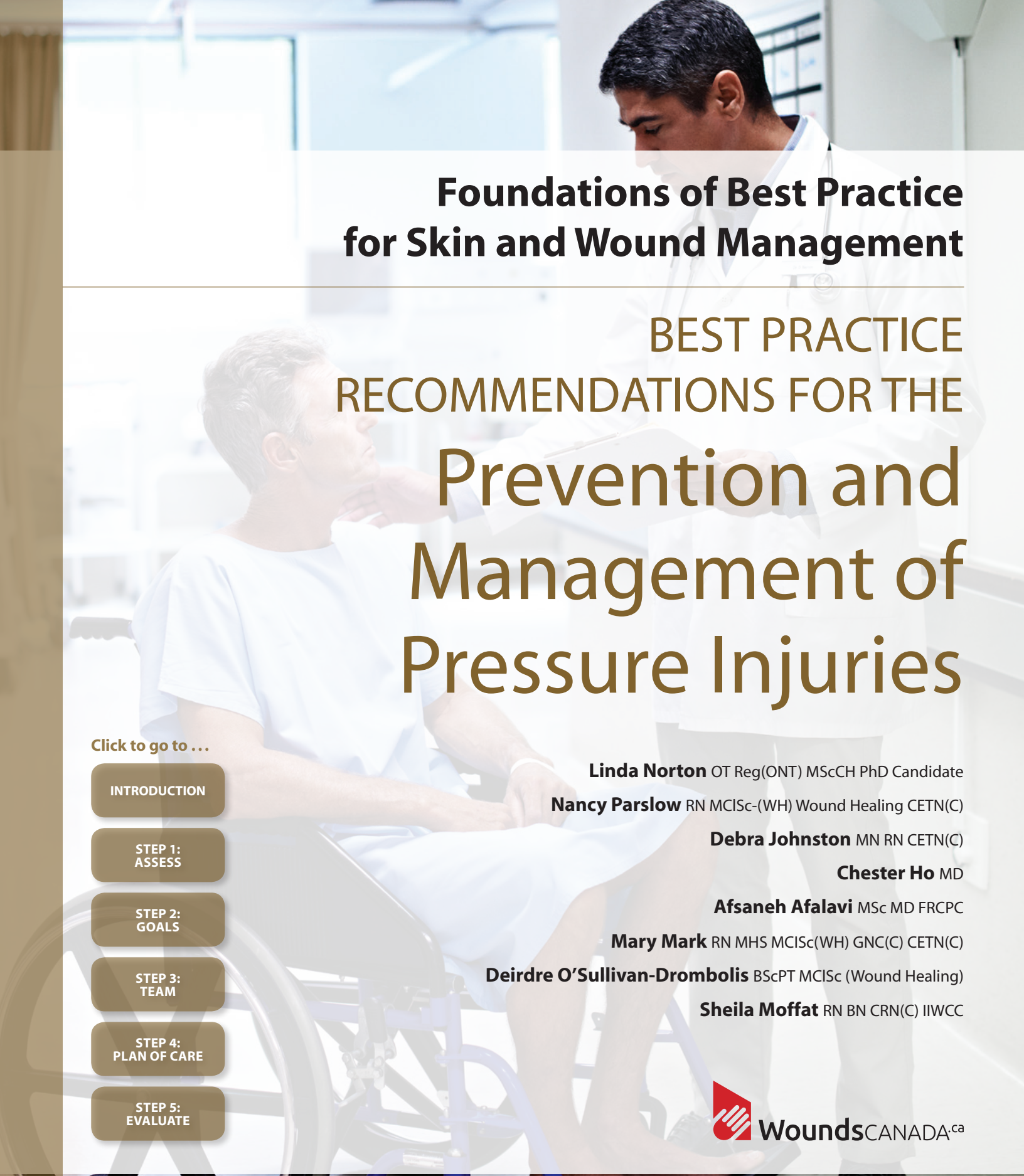

Foundations of Best Practice for Skin and Wound Management

BEST PRACTICE RECOMMENDATIONS FOR THE Prevention and Management of Pressure Injuries

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The best practice recommendation articles are special publications of *Wound Care Canada*. Together they form the Foundations of Best Practice for Skin and Wound Management, an online resource available for free download from the Wounds Canada website (woundscanada.ca).

These 2017 updates build on the work of previous author teams and incorporate the latest research and expert opinion.

We would like to thank everyone involved in the production of past and present versions of these articles for their hard work, diligence and rigour in researching, writing and producing these valuable resources.

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This paper was produced by the Canadian Association of Wound Care (Wounds Canada). The editing and layout were supported by an unrestricted educational grant from Mölnlycke Health Care.

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Last updated 2018 01 24.

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Introduction

Introduction

The prevention and management of pressure injuries continues to be a concern in the Canadian health-care system. In a 2003 study funded by the Canadian Association of Wound Care (Wounds Canada), the overall prevalence of pressure ulcers across all health-care settings was 26%, with approximately 70% of these wounds considered preventable.[1] According to published literature, clinical practice and expert opinion, nearly all pressure ulcers can be prevented.[2] Prevention, including best practices and use of appropriate equipment, is of paramount importance and must be the focus of care for all patients and across all care settings.

Despite the focus on prevention to date, pressure injury incidence rates have not significantly decreased in Canada[3] when compared with other countries around the world, including the US.[4,5] An integrated approach focused on prevention is required across all areas of the health-care system to make a significant difference in incidence rates. For optimal effectiveness, interdisciplinary teams need to be integrated to include the person at risk of or with a pressure injury (as the first team member) along with their families and departments such as purchasing and housekeeping.

Pressure injuries are expensive. The lowest cost for treating a deep-tissue injury or Stage 1 or 2 wound is $2,450 per month, while an uncomplicated Stage 3 or 4 is $3,616 per month.[6] Pressure injuries complicated by osteomyelitis cost $12,648 per month to treat.[6] The equipment and interventions required to prevent pressure injuries are less expensive than the cost of treatment.[7] The number of pressure injuries in a setting can be multiplied by the appropriate monthly cost per stage to determine the total cost of treatment per month in a setting. Explicitly identifying this cost may help with the advocacy for pressure injury prevention programs and equipment.

In one study the cost of treatment for individuals over 65 who were admitted to hospital with a pressure injury was compared with individuals over 65 who acquired a pressure injury while in the hospital.[8] Costs to treat pressure injuries that were present prior to admission ranged from $11,000 for a Category/Stage 3 pressure injury to $18,500 for a Category/Stage 4 pressure injury.[8] Hospital-acquired pressure injury

Stage or Category?

