Developed by the BC Interprofessional Skin & Wound Committee in collaboration with Occupational Therapists, Physiotherapists, & NSWOCs/					
Wound Clinicians from:					
First Notions Health Authority Health through weliness	Provincial Health Services Authority Services				
Title	Guideline/Procedure: Pressure Mapping Assessment				
DST	This Decision Support Tool (DST) provides guidance on the use of pressure mapping				
Indications	technology to assess and visualize the pressure distribution on a client's body in contact				
for Use	with their support surface(s).				
	Clients who require pressure mapping need an interprofessional approach to provide				
	comprehensive, evidence-based care. This DST provides direction for Occupational				
	Therapists and Physiotherapists who use pressure mapping assessment as part of client care.				
Practice	Pressure Mapping Assessment is a basic entry level practice competency for Occupational				
Level	Therapists (OT) and Physiotherapists (PT) who have gained knowledge, skills and				
	competencies related to a specific pressure mapping technology. Additional education				
Background	 and/or mentoring may be needed to obtain or maintain these competencies. Pressure mapping technology (2D/3D) is a measurement and visual reporting tool used 				
Background	as part of a broader pressure injury risk assessment for treatment of a pressure injury.				
	Pressure mapping provides a visual image and numeric value of a client's sustained				
	pressure on weight bearing surfaces when lying and sitting, (e.g., chair, bed, wheel-				
	chair). It serves to measure the surface interface pressure, that is, the pressure				
	between the client's tissue and a support surface. Results help inform the selection of				
	wheelchairs, bed mattresses, and cushion(s), determine pressure re-distribution strategies, and/or identify the need for equipment modification.				
	 Pressure mapping provides the client with visual cues to understand their current level 				
	of risk for developing a pressure injury and the need for prevention strategies, such as				
	repositioning, weight shifts, mobilization and support surfaces to mitigate these risks.				
Bookmarks	Indications for Use				
	Practice Level Background				
	Assessment and Determination of the Need for Pressure Mapping Assessment				
	Interventions				
	Procedure: Equipment & Supplies				
	Procedure: Set Up for the Pressure Mapping Assessment				
	Procedure: Conduct the Pressure Mapping Assessment Procedure: Interpretation and Decumentation of Procedure Mapping Assessment Data				
	<u>Procedure: Interpretation and Documentation of Pressure Mapping Assessment Data</u> Documentation				
	<u>Definitions</u>				
	References/Bibliography				
	Document Creation/Review				
Related	Appendix A: Pressure Mapping Assessment Worksheet				
Documents	Guideline: Prevention of Pressure Injury in Adults & Children				
200411101110					

Assessment and Determination of the Need for Pressure Mapping Assessment

Assessment

1. Client's risk for pressure injury including sensation, moisture, motor function and activity, nutrition, and friction/shear using the Braden risk score and sub-scales. For children assess tissue perfusion using the Braden Q risk score and sub-scales.

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- 2. Client's skin using the Head-to-Toe Skin Check to determine if a pressure injury currently exists or if there are areas at risk.
- 3. Functional activities of daily living (ADL), including sitting, lying, transfer surfaces, and equipment. Also assess the client's:
 - Living situation.
 - Presence of a caregiver(s).
- 4. Conditions that may impact pressure mapping, such as pain or spasms.
- 5. Post-operative surgical risk, (e.g., flap surgery for person with a spinal cord injury).
- 6. Client's ability to comprehend and participate in the assessment processes, such as being able to rest quietly during pressure measurements.
- 7. Client's goals of care, including preferences for prevention and management of risk factors.
- 8. Client's culture and traditions to determine if they facilitate the assessment process.

Determine the Need for Pressure Mapping Assessment

- 1. Based on the above assessment findings, in particular the Braden sub-scales of sensory perception, mobility and activity and the presence of, or areas at risk for, a pressure injury(s).
- 2. As part of a comprehensive assessment to assist with a diagnosing a condition/disorder.
- 3. Requirement as part of a funding application(s) and/or a prescription for a sitting or lying surface or a transfer device.

