Preventing Pressure Injuries in the Spina Bifida Population

June 4, 2026

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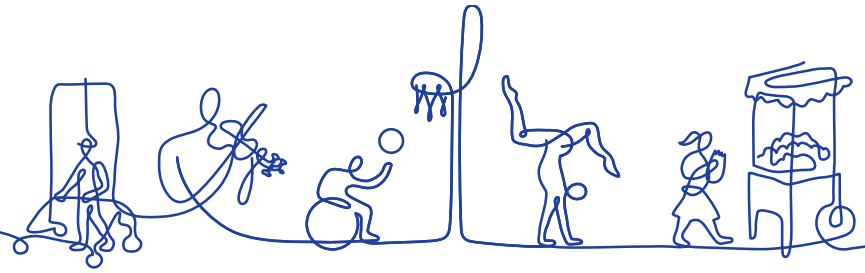

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Studies indicate that approximately 26% of individuals with spina bifida have a history of pressure injuries. 19% report having had one in the last year.

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Pressure injury prevention programs have shown as much as a 67% reduction in incidence with a substantial reduction in the cost of care

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Skin Barrier Function

The skin's barrier function is a multilayered defense system that protects the body from environmental threats while maintaining internal stability.

- Physical Barrier
  - Stratum corneum
  - Keratinocytes
  - Skin appendages

- Chemical Barrier
  - Acid mantle
  - Sebum and sweat
  - Lipid matrix

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- Immunological Barrier
  - Innate immune cells
  - Signaling molecules
  - Antimicrobial peptides

- Regulatory Functions
  - Thermoregulation
  - Mechanical protection
  - Sensory function

The skin is our largest organ, and we must protect it

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Mechanism of Pressure Injury

- A pressure injury (PI) is localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device.
- The injury occurs as a result of intense and /or prolonged pressure or pressure in combination with shear.
- According to the National Pressure Injury Advisory Panel (NPIAP) the tolerance of soft tissue for pressure and shear may be affected by microclimate, nutrition, perfusion, comorbidities, and condition of the soft tissue.
- PI prevention must include strategies to reduce both the magnitude of loading (intensity of pressure) and the duration of loading (time).
  - Specifically, pressure redistribution surfaces and routine repositioning.
- Overhydrated skin from moisture is more vulnerable to friction and shear damage and is less able to distribute weight normally.
  - Incontinent patients are 5 times more likely to develop a PI.

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General Risk Factors for wounds

Age: Aging skin can become thinner and weaker, developing skin (neonates) is not mature and has less layers.

Nutrition: Inadequate protein levels can delay wound healing

Blood pressure: Low blood pressure can lead to low perfusion

Comorbidities: Health issues such as diabetes and heart disease can have a negative impact on skin and wound healing

History of pressure injuries: Skin of a healed pressure injury may already be weak and require a support surface such as high-density foam, low air loss or alternating pressure

Reduced mobility: Individuals who can't easily reposition themselves are at higher risk

Excess moisture: Whether due to wound drainage or incontinence, excessive moisture can increase the risk of skin breakdown

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Spina Bifida related risks

- In more severe forms, especially myelomeningocele, the defect can extend into the lower spinal cord, including areas that control autonomic functions such as blood vessel tone, bladder, bowel, and temperature regulation.
- When the spinal cord is damaged at or below the conus medullaris, the nerves that regulate vasomotor tone (the ability to constrict or dilate blood vessels) can be affected. This can lead to:
  - Impaired blood vessel control in the skin and extremities
  - Temperature regulation problems (cold extremities, poor sweating)
  - Peripheral vascular changes that may mimic vasomotor disorders

- In the setting of poor perfusion, pressure applied to the skin for <2 hours may be sufficient to cause severe tissue damage.