The EPUAP classifies pressure injuries in categories while the NPUAP classifies pressure injuries in stages. The terms *category* and *stage* are used interchangeably when discussing pressure injuries.

treatment costs ranged from $44,000 for Category/Stage 2 to $90,000 for Category/Stage 4.[8] Where pressure injuries were the primary reason for admission to the hospital, the mean cost of hospitalization was $23,922 ± $54,367 and ranged between $1,247 and $597,363.[8]

Although pressure injury prevention has had increased attention in recent years, Vanderwee et al. found that "only 10.8% of the patients at risk received fully adequate prevention in bed and while sitting."[9] At the same time, "more than 70% of the patients not at risk received (some) pressure ulcer prevention while lying or sitting."[9] Overall, the authors suggest "the biggest improvement can be gained in prevention interventions while sitting and the prevention specific for heels."[9] This study points to the importance of assessing individual patients to ensure pressure management resources are used appropriately to prevent pressure injuries.

The recommendations that are included in this paper are based on the best available evidence and are intended to support the clinician and integrated team in planning and developing best practices in the prevention and management of pressure injuries (see "Best Practice Recommendations for the Prevention and Management of Wounds" for a discussion of the evidence). [10] The interprofessional team of authors engaged in synchronous and asynchronous collaboration using a variety of online tools. This collaborative process fostered rich discussion of the literature and its applicability to practice at the bedside. The depth of these discussions is reflected throughout this paper.

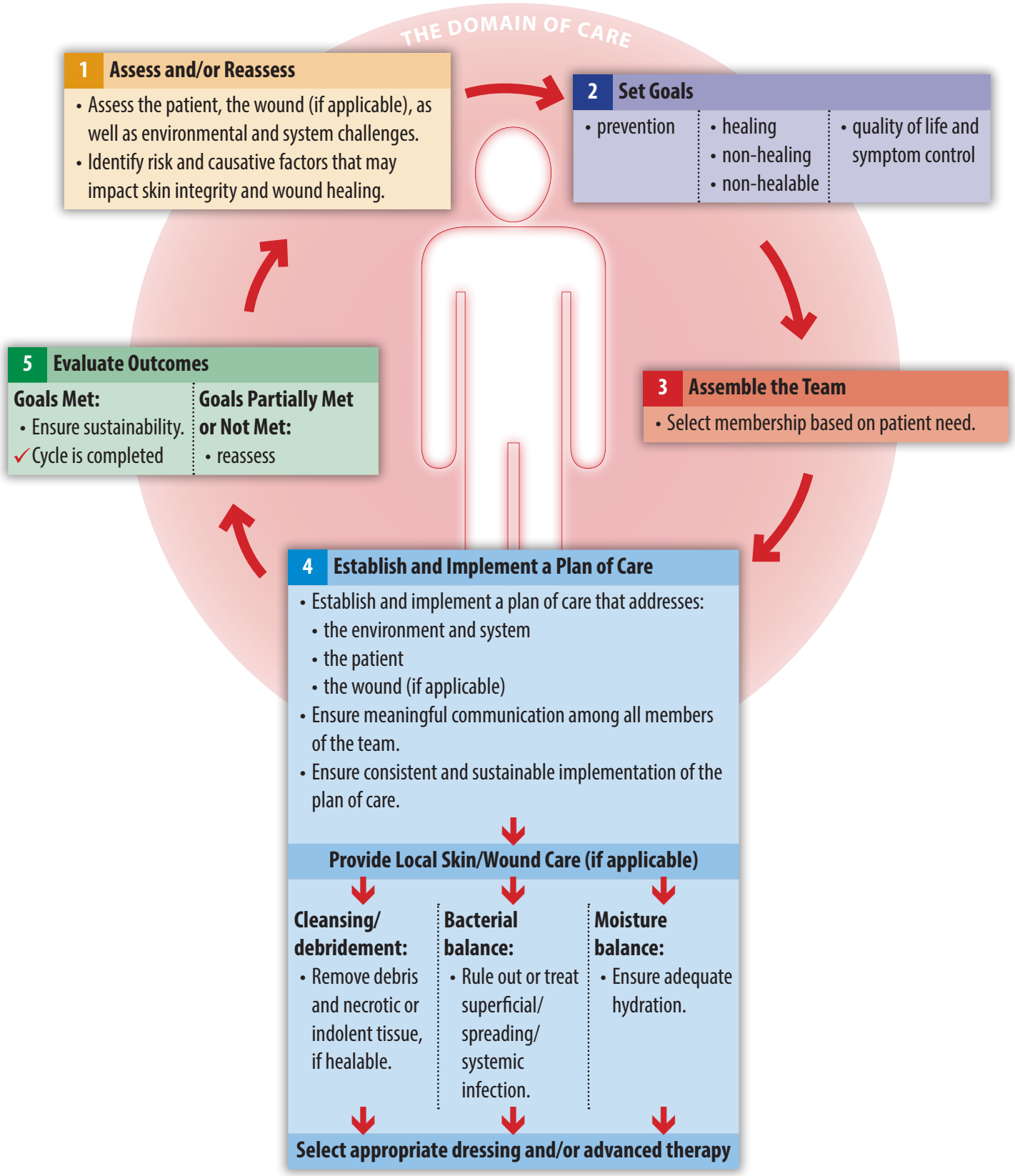
The Wound Prevention and Management Cycle

This paper offers a practical, easy-to-follow guide incorporating the best available evidence that outlines a process, or series of consecutive steps, that supports patient-centred care. This process, called the Wound Prevention and Management Cycle (see Figure 1) guides the clinician through a logical and systematic method for developing a customized plan for the prevention and management of wounds from the initial assessment to a sustainable plan targeting self-management for the patient.

"Pressure Ulcer" or "Pressure Injury"?

In May 2016, the National Pressure Ulcer Advisory Panel updated the term *pressure ulcer* to *pressure injury*. This update was done to clarify that both Category/Stage 1 and Deep Pressure Injuries refer to intact skin.[11,12] The definitions of the categories of pressure injuries were changed slightly by the revision.[13] In this document, the term *pressure injury* is considered synonymous with *pressure ulcer* and is used throughout the document except when directly quoting previously published literature.

Figure 1: The Wound Prevention and Management Cycle



The recommendations in this document are based on the best available evidence and are intended to support the clinician, the patient, his/her family and the health-care team in planning and delivering the best clinical practice. Two foundational papers supplement this document with additional evidence-informed information and rec-

ommendations that are general to all wound types: "Skin: Anatomy, Physiology and Wound Healing,"[14] and "Best Practice Recommendations for the Prevention and Management of Wounds."[10]

There are three guiding principles within the best practice recommendation papers (BPRs) that support effective prevention and management of skin breakdown:

1. the use of the Wound Prevention and Management Cycle regardless of the specifics to prevent and manage skin breakdown
2. the constant, accurate and multidirectional flow of information within the team and across care settings
3. the patient as the core of all decision making

Quick Reference Guide

The quick reference guide (QRG) (see Table 1) provides the recommendations associated with the five steps in the Wound Prevention and Management Cycle (see Figure 1). These recommendations are discussed with the supporting evidence.