Interventions

- 1. Educate the client and/or family regarding the pressure mapping procedure, including:
 - The length of time needed to collect pressure mapping measurement data.
 - Positioning and re-positioning as needed during the procedure.
 - Coordination of wound dressing removal and reapplication, if needed.
 - Provision of effective pain management prior to the pressure mapping procedure.
 - How family can help with client transfers and positioning during the assessment, if needed.
- 2. Develop strategies to address lack of client participation in pressure mapping, including scheduling times or having a support person available, if needed.
- 3. Communicate with the health care team if there is a need for a second person to assist with transfers and/or the removal/reapplication of dressings.
- 4. Ensure the availability of equipment and surfaces to be assessed during the pressure mapping procedure.
- 5. Conduct pressure mapping measurements (<u>see page 3: Procedure for Pressure Mapping Assessment</u>)
 - a. Follow the established procedure for the available pressure mapping technology being used.
 - b. Complete a pressure mapping assessment of the client's current sitting, lying and transfer support surfaces, as needed:
 - Sitting: Wheelchair(s), Broda chair, Tilt chair with cushion(s), toileting devices and other sitting surfaces. Complete an agency specific OT wheelchair assessment tool, if needed.
 - Lying: Bed surfaces (all types). Complete an agency specific OT support surface assessment tool. if needed.
 - o Transfer: Transfer boards, transfer bathing chairs, transfer to automobile. Complete an agency specific OT transfer surface assessment tool, if needed.
- 6. Interpret the pressure mapping results (<u>see page 7: Procedure for the Interpretation and Documentation of Pressure Mapping Assessment Data</u>)

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Procedure: Pressure Mapping Assessment

Equipment and Supplies:

- Pressure Mapping Documentation Worksheet (electronic or hard copy) (See <u>Appendix A</u> for example).
- o 1 x (22" x 24") thin clear plastic bag for wheelchair mat
- o 2 x (35" x 50") thin clear plastic bags for torso mat
- o 1 x large plastic bag to create a clean workspace
- o 6 x alcohol swabs
- Cleaners and disinfectant wipes
- Alcohol-based hand sanitizer
- Supply of disposable gloves
- o Tape to ensure the bag covering the mat is sealed
- o Disposable scissors to trim the bags as needed
- o Goniometer or phone app to accurately mark degrees of wheelchair tilt or HOB elevation
- Wipeable measuring tape (vinyl)

Technology Equipment:

- o Pressure Mapping (mat) technology and appropriate template. (See below 1. a-e)
- Interface module (if required for your system)
- Dedicated laptop or tablet for pressure mapping technology and its power cord
- Card reader
- Compact Flash card to transfer data
- USB cable to connect interface module to laptop
- Power bar with at least 3 outlets
- Mouse for laptop
- o Extension cord
- Sensor mats for the bed and/or wheelchair
- o Timer or cellphone with a timer
- Camera on tablet, if needed

Preparation Prior to the Client Visit:

- 1. Technology:
 - a. Ensure the most current software is downloaded onto laptop or tablet.
 - b. Download the appropriate template and the User's Manual Instructions for Use
 - XSensor: https://www.xsensor.com/
 - o BodiTrak: https://www.boditrak.com/
 - Tekscan: https://www.tekscan.com/
 - c. Test equipment to ensure the pressure mat ID Number (#) matches the downloaded template. If trouble-shooting is needed see page 4: <u>Troubleshooting the System.</u>
 - d. If the mat is not registering high pressure when checked on a firm surface, recalibrate. See manufacturers operating instructions or contact the Vendor to discuss the issue and plan a recalibration of the equipment.
 - e. As internet is not fully available in all communities, take the Instructions for Use to the client visit.
- 2. Client must have the following available for the visit:
 - The cushion and/or mattress device(s) to be tested.
 - o The client's own equipment, if it is contributing to the pressure issue(s).
- 3. The availability of second person (health care provider or family) to assist with transfers and positioning, if needed.
- 4. Prepare a test protocol:
 - List the type of cushions, seats, postures, surfaces, and activities to be tested.
 - Prepare a draft order of the testing to be completed during the visit to maximize client comfort/positioning during the assessment and to minimize the number of transfers.

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- For each test position, plan an approximate 7-minute rest and add this time to the over-all time needed to complete the mapping.
- If wound is present, determine if there is a need to pressure map the wound area with the client's usual dressing in place or if the dressing needs to be removed for the assessment (wound to be covered with thin dressing for protection).
- 5. If the wound dressing is to be removed, coordinate the visit with a nurse to removal and reapplication.