Spina Bifida related risks

- Immobility is the most important risk factor that contributes to development of pressure injuries (PI).
- Sensory loss in spina bifida. They do not perceive pain with prolonged pressure.
- Incontinence
  - **Urinary incontinence**: ~60% of spina bifida patients.
  - **Bowel incontinence**: ~57% of patients.
- Muscle weakness and atrophy affect soft tissue padding over bony prominences

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Spina Bifida related risks

- **Other factors** –
  - Higher lesion level
  - wheelchair use
  - shunt presence
  - recent surgery
  - male sex
  - Scooting and transfer behaviors

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Contributing Co-factors

- Malnutrition
- Vitamin deficiency
- Dehydration
- Smoking
- Lung disease
- Scoliosis or other deformity
- Peripheral artery disease
- Chronic kidney disease
- Cardiovascular disease
- Diabetes
- Medications (corticosteroids, opioids, sedatives, anticoagulants, diuretics)

Most Common SB Injuries

Sitting areas:

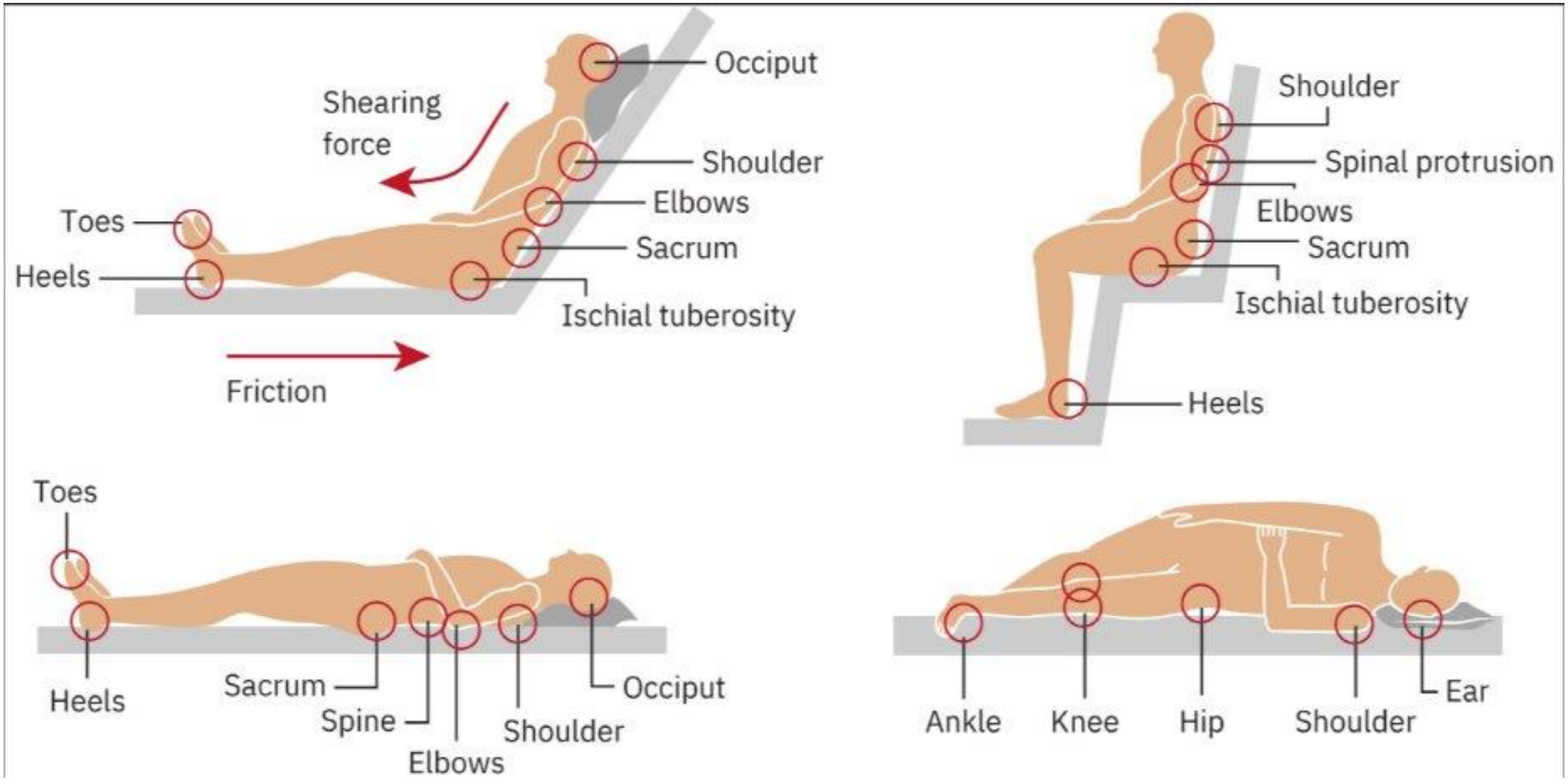
- Ischial tuberosities (sitting bones) – especially in wheelchair users
- Heels – from prolonged sitting or standing
- Greater trochanters (hip bones) – if standing or using a standing frame
- Sacrum – if lying in a supine position without proper support