Table 1: Wound Prevention and Management Quick Reference Guide

Step		Recommendation	Evidence
1	**Assess and/or Reassess**	1.1 Select and use validated patient assessment tools. 1.2 Identify risk and causative factors that may impact skin integrity and wound healing. 1.2.1 Patient: Physical, emotional and lifestyle 1.2.2 Environmental: Socio-economic, care setting, potential for self-management 1.2.3 Systems: Health-care support and communication 1.3 Complete a wound assessment, if applicable.	Ia – IV Ia – IV Ia – IV
2	**Set Goals**	2.1 Set goals for prevention, healing, non-healing and non-healable wounds. 2.1.1 Identify goals based on prevention or healability of wounds. 2.1.2 Identify quality-of-life and symptom-control goals.	Ia – IV
3	**Assemble the Team**	3.1 Identify appropriate health-care professionals and service providers. 3.2 Enlist the patient and their family and caregivers as part of the team. 3.3 Ensure organizational and system support.	IV IV IV
4	**Establish and Implement a Plan of Care**	4.1 Identify and implement an evidence-informed plan to correct the causes or co-factors that affect skin integrity, including patient needs (physical, emotional and social), the wound (if applicable) and environmental/system challenges. 4.2 Optimize the local wound environment aided through 4.2.1 Cleansing 4.2.2 Debriding 4.2.3 Managing bacterial balance 4.2.4 Managing moisture balance 4.3 Select the appropriate dressings and/or advanced therapy. 4.4 Engage the team to ensure consistent implementation of the plan of care.	IV Ia – IV Ia – IV Ia – IV
5	**Evaluate Outcomes**	5.1 Determine if the outcomes have met the goals of care. 5.2 Reassess patient, wound, environment and system if goals are partially met or unmet. 5.3 Ensure sustainability to support prevention and reduce risk of recurrence.	IV Ib – IV IV

Each recommendation above is supported by the level of evidence employed by Registered Nurses' Association of Ontario (RNAO) guideline development panels (see Table 2). For more detailed information refer to the designated references.

Table 2: Levels of Evidence[16]

Ia	Evidence obtained from meta-analysis or systematic review of randomized controlled trials.
Ib	Evidence obtained from at least one randomized controlled trial.
IIa	Evidence obtained from at least one well-designed controlled study without randomization.
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study.
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Used with kind permission from the Registered Nurses' Association of Ontario.

Key reference documents include:

- Registered Nurses' Association of Ontario. Best Practice Guidelines for Risk Assessment and the Prevention of Pressure Ulcers; 2011.
- Registered Nurses' Association of Ontario. Assessment and Management of Pressure Injuries for the Interprofessional Team, Third Edition. Toronto, ON: Registered Nurses' Association of Ontario; 2016.
- National Pressure Ulcer Advisory Panel/European Association of Pressure Ulcer Panel Pressure Ulcer Prevention Guidelines, 2009.
- National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Australia; 2014.
- Wound Ostomy and Continence Nurses Society Guidelines for the Prevention and Management of Pressure Ulcers; 2010.
- Association for the Advancement of Wound Care Pressure Ulcer Guideline; 2010.
- Bolton LL, Girolami S, Corbett L, van Rijswijk L. The Association for the Advancement of Wound Care (AAWC) Venous and Pressure Ulcer Guidelines. Ostomy/Wound Management. 2014;60(11):24–66.
- AORN (Association of peri-Operative Registered Nurses Association). Best Practices for Preventing Hospital Acquired Pressure Injuries in Surgical Patients. AORN. 2011;29.

Step 1: Assess and/or Reassess

Step 1: Assess and/or Reassess

Recommendations

1.1 Select and use validated patient assessment tools.

Discussion: The use of pressure injury prevention recommendations based on a risk assessment has demonstrated effectiveness in reducing the incidence of pressure injuries.[17] Expert opinion clearly supports the use of validated pressure injury risk assessment tools (e.g., Norton, Braden, Waterlow, Gosnell, SCIPUS) but controversy exists over which tool is best suited to a particular care setting.[18] In any case, expert opinion recommends the consistent use of a specific validated tool and the development of care plans based on the subscale scores that identify factors that put the person at risk for pressure injury development.[19,20] As well as the extrinsic risk factors that are addressed by the risk assessment tools, clinical judgment is required to assess for intrinsic risk factors that include physical, psychosocial and medical conditions.[7] Factors such as neurological deficits, advanced age, hydration status, peripheral vascular disease and level of consciousness must also be taken into account.[7]

Other assessment tools may be required based on the needs of the person with a pressure injury, such as those with spinal cord injury, in critical care or in perioperative areas. No matter what assessment tool or scale is chosen, the same measurement should be used for subsequent assessments for ongoing comparison.

Nutritional screening: Nutritionally compromised patients can be assessed using a validated nutritional screening tool such as the Mini-Nutritional Assessment – Short Form, the Canadian Nutrition Screening Tool, the Malnutrition Universal Screening Tool or the Malnutrition Screening Tool.[21]

Pain assessment: Pain scales provide a systematic approach for assessing and addressing the factors that are causing or exacerbating wound-related pain (such as ischemic damage due to unrelieved pressure, shear and friction).[22,23] There is no one pain scale deemed universal and useful for all individuals; however, changes in pain levels may indicate a need to reassess the choice and timing of analgesics and/or other interventions used in pain management.[18,24]

Quality-of-life assessment: Pressure injuries that are non-healing or slow to heal may have a significant impact on the patient's quality of life. Use of a validated quality-of-life (QoL) assessment tool may be beneficial to identify potential barriers and patient lifestyle issues that may interfere with positive participation in the plan of care.[18]

1.2 Identify risk and causative factors that may impact skin integrity and wound healing.

Discussion: Assessment is the foundation for providing the correct treatment.