	Procedure: Set Up for the Pressure Mapping (PM) Assessment			
Steps		Key Points		
1.	Review the chart and overall care plan: Review allergies & sensitivities to products.	Ensure the client understands the rationale for PM as part of the care plan.		
2.	 Communicate with client and /or family: Obtain verbal consent for PM and photos. Explain the procedure and time required to conduct the scan in each position. Assess client for pain and anxiety and give appropriate medication(s); allow time for medication(s) to take effect. 	Obtaining verbal consent from the client/family is essential so they understand the goal of PM and that photos may be taken. The client undergoing PM may experience pain and anxiety so consider pain management strategies, such as reassurance, education, positioning for comfort and medication(s).		
3.	 Set-Up the equipment: Set up the laptop and mouse. Set up the pressure mapping surface, ensuring the template ID number (#) matches the mat ID (#). Plug in the interfaces. Ensure pressure settings (mmHg) are set, if not pre-set. Insert card readers, flash cards, and drives. Set-up for the procedure: 	 Troubleshooting the System: If mat is not sensing, turn OFF the laptop or tablet and reboot the system. Ensure the technology interfaces are communicating with each other. Ensure that the mat is plugged into the correct port connection, if using a wired system. Check that the template ID and mat ID match. 		
	 Gather the supplies. Clean and disinfect the laptop or tablet and timer and equipment, as needed. Set up a clean working field by placing the large plastic bag on a table. Lay out the laptop, mouse, tablet, timer and cellphone equipment. Cover the pressure mapping mat with a clean clear plastic bag and cut to size if needed. Tape the mat securely. Do not tug on fragile mat wires when covering the mat. Consider delegating one person to operate the software and one person to move, transfer or reposition the client, as needed. If needed for the purpose of the mapping assessment, have the nurse remove wound dressing(s) and cover the wound(s) with a thin dressing(s) during pressure mapping. Perform hand hygiene and don clean gloves each time you touch the client. 	Setting up a clean field and equipment, and covering the pressure mapping mat reduces the possibility of cross contamination between the client and the equipment. Taping the mat securely ensures the client does not slide during the testing process. Tugging on the mat wiring harness can cause shearing and damage the sensors on the mat. Assigning one person to use the software and another to assist with client positioning and equipment management also avoids cross contamination between the client and the equipment. Dressing may not need to be removed for the assessment.		

Procedure: Conduct the Pressure Mapping Assessment			
Steps	Key Points		
 Transfer client onto the pressure mat: Carefully transfer the client, minimizing shearing to both mat and client's skin. Have two people transfer and position the client who has poor balance, low muscle tone, posterior pelvic tilt and/or an open hip angle. 	Use caution as the clear plastic bag covering the mat may contribute to sliding on the surface of the mat.		
 Follow these tips to protect the integrity of the pressure map: Do not use a transfer board. Do not swivel the client while on the mat. Do not pull on the edges of the mat while it is resting under a client. Do not remove transfer slings or pads, if this is the normal set-up for the client. 	Careful client transfers and minimal movement on the mat ensure the safety of the mat sensors and therefore ensure more accurate results.		
Conduct a pre-mapping positioning check of the client and the mat: Conduct a post-transfer positioning check.	Use the goniometer or cellphone application to measure angles to ensure the client is at the correct position for the assessment.		
 Use the goniometer or cellphone application to measure body angles, as needed. Check the PM visual display to ensure the mat is square. Perform a hand check at any peak pressure areas to smooth out wrinkles. 	Wrinkles reduce the sensitivity of the mat sensors.		
 Prepare the client to rest quietly: Allow the client to relax and settle into the cushion or mattress for approximately 7-minutes before recording the data. Use a timer to count the minutes. Position the tablet screen so the client can visualize the start-up process, if appropriate. 	The 7-minute settling period minimizes both mat and the client creep ensuring accurate data and consistency between tests. It also allows time to engage and educate the client about the process.		
4. Prepare for mapping:	Positioning the screen out of the client's view during pressure mapping prevents the client shifting position to view the images. Shifting position causes the pressure to increase in the direction of the shift. For example, a screen positioned to the right will increase loading on the right.		
 Capture the pressure mapping data: Static Evaluation: Complete by clicking scan to begin the recording or a snapshot of the image. Take at least 3 snapshots for comparison in any one position. Dynamic Evaluation: Complete by 	Entering pertinent information beneath each captured image related to surface, position, posture, seating equipment, angles, and orientation in space, or circumstances, supports the collection of a comprehensive client assessment. When the document is saved, select 'views' and		
selecting record – this begins recording multiple images over time (e.g., pressure changes with self-propulsion). • Document the type of evaluation and record information about the client below each captured image before going to the next positioning scenario.	'comparison view' to see a side by-side comparison of all the different 'snapshots' in different positions. Ensure images are captured to reflect the pressure legend, mat orientation, specific client posture, position and individual circumstances. This information helps to understand the position and individual and interpret the results.		