Lying positions:

- Greater trochanters and iliac crests – if lying on the side or back without repositioning
- Sacrum – if lying supine without a low-profile mattress or cushion

Other high-risk areas:

- Knees – from prolonged sitting or lying
- Ankles/feet – from poor footwear or prolonged pressure
- Cervical spine – if lying on the neck without a pillow or support


Occiput
Shearing force
Shoulder
Elbows
Toes
Sacrum
Heels
Ischial tuberosity
Friction
Shoulder
Spinal protrusion
Elbows
Sacrum
Ischial tuberosity
Heels
Toes
Heels
Sacrum
Spine
Elbows
Shoulder
Occiput
Ankle
Knee
Hip
Shoulder
Ear

Prevention

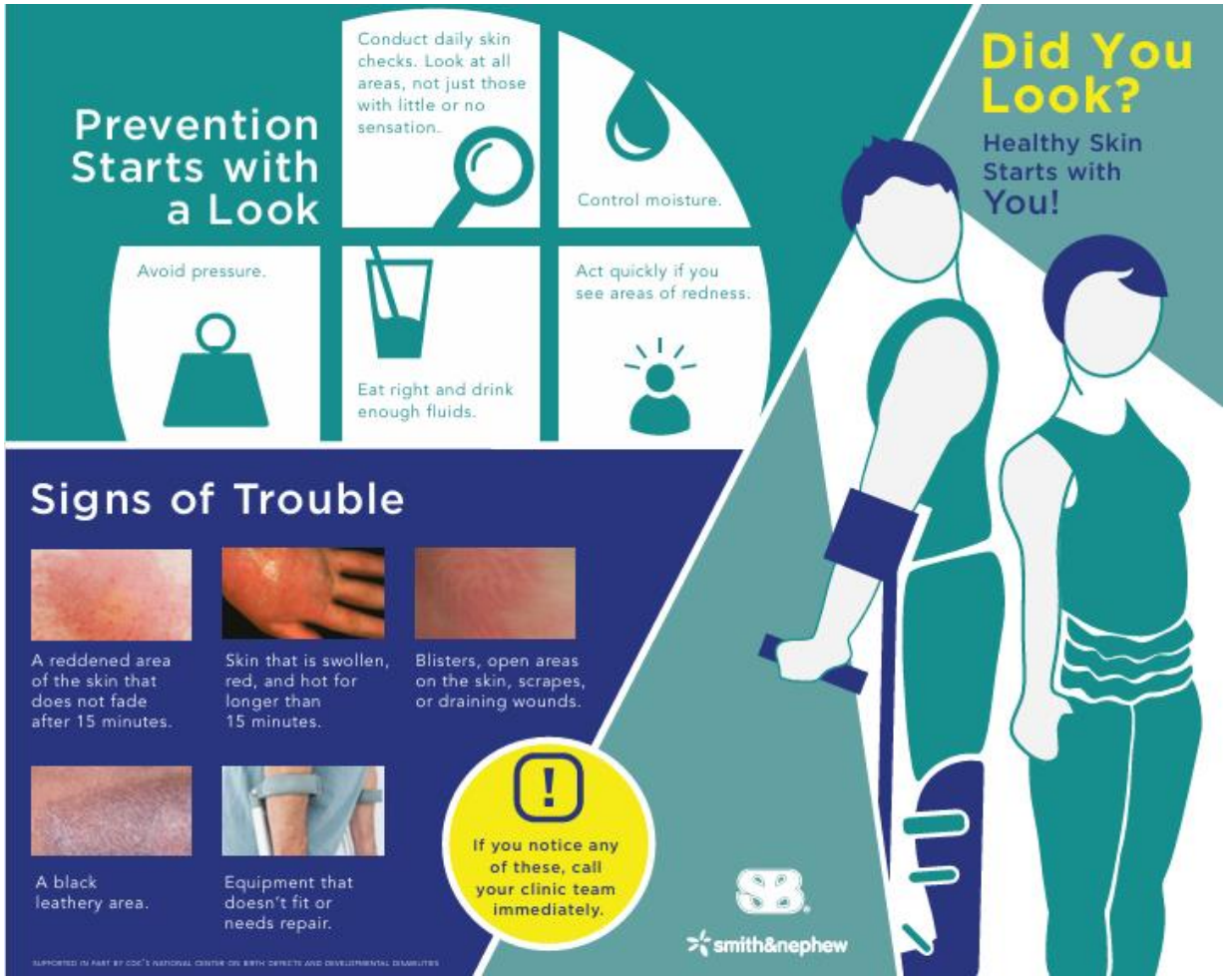
Clinician Actions

- **Risk assessment –** Screen for all identified risk factors at each visit.
- **Pressure relief education –** Teach and demonstrate weight shifts, transfers, and positioning.
- **Use of pressure-relieving devices –** Recommend specialized cushions, mattresses, or seating.
- **Skin integrity programs –** Implement structured skin care and prevention campaigns.
- **Multidisciplinary care –** Coordinate with physiotherapy, urology, dieticians and wound care specialists.
- **Regular monitoring –** Perform frequent skin checks, especially in high-risk areas.

DID YOU LOOK?

Clinic-Staff-Training-Manual.pdf

PowerPoint Presentation



Braden or Braden Q Scale

BRADEN SCALE FOR PREDICTING PRESSURE SORE RISK

Patient=s Name _____ Evaluator=s Name_____ Date of Assessment

SENSORY PERCEPTION ability to respond meaningfully to pressure-related discomfort	**1. Completely Limited** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation. OR limited ability to feel pain over most of body	**2. Very Limited** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness OR has a sensory impairment which limits the ability to feel pain or discomfort over 2 of body.	**3. Slightly Limited** Responds to verbal commands, but cannot always communicate discomfort or the need to be turned. OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No Impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort..				
MOISTURE degree to which skin is exposed to moisture	**1. Constantly Moist** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. Very Moist** Skin is often, but not always moist. Linen must be changed at least once a shift.	**3. Occasionally Moist:** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely Moist** Skin is usually dry, linen only requires changing at routine intervals.				
ACTIVITY degree of physical activity	**1. Bedfast** Confined to bed.	**2. Chairfast** Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. Walks Occasionally** Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair	**4. Walks Frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours				
MOBILITY ability to change and control body position	**1. Completely Immobile** Does not make even slight changes in body or extremity position without assistance	**2. Very Limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly Limited** Makes frequent though slight changes in body or extremity position independently.	**4. No Limitation** Makes major and frequent changes in position without assistance.				
NUTRITION usual food intake pattern	**1. Very Poor** Never eats a complete meal. Rarely eats more than a of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IV=s for more than 5 days.	**2. Probably Inadequate** Rarely eats a complete meal and generally eats only about 2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR receives less than optimum amount of liquid diet or tube feeding	**3. Adequate** Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs	**4. Excellent** Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION & SHEAR	**1. Problem** Requires moderate to maximum	**2. Potential Problem** Moves feebly or requires minimum	**3. No Apparent Problem** Moves in bed and in chair					