1.2.1 Patient: Physical, emotional and lifestyle

Discussion: Clinicians must complete a comprehensive patient history to determine general health status, comorbidities and risk factors that may lead to pressure injury formation or that may affect the healing of existing wounds. To facilitate consistent implementation of strategies for pressure injuries, patient levels of risk and additional risk factors must be communicated with all team members. Strategies to communi-

Pressure is defined as "the force per unit area exerted perpendicular to the plane of interest."[7,25] **Shear** is defined as "the force per unit area exerted parallel to the plane of interest."[7,25,26]

From a clinical perspective, friction tends to hold the skin in place, enabling the shearing of the bony prominence against the inside of the skin.[27]

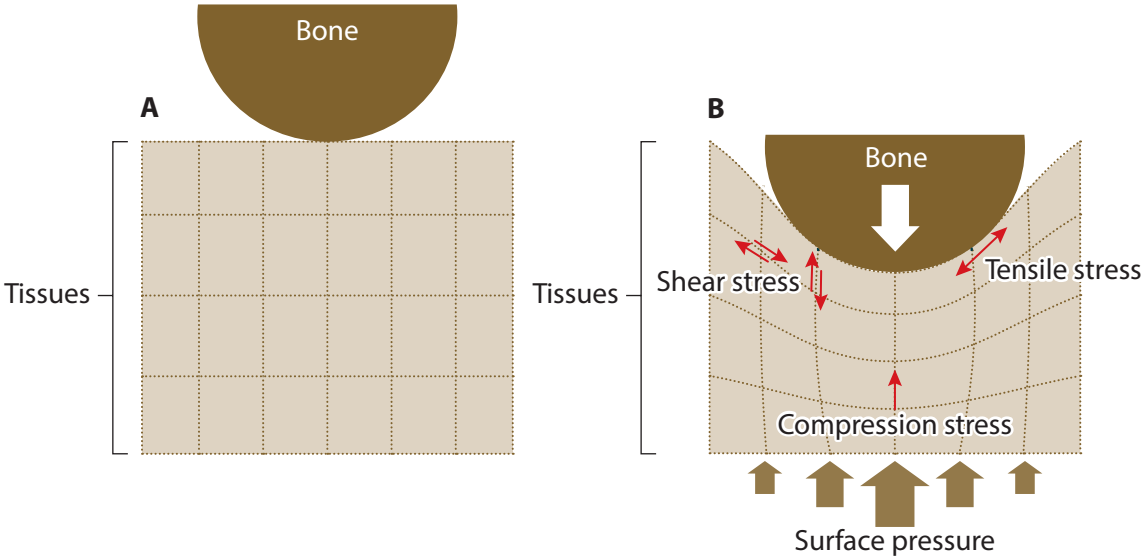
cate risk include but are not limited to unit huddles/rounds, patient safety boards, identifying patients with an armband and email alerts.

Physical Assessment

Pressure and shear injury: Clinicians must assess for potential sources of pressure and shear injury by evaluating the patient's posture, activities, mobility, lifestyle and current support surfaces such as sleeping and sitting surfaces.

Pressure is recognized as the main factor in the development of pressure injuries, with pressure three to five times higher internally near a bony prominence. The role of shear force is equally as important to understand. Shear can be described as the deformation of tissue by two oppositely directed parallel forces, such as what happens with patients slipping down in bed. Figure 2 demonstrates how pressure alone also contributes to shear strain in the tissue as the tissue deforms around the shape of the bony prominence.[28] The addition of shear forces doubles the impact of pressure.[29]

Figure 2: Tissue Distortion Due to Pressure



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An assessment to determine the forces occurring on all sleeping and sitting surfaces and during all transitions (e.g., transfers, sitting up in bed) will identify the priority areas for intervention.[30,31]

Friction injuries are often misdiagnosed as pressure injuries. An analysis of the literature by Brienza identified that friction contributes to shear strain in deeper tissues, which is identified as a factor in the development of a pressure injury.[32] Tissue damage from friction is related to excessive cell deformation and not ischemic pressure injury in the superficial layers of the skin. Therefore friction alone is not a direct cause of a pressure injury. Friction is identified as a "risk factor that may contribute to, or exacerbate pressure injury development due to the shear it creates."[32] Thus shear has been identified as a "primary causative factor" contributing to pressure injury development and friction has been eliminated from the current NPUAP definition of pressure injury.[32]

Nutrition screening using a validated tool for the appropriate clinical setting should be undertaken for all individuals with pressure injuries to identify those at risk for poor healing due to nutritional problems.[7] Lack of optimal nutrition and hydration status may interfere with treatment effectiveness for people with pressure injuries.[33]

In addition to using validated nutritional screening tools, it is important to review blood work for signs of compromised nutritional status. A comprehensive assessment utilized to screen participants with Category/Stage 2, 3 and 4 pressure ulcers in a randomized controlled trial by Houghton et al. identified a decreased healing potential when the number of abnormal blood values increased and a higher rate of non-healing over a six-month period for those with two or more abnormal blood values (even mildly abnormal).[33,34] This study highlighted the value of blood analysis as an effective tool to assist in the identification of nutrition-related barriers that negatively impact pressure injury healing.[33]

Determining the level of hemoglobin and conducting vascular studies in relevant cases can be beneficial. The presence of low hemoglobin and the presence of more than one wound can be risk factors for delayed wound healing.[35] Having two or more low hematological values is also thought to be indicative of delayed wound healing.[34]

Table 3: Blood Screening for Nutritional Barriers to Wound Healing

Suggested blood screen to identify nutrition-related barriers to pressure injury healing[33]	**Screening for**	**Normal values**
Complete blood count (CBC)	Hemoglobin(g/L)	123 – 174
Iron status screening: ferritin, serum iron, % saturation, TIBC (total iron binding capacity): (assess for iron deficiency anemia)	Ferritin: (µg/L)	41 – 300
	Serum iron: Fe (µmol/L)	11 – 32
	Sat %	0.20 – 0.65
	TIBC (µmol/L)	45 – 82
CRP, ESR: (inflammation/infection – anemia of chronic disease)	CRP (mg/L)	< 0.8
	ESR (mm/hour)	< 6 ≤ 10
Prealbumin/albumin: severity of illness/injury and risk for malnutriton	Prealbumin (mg/L)	180 – 450
	Albumin (g/L)	35 – 50
BUN, creatinine: assess for dehydration and kidney function	BUN (mmol/L)	2.5 – 8.0
	Creatinine (µmol/L)	50 – 120
Fasting blood glucose (FBG) and **glycosylated hemoglobin** (HgbA1C): assess for hyperglycemia/ diabetes	FBG (mmol/L)	3.3 – 5.8 (39)
	HgbA1C	4 – 6 %
Thyroid function: assess for hypothyroidism	TSH (mU/L)	0.4 – 5.00

Incontinence-associated dermatitis (IAD) and pressure injuries may co-exist, and therefore a thorough assessment is essential to differentiate the etiology of a pressure injury, IAD or other skin conditions, thus enabling appropriate management strategies.[36] In 2015 a Global Expert IAD Panel used the following descriptor to differentiate IAD from pressure injuries: "IAD is a 'top down' injury, i.e., damage is initiated on the surface of the skin, while pressure ulcers are believed to be 'bottom up' injuries, where

damage is initiated by changes within soft tissue."[37] It is important that clinicians "determine the type of fecal or urinary incontinence based on symptoms and history; consider onset, duration, aggravating and relieving factors."[38]

Skin assessment relies on clinical observation and visual inspection as described in the following table.