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Steps	Key Points		
Validate the images: Using hands, confirm that the areas of higher pressure shown in the mapping correlate with the client's bony	Do not assume that the high pressure observed on the laptop screen matches a typical bony prominence. Lifting the client's leg may assist to verify what is being seen on the map.		
prominence(s) being assessed.	Be alert to items that could create increased pressure points, such as the mat, clothing wrinkles, items in pockets, rigid seams, sensor mat creep, hammocking, and/or hysteresis.		
 7. Review findings (mapping colours) with client: Reposition the screen such that the client can easily see. Depending on the mmHg settings used, the: Black tab usually represents the lead from the mat to the interface. Blue and green (cooler colours) usually represent areas of less pressure. Yellow, orange, and red (warm colours) 	Explain the significance of the colour gradient by comparing it to Doppler radar weather map.		
usually represent areas of higher pressure.			
8. To collect images or scans of alternate positions on the same surface and/or a new surface, repeat Steps 1 – 7 for each position change and/or surface being tested.			
If wound dressing removed, nurse to reapply new dressing.			
 10. Clean the workspace: Remove the mat from the plastic bag. Clean/disinfect the mat and cords. Wipe down; do not soak. Allow to dry. Store the dried mat and cord in its case. Clean/disinfect the laptop and mouse, tablet, or cellphone and allow to dry. Return the laptop cords and mouse to storage. Plug in the laptop or tablet to charge. 	Cleaning and disinfecting the mat following manufacturer's instructions helps to prevent crosscontamination.		

Procedure: Interpretation & Documentation of the Pressure Mapping Assessment Data

Key Points and Cautions:

- Do not focus exclusively on the measurement data or numbers at the expense of clinical judgment.
- No single numeric value indicates acceptable or unacceptable levels of sustained pressure. A numeric
 value provides a comparative value used to identify the ability of a support surface to distribute and
 minimize pressure.
- Do not focus on a single peak pressure value, rather look at the pressure distribution and the relative comparisons on different surfaces. Review points of peak pressure as they are a more reliable and comparable measure than a single maximum pressure value.
- The best pressure mapping image may not be captured during the most functional position. A mapping scan alone is not used to make decisions for seating or bed surface interventions. Decisions must also consider the clients' goals, comfort, fit, postural stability, functional mobility, cushion weight, heat and moisture, maintenance, and set-up.
- Consider the impact of creep, hammocking (bridging), and hysteresis which may interfere with results.
- Consider the impact of moisture, microclimate, shear and friction, which pressure mapping does not capture, when making clinical decisions.
- A high mmHg value suggests the need for careful monitoring for areas identified at risk. However, ensure that evidence of tissue damage is not dismissed even when the map suggests there is not a problem.
- Be knowledgeable of the client's current wound location(s) in relationship to mapping results.

Steps to Interpretation of Data	Key Points		
Maximum Pressure: Review points of maximum pressure as areas of potential problems.	Review findings depending on initial pressure settings (mmHg). Settings may be pre-set.		
Peak Pressure Index: Review points of peak pressure.	A high change in values in adjacent sensors gives an indication of poor envelopment.		
Sensing Area: Review the sensing area as a comparative value; the larger the area the better.	Determine if the area of pressure distribution reduces or increases in response to the interventions		
 Symmetry: (comparing left to right) Review the shading and numbers as they indicate if there is equal weight distribution on the surface. 	Asymmetry requires a further seating evaluation. Evaluation may show pelvic/trunk deformity from pelvic obliquity or scoliosis, postural imbalance from functional lean, or a poor seating set-up.		
Regional distribution (for some systems): Review the percentage of the total load in each selected region. If no sub-region is selected, the regional distribution will always be 100%. Select an area by holding down the CTRL button, left click on a cell and drag the cursor over another area. Lock the area by right clicking over the contour plot and selecting 'Lock' regions.	The 3-D graphical view shows higher pressures as peaks and lower pressures as rolling hills. The appearance of a 'mountain range' suggests higher rates of change in pressure from one point to the next. This focuses attention to possible areas at higher risk for skin breakdown.		
Contour /Pressure Gradient: Review the image to the right of the screen by the numeric scale.	Gradient refers to how close the high-pressure values are to the low-pressure value. The goal is to have the gentlest change possible, as in 'the foothills are preferable to the Rockies!'		
Co-efficient of Variation: Review statistical value that shows how evenly the pressure is distributed over the surface.	The statistical value is used as a comparative value with a smaller value being preferable.		
Dispersion Index (DI): Dispersion Index = A / A+B	Dispersion of the contact area is best when distributed over the full buttock and thighs. It is		