BRADEN Q SCALE

Additional Risk Assessments:

1. *Previous pressure injury*
2. *Patient is palliative*

→ *If YES to either, Consider at High Risk.*

16-28 = At Risk	13-15 = Moderate Risk	10-12 = High Risk	≤9 = Very High Risk

Risk	Score / Description			
FRICTION & SHEAR	**4 = No Apparent Problem:** Able to completely lift patient during a position change; Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.	**3 = Potential Problem:** Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains good positioning in chair or bed most of the time but occasionally slides down.	**2 = Problem:** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance.	**1 = Significant Problem:** Spasticity, contracture, itching or agitation leads to almost constant thrashing and friction.
TISSUE Perfusion and Oxygenation	**4 = Excellent:** Normotensive, Oxygen saturation >95%; Normal Hemoglobin; & Capillary refill < 2 seconds.	**3 = Adequate:** Normotensive; Oxygen saturation may be<95% **OR** hemoglobin may be< 100 **OR** capillary refill may be > 2 seconds; Serum pH is normal.	**2 = Compromised:** Normotensive; Oxygen saturation may be<95 % **OR** hemoglobin may be <100 **OR** capillary refill may be > 2 seconds; Serum pH is <7.40.	**1 = Extremely Compromised:** Hypotensive (MAP<50mmHg<40mmHg in a newborn) **OR** the patient does not physiologically tolerate position changes.
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**4 = No Impairment:** Responds to verbal commands. Has no sensory deficit, which limits ability to feel or communicate pain or discomfort.	**3 = Slightly Limited:** Responds to verbal commands, but cannot always communicate discomfort or need to be turned **OR** has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**2 = Very Limited:** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness **OR** has sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**1 =Completely Limited:** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation **OR** limited ability to feel pain over most of body surface.
ACTIVITY Degree of physical activity	**4 = All patients too young to ambulate OR walks frequently:** Walks outside the room at least twice a day and inside room at least q 2 hours during waking hours.	**3 = Walks Occasionally:** Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**2 = Chairfast:** Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**1 = Bedfast:** Confined to bed.
MOBILITY Ability to change and control body position	**4 = No limitation:** Makes major and frequent changes in position without assistance.	**3 = Slightly limited:** Makes frequent though slight changes in body or extremity position independently.	**2 = Very Limited:** Makes occasional slight changes in body or extremity position but unable to completely turn self independently.	**1 = Completely immobile:** Does not make even slight changes in body or extremity position without assistance.
MOISTURE Degree to which skin is exposed to moisture	**4 = Rarely Moist:** Skin is usually dry, routine diaper changes, linen only requires changing every 24 hours.	**3 = Occasionally Moist:** Skin is occasionally moist, requiring linen change every 12 hours.	**2 = Very Moist:** Skin is often, but not always moist. Linen must be changed at least every 8 hours.	**1 = Constantly Moist:** Skin is moist almost constantly by perspiration, urine, drainage, etc. Dampness is detected every time patient is moved or turned.
NUTRITION Usual food intake pattern	**4 = Excellent:** Is on a normal diet providing adequate calories for age. For example: eats/drinks most of every meal/feeding. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.	**3 = Adequate:** Is on tube feedings or TPN, which provide adequate calories and minerals for age **OR** eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered.	**2 = Inadequate:** Is on liquid diet or tube feedings/TPN which provide inadequate calories and minerals for age **OR** Albumin <3 mg/dl **OR** rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement.	**1 = Very Poor:** NPO and/or maintained on clear liquids, or IVs for more than 5 days **OR** Albumin 2.5mg/dl **OR** Never eats a complete meal. Rarely eats more than ½ of any food offered. Protein intake is only 2 servings of meat or dairy products per day. Takes fluids poorly. Does not take a liquid dietary supplement.