Table 4: Differential Diagnosis of Pressure Injury and IAD[37]

	Pressure Injuries (Category/Stage 1)	Pressure Injuries (Category/Stage 2)	Incontinence-associated Dermatitis
Location	Over bony prominence or sites exposed to external pressure and shear, or associated with a medical device	Over bony prominence or sites exposed to external pressure and shear, or associated with a medical device	May be localized to the perineum, perigenital areas or generalized to include buttocks; gluteal fold; medial and posterior aspects of upper thighs; lower back; may extend over bony prominence
History	Exposure to pressure, shear, immobility	Exposure to pressure, shear, immobility	Urinary and/or fecal incontinence
Pain (for those with intact sensation)	Burning, itching, warmth	Burning, pain	Burning, itching, tingling, pain
Odour	None	Unlikely	Fecal or urine
Characteristics	Intact skin with distinct area of non-blanchable erythema	Shallow open area with distinct edges or margins	Area is diffuse with poorly defined edges with superficial, partial-thickness skin loss or may be intact skin with blanchable or non-blanchable, blotchy erythema
Periwound skin	Intact	Intact	Irritated, red
Infection	Rare	Rare, although secondary soft tissue infection may be present	Secondary superficial skin infection such as candidiasis may be present
Improvement	Pressure redistribution	Pressure redistribution	Control/containment of incontinence, effective skin protection

Surgical considerations: If surgery is being considered for closure of a pressure injury, a pre-operative assessment should be conducted, including management of underlying medical conditions, optimizing nutritional and hydration status, smoking cessation, bowel regulation, management of spasticity/contractures and presence of or management of infection.[39] The patient's ability to adhere to the post-operative medical requirements and rehabilitation processes must be assessed before surgery is offered. These include, but are not limited to: post-operative protocols for pressure redistribution and progressive seating, as well as readiness for tertiary prevention of pressure injuries.

Emotional Assessment

Pressure injuries negatively affect quality of life (QOL).[40–43] Effects on QOL differ between partial-thickness and full-thickness tissue injuries.[44] A psychological and QOL assessment should be conducted to assess the impact of the pressure injury on the QOL for the patient and their family/caregivers. This assessment will assist in determining their goals, along with their ability and determination to participate in the plan of care.[40] If a pressure injury is deemed healable, commitment of the person with a pressure injury and caregivers is crucial in achieving successful outcomes in a timely, resource-efficient manner. As with all parameters of a complete assessment it will ultimately guide the plan of care.

Assessment needs to identify if the patient has multiple unmodifiable factors such as achieving a balance between the need for total offloading (bed-rest) and social, physical and psychological needs, recognizing that bed-rest can cause psychological and physical harm and social isolation.

Lifestyle: The importance of the lifestyle choices the person with a pressure injury makes regarding pressure injury prevention and management practices cannot be overstated. Clark et al. summarize the impact of lifestyle choices on pressure ulcer risk: "Every person sculpts a unique existence that reflects an interconnected network of psychological traits, goals, values, preferred activities, environmental opportunities and challenges, habits, routines, and personal health practices.[45] Embedded in the context of his or her daily activities and concerns, each individual has a distinctive pattern of pressure ulcer risk."[45]

Lifestyle factors should be considered when identifying risk for the development of pressure injuries. Jackson et al. have identified six factors that influence the development of pressure injuries in people with spinal cord injuries.[46] These factors include perpetual danger (of developing a pressure injury), change or disruption of routine, decay of prevention behaviours, lifestyle risk ratio, individualization, simultaneous

presence of awareness and motivation, lifestyle trade-off and access to needed care, services and supports.[46]

An assessment of daily activities, life goals, habits and routines, in addition to the devices and care available, is required to identify the person's pattern of pressure injury risk. A thorough assessment enables the health-care provider to work with the person with the pressure injury to identify realistic ways to reduce the risk of further pressure injuries.

Risk Assessment for Special Populations

Assessment of certain categories of patients requires that the clinician be aware of and assess for specific factors that may increase risk for skin breakdown or affect healing of pressure injuries.

Risk for the elderly and vulnerable: Advancing age has been identified as a predictor of pressure-related injuries due to the gradual decline of general nutritional and mental status, decreased mobility, sensory perception deficits, incontinence and the changing characteristics of the skin such as decreased elasticity.[47]

In nursing home residents with non-blanchable erythema, pressure injury risk is increased for those with hypotension, contractures or a history of cerebral vascular accident, while those with urinary incontinence have a decreased risk of developing a pressure injury, perhaps in relation to the increased movement and positioning while care is being provided.[48] Being aware of the increased risks can assist clinicians to target high-risk individuals for prevention programs.[48]

Risk for the patient with a spinal cord injury: Due to the lifelong risk of developing a pressure injury, patients with a spinal cord injury require frequent expert assessment from an integrated team to prevent and manage pressure injuries.

Risk for the patient in critical care: Pressure injury incidence and prevalence rates remain higher in critical care areas due to the numbers of severely compromised patients.

Risk for pediatric populations: Various pediatric risk assessments tools exist. However, due to the variation of pressure injury risk factors within the wide range of the pediatric population—from neonates to infants and children—a valid PI risk assessment tool with validated cut-off points is still not available.[49] Further adding to this risk assessment complexity is the child's communication level, developmental status and ability to properly differentiate pressure from other sensory perceptions of medical devices. According to Schluer et al.,"in line with clinical expertise in the field of PU development in children, it is more reliable to focus on different risk populations, such as children hospitalized in a PICU, and also to assess equipment-related factors contributing to the development of PUs."[49]

While the presence of medical devices is a specific risk factor in all age groups, limited activity, mobility and skin sensitivity are additional risk factors for this patient population. A comprehensive assessment should therefore include a pressure injury risk assessment and a head-to-toe skin assessment, including areas under splints, braces, traction boots, tracheostomy plates and arm boards.[50]

Risk for bariatric populations: Although the precise relationship between obesity and pressure injury development is unclear, maceration, inflammation and tissue/skin necrosis are reported in large and deep skin folds in severely obese patients. Literature reports that both increased tissue weight and fragile vascular and lymphatic frameworks subject the skin and tissues to ensuing complications.[40]

It can be challenging to assess skin and visualize all bony prominences. Skin areas under the pannus such as the hips, pubis, trunk and thighs require assessment, as the weight of the pannus can precipitate pressure injuries. Pressure injuries need to be differentiated from intertriginous dermatitis.[47]

Risk for surgical patients: Surgical patients have an especially high risk of developing intra-operative pressure injuries due to the prolonged pressure from immobility during the intra-operative and immediate post-operative periods. Additional risk factors may include: duration of time patient was immobilized before surgery, length of surgery, hypotensive episodes during surgery, low core temperature during surgery and reduced mobility on day one post-operatively.