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Where A = pressure over the ischial tuberosity &	least desirable to have pressure distributed
sacral-coccyx area	primarily over the ischial tuberosities and sacral
Where B = pressure outside the ischial tuberosity &	regions. Ideally you should see a 'horseshoe'
sacral-coccyx area	shape.

Documentation

- 1. Document the pressure mapping technology used, the findings and interpretations.
- 2. Revise the care plan based upon the assessment and include anticipated clinical outcomes.
- 3. Document client and/or family education and any written materials discussed, if applicable.

Definitions

Client: Recipients of care; patient in acute care; client in community care and resident in long term care.

Creep (deformation): The tendency of the pressure mat to move over time; this occurs when pressure values increase over time under the constant load of the client weight; there is cushion creep and client tissue creep.¹⁰

Hammocking (bridging): Occurs when support surface contours affect the pressure distribution being measured so that the pressure mat itself may affect the readings.¹⁰

Hysteresis: The tendency for sensors to under-read (sense) when loads are applied, and to over-read (sense) when loads are reduced. ¹⁰

Pressure: The "force per unit exerted perpendicular to the plane of interest" (National Pressure Injury Advisory Panel, NPIUP, 2019, p. 4).

Pressure Mapping Technology: Pressure mapping systems usually include a map for seating assessments and a torso/body map for lying assessments; both may be used as part of an assessment related to transfers and associated pressure issues. Houghton and colleagues (2013) state pressure mapping systems are comprised of: "sensor array in a flexible mat measure interface pressures between the body [clients' tissue] and support surface. The pressure sensors are connected to a laptop system that displays the pressures measured at each sensor, using a colour-coded image and a number. These outputs display the level of pressure at each sensor, the overall amount of contact area for pressure distribution, and pressure asymmetries. Higher areas of pressure may indicate bony prominences, but manual palpation is necessary to confirm this" (p. 75).

Surface Interface Pressure: The pressure between the client's tissue and a support surface.

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Document Creation/Review

This guideline is based on the best information available at the time of its Provincial First Read and relies on evidence, expert consensus and avoids opinion-based statements where possible. The document has undergone a provincial stakeholder review.

Created By	British Columbia Provincial Interprofessional Skin & Wound Committee in collaboration with Occupational Therapists, Physiotherapists and Nurses Specialized in Wound Ostomy Continence/Wound Clinicians
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Appendix A: Pressure Mapping (PM) Documentation Worksheet

Use this worksheet to document the PM assessment and to guide clinical thinking, and to ensure documentation in the case notes. In most PM systems, case notes can be typed in the "notes section" under each scanned image.

Prior to Visit:						
Complete a Technology Check: Test technology and power cords Test pressure mapping mat Check interface laptop template ID to match mat ID on pressure mapping equipment Date of last calibration Client's Equipment: Client's own equipment is available for testing.						
☐ Potential sitting/lying/transfer equipment available during the pressure mapping visit.						
During the visit, complete the following:	Set up #	Set up #	Set up #			
Environment and Set Up						
 Presence of linen layers (incontinence pad, briefs, sling, bed linens, etc.) Presence of clothing (jeans, leggings, etc.) 						
Seat cushion or mattress being trialed						
Angle of back rest						
Back rest (type)						
Degrees of tilt in the chair						
Ü						
Head of bed (HOB) elevation						
Foot of bed (FOB) elevation						
Position of lead (front left, front right, etc.)						
Waited a total of 7 minutes to all creep to settle						
Mapping Results						
Location of peak pressure (bony prominence):						
Peak Pressure Index in mmHg						
Average Pressure						
Total sensing area						
Comment on symmetry						
Dispersion						
Gradient						
Foot support (footrest height / angle changes)						
Upper extremity position (armrest, back rest and position changes).						
Additional Comments/Observations (client report of comfort, pain, spasms etc.)						

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