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Prevention

Patient Education & Self-Care

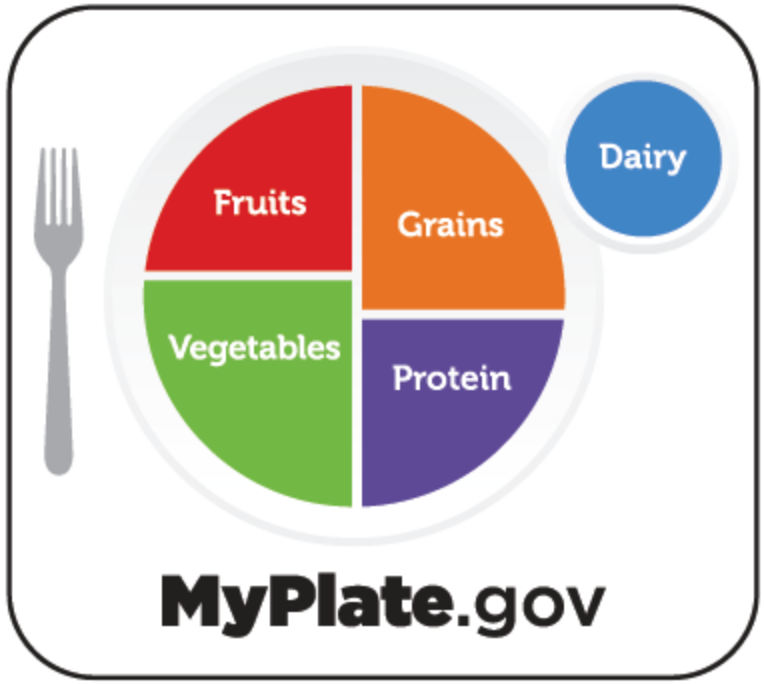
- **Daily skin inspection** – Check for color, texture, temperature, and signs of irritation.
- **Position changes** – Shift weight regularly, every 15-60 minutes while sitting, every 2 hours while lying down to relieve pressure; learn and practice pressure relief techniques.
- **Skin hydration** – Keep skin moisturized to prevent dryness. Drink plenty of fluids for hydration.
- **Nutrition**- The importance of maintaining a healthy diet.
- **Awareness of warning signs** – Report redness, warmth, swelling, or pain immediately to a clinician.

Prevention

- **Incontinence Management-**
  - Early intervention and consistent management improve quality of life.
  - Regular follow-ups with urologists and primary care providers are important for both children and adults.
  - Lifestyle adjustments, including avoiding bladder irritants like caffeine and fizzy drinks, support continence management.
  - Use protective barriers and change soiled areas promptly.

Nutrition

- Prevention



- **Treatment**

Good nutrition is an important part of the wound healing process. The body needs extra calories, protein, fluid, vitamins, and minerals to support tissue regeneration, collagen formation, and support immune function. Our energy and protein needs are increased when wounds develop. Early nutrition intervention helps prevent further development of wounds.

  - Carbohydrates
  - Fat
  - Protein
  - Vitamin C
  - Zinc

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Wounds don’t just come from wheelchairs. It’s important to look at the full picture.

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Clinical Questions and Problem Solving

- How often are you in your wheelchair daily? For what length of time?
- How do you move around your home? School? Community?
- When you are at home, where do you sit, play, etc?
- When you are school, where do you sit, play, etc?
- Observe the child transfer from wheelchair to chair or mat in the clinic space.
  - Are they clearing the wheel of the wheelchair? Do they get stuck or stop to reposition?
- Observe wheelchair propulsion.
- If they crawl, scoot, or walk, observe this in the clinic.
  - Are they shearing/putting pressure on the area of concern during these movements?
- What other activities do you participate in (ex. wheelchair sports, acting in productions, swimming)?