Risk for patients at end of life: In many terminally ill patients, multiple factors and co-morbid conditions increase their risk for the development of pressure injuries and need to be identified.[51]

1.2.2 Environment: Socio-economic, care setting, potential for self-management

Discussion: People who are at risk for or who have a pressure injury often have other co-morbidities, including disabilities such as mobility impairments. People with disabilities are often underemployed in Canada when compared with Canadians without a disability. Fewer than half of people aged 25 to 64 with a disability are employed.[52] Furthermore, over 12% of people with disabilities have been refused a job because of their disability, with that figure rising to 33% for those with a severe or very severe disability.[52] People with disabilities who are employed tend to earn less than their non-disabled co-workers.[52] The underemployment of people with disabilities has a direct impact on treatment plans, as they may not have the resources to pay for additional equipment or care.

Care is shifting away from institutions to the community, with over two million Canadians with disabilities receiving care at home. Most people (88%) receive at least some care from family and friends, while only 12% rely on professional services alone. For those receiving some care from family and friends, 70% have more than one person helping them.[53] Given these statistics, assessing the risk for pressure injuries and implementing appropriate treatment plans present unique challenges. Self-management, sometimes through the ability to direct others, becomes critically important. People at risk for pressure injuries or who have pressure injuries need to be able to identify and manage their own risks related to pressure injuries, as well as implement treatment plans.

1.2.3 Systems: Health-care support and communication

Discussion: A systematic review by Sullivan identified key recommendations for in-facility health-care delivery to prevent hospital-acquired pressure injuries.[54] Findings suggested that the "integration and implementation of multi-component core initiatives (bundles) for pressure ulcer prevention improved processes of care and reduced pressure ulcer rates in acute and long-term care settings."[54] Also identified were "key components of successful implementation, including: a focus on accounta-

bility with continued measurement of performance, simplification and standardization of pressure ulcer-specific interventions and consistency in staff training related to documentation, involvement of multidisciplinary teams and leadership, identification of designated skin champions with staff having autonomy for interventions, ongoing staff education, and sustained focused audits with feedback and recognition of front line staff successes."[54] In addition, recommendations for performance measurement to sustain improvements included embedding quarterly prevalence and incidence studies using validated collection tools into "assessments of risk/quality and professional practice, and continually monitoring all hospital-acquired pressure ulcers."[54]

A review of the literature by the RNAO identified that the review of patient records did not provide valid and reliable data about pressure injuries and often under-predicted prevalence rates. It recommended that more attention be focused on the quality of documentation of the data to enable the reliable use of the electronic patient record

for data collection in the future.[7] Additional quality indicators such as the "Required Organizational Practices" identified by national accreditation organizations were also recommended as a method to monitor outcomes.[7]

The Pressure Ulcer Awareness and Prevention Program (PUAP), a continuous quality improvement (CQI) program implemented in Canadian institutions, demonstrated a reduction rate up to 57% (prevalence) and 71% (incidence).[55]

According to Bales et al., program sustainability requires assessment to determine if there is support through strong leadership, involvement of staff in decision-making and a desire to foster interdisciplinary relationships.[56]

1.3 Complete a wound assessment, if applicable.

Discussion: The RNAO recommends "a comprehensive head-to-toe skin assessment be carried out with all clients at admission, and daily thereafter for those identified at risk for skin breakdown. Particular attention should be paid to vulnerable areas, especially over bony prominences and skin adjacent to external devices."[16]

The frequency of a comprehensive skin assessment after initial assessment depends on policies of the care setting. A thorough examination of bony prominences, folds, perineal and perigenital area, and under medical devices is recommended. Evaluation tools and approaches for skin damage such as high-resolution ultrasound[57] and measuring subepidermal moisture[58] have been developed—and there are studies in progress—but currently there is not enough evidence to recommend implementation into clinical practice.[59]

Health-care providers should assess and determine the category/stage of the pressure injury according to the 2016 NPUAP revised staging definitions.[11] The categories Unclassified/Unstageable and Deep Tissue Injury should continue to be used. Categorizing pressure injuries from 2 to 4 is preferred to the use of the terms *staging* or *grading,* which tends to indicate a hierarchical progression,[7,60] which is not always the case. Accurate categorization of pressure injuries is essential for treatment planning, data collection and financial reimbursement.[61,62] The NPUAP recommends that pressure injuries be categorized/staged according to the depth of original injury and not be categorized/staged in reverse as healing occurs. That is, a pressure injury that was originally identified as a Category/Stage 4 would be classified as a healing Category/Stage 4 pressure injury as healing progresses.[63] Visual inspection to identify/classify pressure injuries in darkly pigmented skin is a challenge and is often inaccurate, requiring assessment for differences in skin temperature, colour, consistency and pain.[20,60,64] Wounds that are not pressure injuries should not be classified using NPUAP criteria. It is essential to differentiate pressure injuries from various other wound etiologies such as arterial ulcers, neuropathic ulcers, skin tears and incontinence-associated dermatitis.[51]

Pressure injuries need to be assessed on admission to the care setting and at least weekly thereafter.[20,60,65,66] The MEASURE (measure, exudate, appearance, suffering, undermining, re-evaluate, edge) mnemonic[67] captures many of the key parameters essential for pressure injury assessment.[40,68] Validated and reliable assessment tools that can detect progress toward healing and provide valuable information to direct treatment decisions should be used.[20,60,69–71]

Such tools include the Pressure Ulcer Scale for Healing (PUSH)[72] and the Bates-Jensen Wound Assessment Tool (BWAT).[26] Although the BWAT demonstrated excellent reliability when used by nurses with special training in wound assessment and has undergone some testing that identified that the total BWAT score may be useful in predicting outcomes, more research is required to determine its predictive validity.[73] The revised Photographic Wound Assessment Tool (PWAT)[26] is a valid and reliable tool to assess chronic wounds of various etiologies using digital images, but it has not been tested to determine if it is responsive to changes in wound status over time.[74] If available, serial photography using a standardized technique and/or reliable validated electronic data collection devices can also provide valuable information to assist with wound assessment.[60]

Although there are several wound assessment tools available, none of the 10 tools reviewed by Pillen et al. were found to be valid in all required criteria (validity, reliability and sensitivity).[75] The Pressure Ulcer Scale for Healing (PUSH) and Pressure Sore Status Tool (PSST), also known as the Bates-Jensen Wound Assessment Tool (BWAT), showed the strongest scores for responsiveness.

