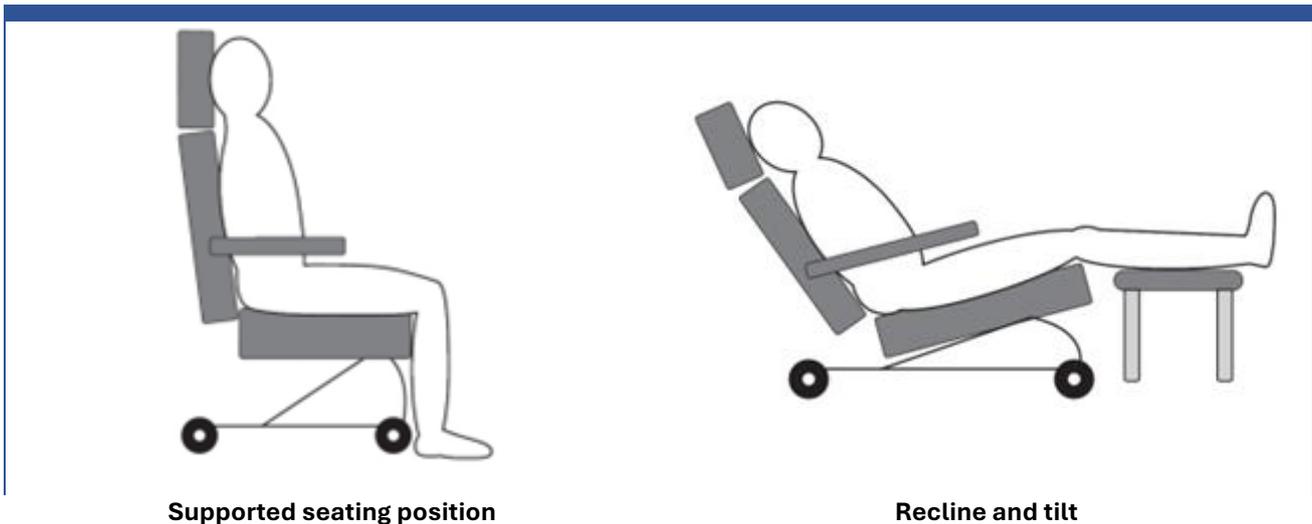
(Good practice statement)

Supporting information

Maintaining proper positioning and postural control is important in avoiding shear and friction.³⁵ There is no direct comparative evidence on the impact of different seating positions (e.g., dynamic seating such as tilt-in-space and rear-tilted), in preventing PI occurrence. Studies have demonstrated that peak interface pressure can be reduced at the ischia, sacrum and back by using a foot support when seated upright,³⁵ and by implementing reclined seating,³⁵⁻³⁸ seat tilting, or a combination of tilt and recline.^{36,39} Studies have also demonstrated that skin perfusion significantly increases when tilt-in-space is combined with a reclined position.³⁹ However, when the pressure is offloaded from these regions, it is redistributed to other pressure points (e.g., the coccyx).

An example of a pressure redistribution protocol for an individual sitting out of bed^{31,40}

- Perform a pressure redistribution maneuver as often as every 10 minutes, adjust frequency based on assessment of the skin and tissues
- Perform the pressure redistribution maneuver for at least 30 seconds, increasing to as long as is tolerated
- Use a combination of maneuvers, including:
 - Rear tilt
 - Right and left side lean
 - forward lean
 - push up



Supported seating position

Recline and tilt

Implementation considerations

- Select a seated posture and chair/wheelchair that maintains the individual's independence and full range of activities.
- Position the feet directly on the ground or with a footrest adjusted to slightly tilt the pelvis forward by positioning the thighs slightly lower than horizontally when the individual is seated upright in a chair. A correctly adjusted chair/wheelchair can assist in maintaining posture and stability.³⁵
- Be aware of the impact of seating on anatomical locations. Sitting in a non-upright position (e.g., slouching) applies greater pressure to the sacrum while an upright seating position applies greater pressure to the ischia.³⁶
- Avoid sitting on medical devices, including manual handling equipment (e.g., transfer sling) unless it is designed for this purpose).
- Tilt the seat a minimum of 30-degree to achieve adequate pressure reduction at the ischial tuberosities.^{35,36,38} If 30-degree tilt is not tolerated, small angle changes performed more frequently can be implemented.⁴¹ Ensure that pressure is appropriately relieved from the heels while avoiding pressure on the Achilles tendon. Consider the recommendations in the guideline section *Preventing Heel Pressure Injuries*.

Additional considerations for individuals who are independent wheelchair users

- Refer individuals who have a change in body dimensions, range of movement, posture and/or physical abilities for a re-assessment by a clinician with specific expertise in seating individuals at risk of PIs^{6,8} (e.g., seating specialist, physiotherapist, physical therapist, occupational therapist, etc.). Regular re-assessment of the fit of the wheelchair and the posture support it provides could improve outcomes.^{23,42}
- Use a combination of tilt and recline to reduce pressure and shear. Using the recline feature in isolation can increase shear forces.^{4,5,41,43} Use tilt-in-space before activating recline.

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