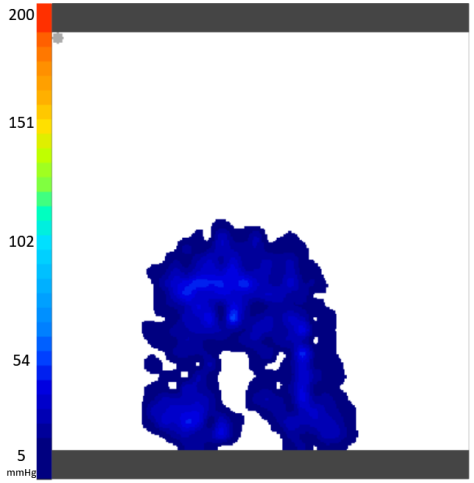
Assessment of Pressure on Seating Surfaces

- Manual pressure assessment, close look at positioning in equipment/surfaces
  - Cushion orientation and position in wheelchair
  - Observe posture at rest, position of comfort
  - State of the wheelchair
- Other forces at work? (e.g. moisture, friction, heat)
  - Examples:
    - No pressure points noted on pressure map or assessment, but patient stays wet between caths.
    - When observing transfers, patient scoots across the cushion and drags bottom along surface of the table.
    - Patient is highly active and plays an outdoor sport during hot months. Wheelchair was left in the sun.

Pressure Mapping

- Pressure mapping can be a helpful tool but is an expensive device and not always readily available.
- Helps identify pinpoint areas of pressure in both static and dynamic sitting.
- It is a clinical tool and should be used as an addition to the other strategies of assessing pressure injuries.
- Signs of pressure on the map system are not always bad.

sitting



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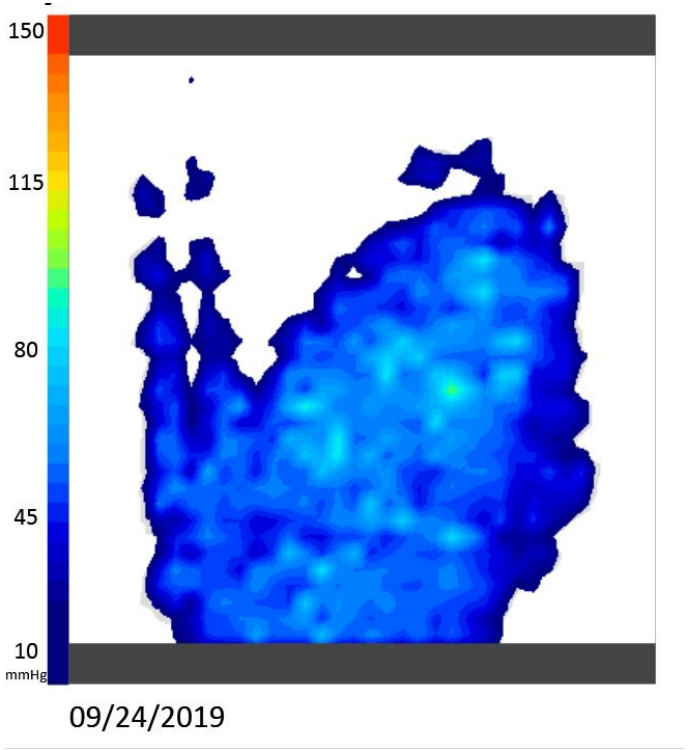
Pressure Mapping for Visualization and Education



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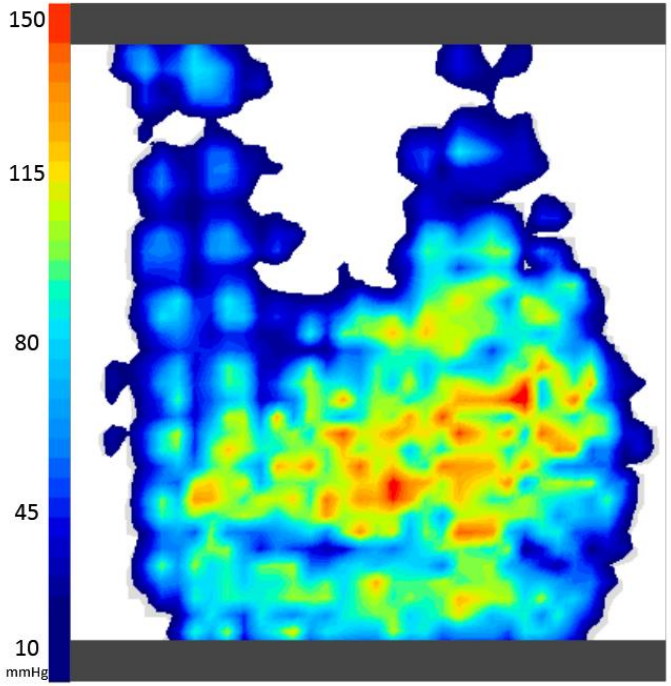
After 60 minutes