Assessment tools specific to special populations, such as those with spinal cord injuries, have been developed to ensure population-specific information is considered. Thomason et al. introduced the Spinal Cord Impairment Pressure Ulcer Monitoring Tool (SCI-PUMT) to improve the outcomes of assessment and treatment of pressure injuries in patients with spinal cord injuries or disorders.[76] One validated tool presently used to measure healing with spinal-cord-injured patients is the Photographic Wound Assessment Tool (PWAT), which shows reliability and validity with other measures of healing.[77]

Khoo and Jansen performed a literature search on types of wound measurement techniques between 2000 and 2014.[78] A comparison of measurement techniques (ruler, digital planimetry, acetate tracings/contact planimetry, as well as laser and structured light devices) revealed digital planimetry provided the best precision and reliability over ruler and acetate tracings. The use of laser and structured light requires more study. Institutional resources must be considered when introducing an organizational standard for practice.

The clinician must be able to identify when bacterial damage is occurring and differentiate between superficial, spreading and deep infection or abnormal persistent inflammation in order to create a plan of care that will provide the appropriate treatment. Accurate identification of the microbial load and causative organisms within the wound is best achieved by tissue biopsy or by the Levine quantitative swab technique.[18]

A bone biopsy is recommended to diagnose osteomyelitis if there is clinical suspicion of osteomyelitis.

Step 2: Set Goals

Step 2: Set Goals

Recommendations

2.1 Set goals for prevention, healing, non-healing and non-healable wounds.

Discussion: Pressure injury prevention should be considered a patient safety goal. Because of the increased acuity of elderly patients admitted and decreased lengths of stay in the hospital, 15% of elderly patients will develop pressure injuries within the first week of hospitalization. For those admitted to long-term care, pressure injuries are most likely to develop within the first four weeks.[79] The mortality rates associated with pressure injuries are as high as 60% for older persons with pressure injuries within one year of hospital discharge.[80,81]

2.1.1 Identify goals based on prevention or healability of wounds.

Discussion: Treatment goals must reflect prevention and/or the overall healing ability of the wound. In order to assist clinicians in setting realistic goals, wounds can be classified as healing, non-healing or non-healable.

The efficacy endpoint of a pressure injury may be classified as complete healing or surrogate endpoints and both must be considered when the team sets goals and develops a plan of care to meet the goals. It is important to be cognizant of surrogate endpoints to measure outcomes of the pressure injuries management plan. Surrogate

markers are the endpoints that occur early in the course of treatment and are predictive of healing. Decrease in wound size and alleviation of smell, discharge and pain are examples of endpoints that are critical for the person with a pressure injury and caregiver. To have consistent and quantifiable goals and objectives, the endpoints should be measurable, repeatable and specific, with interrater reliability.[82]

Once a person has developed a pressure injury, healability will depend on the ability of the team to modify both the intrinsic and extrinsic factors. A goal of wound closure may not be realistic when factors that impair wound healing are present, such as poor perfusion, malnutrition, malignancies, unmanageable co-morbidities and/or lack of adherence to the plan of care.[20,60] Preventing or healing a pressure injury may be improbable, and these wounds may be classified as non-healing or non-healable.[40,68]

Table 5: Intrinsic and Extrinsic Factors that Affect Pressure Injuries[16]

Extrinsic (External) Risk Factors
Hygiene
Living conditions
Medications
Pressure
Friction
Shear
Clothing/garments
Moisture
Transfer type/quality
Transfer slings
Restraint use
Support surfaces
Intrinsic (Internal) Risk Factors
Nutritional status (malnutrition and dehydration)
Reduced mobility/immobility
Involuntary movements
Posture/contractures
Neurological/sensory impairment
Incontinence (urinary and fecal)
Extremes of age
Level of consciousness
Acute illness
History of previous pressure damage
Vascular disease
Severe, chronic or terminal illness
Pain

It is important to determine the adequacy of blood supply to support healing, especially for ulcers on the lower extremities.[40,68] When contributing factors cannot be corrected or there is an absence of adequate blood supply, a wound can be non-healable.

Wound closure may also be unrealistic for patients who are terminally ill. Skin Changes at Life's End (SCALE)[83] may develop, so alleviating pain, reducing smell and managing exudate should be primary goals of the plan of care.[40]

2.1.2 Identify quality-of-life and symptom-control goals.

Discussion: Goals need to be established to enhance the patient's quality of life regardless of the healability of pressure injuries.[40] Such goals may be primary ones or surrogate endpoints to improve quality of life.

Comfort is the principal consideration in supportive care and therefore may supersede prevention protocols and wound treatments for actively dying patients and for those who have conditions that cause them to have a single position of comfort.

Step 3: Assemble the Team

Step 3: Assemble the Team

Recommendations

3.1 Identify appropriate health-care professionals and service providers.

Discussion: The etiology of pressure injuries is complex and multifactorial, and as a result requires an integrated team to address the many underlying impairments and contributing factors. Each team member brings a unique body of knowledge but also needs to have a foundational understanding of pressure injuries, except, perhaps, the patient and their family. Team member knowledge can be assessed through tools such as the Pieper Pressure Ulcer Knowledge Test (PPUKT).[18]

The team process requires that all team members work together, not independently of one another, to create a customized plan of care. The comprehensive patient assessment and goal-setting stages will help identify who should be part of the team. Table 6 lists some of the potential members and what they bring to the team.

Table 6: Team Members and their Knowledge and Skills[18]

Team Members	Knowledge and Skill to Address Impairments
Clinician with advanced wound care training	Optimized care planning for management of pressure injuries
Chiropodist/podiatrist	Specialized care of pressure injuries in the foot; pressure offloading; some surgical procedures to eliminate or minimize pressure points on the foot
Diabetes educator	Ongoing education for the management of diabetes to optimize glucose control and enhance healing potential
Enterostomal therapy nurse	Advanced education regarding risk assessment and management of pressure injuries
Infection disease practitioner	Addressing of unresponsive, recalcitrant, or recurrent infection such as osteomyelitis
Nurse practitioner	Primary health care provider; can prescribe medications, order tests, provide referrals
Occupational therapist	Pressure redistribution, activities of daily living assessments, cognitive assessments and interventions, psychosocial assessment, support/counselling, expertise in assessment of pressure redistribution surfaces, including wheelchair seating prescription, shear prevention and management
Pedorthist/orthotist	Pressure offloading for foot and lower extremity pressure injuries as well as bracing for other areas of the body
Personal support worker	Day-to-day personal care of patient; early recognition of Category/Stage 1 pressure injury

cont'd.