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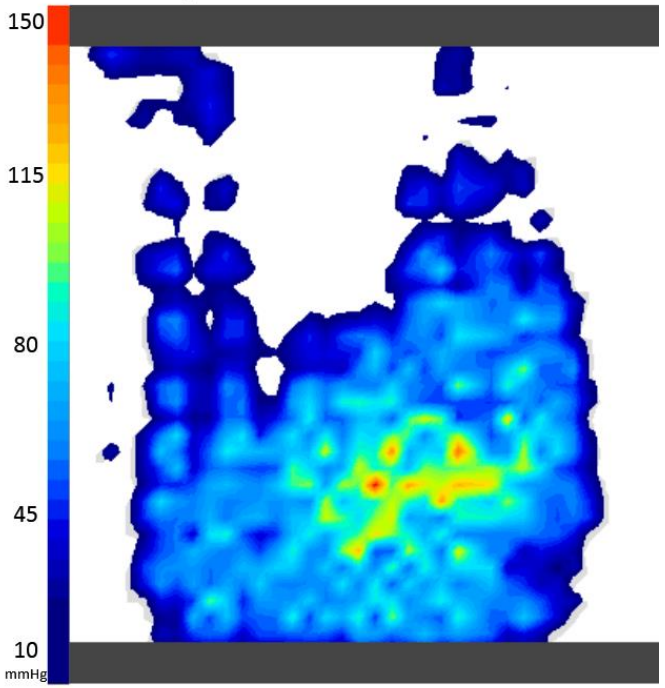
After pressure relief



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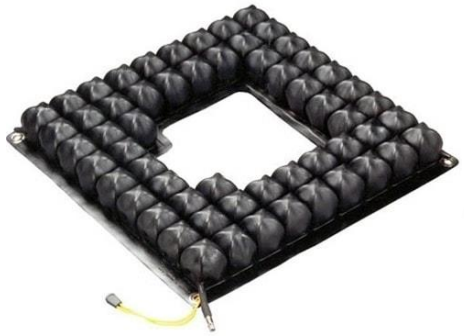
Equipment

- Wheelchair
  - Various types of cushions
    - Roho
    - Custom molded
    - Standard
- Bed
  - Overlays
    - Prodigy
- ADL
  - Toileting
    - Roho for toilet
  - Shower/Bath
    - Roho
  - Self Care
    - Inspection mirror



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Education, Strategies, Activity Modification

- Pressure relief movements
  - Wheelchair push up, leaning, or completely sidelying or prone
  - Set alarms/reminders on phone
  - Observe with patient to ensure carry over
- Use of pressure relieving cushion on other surfaces (desk, car, sports chair, etc.)
- Skin checks by patient and family
  - Take pictures
  - Apps for wound and skin checks:
    - PUP app
- May need to limit time in position causing injury
- If caused by shearing forces, modify transfers, crawling, etc. to reduce these forces.
- If moisture is a problem, educate on importance of staying dry for skin protection and work with clinical team to manage bladder.

Treatment

- Offloading pressure, reducing friction, shear and moisture are key elements in the treatment of pressure injuries.
- TIMERS principle for wound healing

  T – Tissue Management

  I – Inflammation and Infection Control

  M – Moisture Balance

  E – Epithelial Edge Advancement

  R – Regeneration and Repair

  S – Social Factors

- Adhere to the latest clinical practice guidelines from organizations like the National Pressure Injury Advisory Panel (NPIAP) and the Pan Pacific Pressure Injury Alliance (PPPIA) for comprehensive management strategies.

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