Team Members	Knowledge and Skill to Address Impairments
Person with pressure injuries and family/ friends	Experts in their everyday lifestyle, needs and ability to participate in plan of care
Pharmacist	Medication; can optimize management of comorbidities, pain, infection; reconciliation/information/teaching, monitoring for interactions
Physiatrist	Care of persons with SCI; work with rehabilitation personnel
Physical therapist	Pressure redistribution, mobility, safe exercise and reconditioning, adjunctive therapies, wheelchair seating and positioning, shear prevention and management
Physician	Can prescribe medications, order tests, provide referrals, oversee plan of care
Psychologist	Assessment and treatment of mental health issues, coping strategies, quality-of-life issues impacting adherence to the plan of care
Registered dietitian	Assessment and management of nutritional status to ensure optimal nutrition to maintain skin integrity and facilitate healing
RN/RPN	Assessment and management of pressure injuries, dressing changes, administering medication, health teaching and monitoring
Social worker	Psychosocial, spiritual care, psychosocial assessment/social supports (housing, devices, financial resources, etc.) and disposition planning
Speech and language pathologist	Swallowing and communication assessment and recommendations to optimize nutritional intake and quality of life
Spiritual care	Support and counselling for those with slow-to-heal, non-healing and non-healable wounds
Surgeon	Surgical intervention, debridement, flap closure for deep or slow-healing pressure injuries, vascular interventions to improve perfusion to lower limb pressure injuries

3.2 Enlist the patient and their family and caregivers as part of the team.

Discussion: The success of a plan of care for the prevention and treatment of pressure injuries hinges on the collaboration of the person with a pressure injury, their support system and communication among the team of professionals involved in the development of the plan of care. In order to be effective team members, the person with the pressure injury and their support system must have the motivation, capacity, ability and commitment to act, as well as the personal ability to interact effectively with each other.[84]

3.3 Ensure organizational and system support.

Discussion: Health-care organizations need to make available financial and human resources, including relevant consultants and team members as well as time and support for frontline nursing staff and appropriate access to equipment such as moisturizers, skin barriers and therapeutic devices to ensure pressure injury programs are successful.[7] Policies and procedures regarding pressure injury prevention and management also need to be developed, implemented and evaluated regularly.[7]

Organizations need to support appropriate education for staff so they may obtain adequate skills and knowledge to effectively manage the multiple complex issues related to pressure injuries. A needs assessment should be undertaken to identify knowledge gaps and ensure that educational sessions are tailored to meet those needs. Educational sessions need to utilize principles of adult learning, relate to clinical practice and reinforce strategies to sustain knowledge.[85]

Step 4: Establish and Implement a Plan of Care

Step 4: Establish and Implement a Plan of Care

Recommendations

4.1 Identify and implement an evidence-informed plan to correct the causes or co-factors that affect skin integrity, including patient needs (physical, emotional and social), the wound (if applicable) and environmental/system challenges.

Discussion: It is important to establish an interdisciplinary, collaborative, patient-centred treatment plan utilizing an evidence-informed approach that is aligned with the overall goals of care.

A systematic review by Reddy et al. on pressure injury prevention identified that the priority in the prevention of pressure injuries was to identify and address underlying causative and contributing factors rather than focus on local wound care, as she found that the differences between specific treatment strategies were minimal.[86] Focus should be on forces associated with immobility such as shear, friction, temperature and moisture management to effectively reduce the risks of pressure injury development.[86]

Managing Pressure, Friction and Shear

Managing pressure, friction and shear forces is important in any pressure injury prevention and management plan.[28,87] The optimal management of these forces requires an integrated team skilled in the management of pressure, friction and shear within the context of the person's goals and lifestyle. When considering the treatment plan, the focus should be on maintaining mobility while reducing these forces.[28] Treatment expectations may need to be adjusted in the presence of multiple unmodifiable factors such as achieving a balance between the need for total offloading (bed rest) and social, physical and psychological needs.

Utilization of the five As of self-management—(1) assess, (2) advise, (3) agree, (4) assist and (5) arrange—may be a useful technique to assist in the facilitation of "effective collaboration between health-care professionals and persons and their primary caregiver(s) in self-management education."[18]

All patient care facilities across the continuum of care must be able to access the appropriate equipment to meet specific patient needs. Helpful equipment may include repositioning sheets, a trapeze bar, support surfaces in bed, a fitted wheelchair with a pressure management cushion and other equipment designed to reduce pressure, friction and shear. Regardless of the support surface used, it is important that care providers are knowledgeable regarding the use, maintenance and operation of these devices.[7]

Positioning: For patients with a pressure injury on the buttocks and/or trochanter, mobilization should be a priority. At a minimum, sitting should be encouraged where pressure on the ulcer can be managed[36] to promote mobility and the minimization of bed rest. Bed rest has known complications such as anorexia,

Patients as Partners in Care

There has been a recent shift toward utilizing chronic disease patient self-management principles in the healing of chronic wounds.[88,89] Physical activity is a powerful tool in self-management.[90] Engaging patients in carefully prescribed strengthening and conditioning programs by rehabilitation professionals can be safe and very empowering for patients and their families. The mental and physical benefits of exercise are many, including improved mood, sleep patterns, appetite, strength and endurance.[91] These positive effects lead to improved functional status.

decreased executive functioning, de-conditioning and potential pulmonary emboli.[92] There are no randomized controlled trials (RCTs) that indicate that bed rest is effective in the treatment of pressure injuries.[92] Confining patients to bed often results in the person positioning the head of the bed at greater than 30 degrees for important activities such as eating, sponge bathing and visiting with family. Managing pressure, friction and shear throughout activities of daily life likely results in an improved quality of life for the person with a pressure injury and decreases the risk that a pressure injury could develop in fragile tissues.

Factors influencing shear force in bed include body type (slender individuals tend to have the highest shear force at the coccyx and sacrum), whether or not the knee is raised (raising the knees tends to decrease shear) and whether or not the position of the person with a pressure injury (bending points) in a supine position matches those of the bed.[93]

Repositioning should also be considered for all those at risk of pressure injury development.[94,95] Personalized repositioning protocols should be based on the patient's tissue tolerance, level of mobility, medical condition, treatment objectives and the existing support surface.[60]

The use of a pressure-redistributing support surface does not eliminate the need for repositioning. Patient positioning and repositioning should be carefully assessed by a physical and occupational therapist. Several positions, such as semi-Fowler with the head of the bed at greater than 30 degrees and sitting in recline, significantly increase the forces of friction and shear experienced by the patient. Elevating the patient's knees in bed prior to bringing the head of the bed up, utilizing tilt rather than recline and ensuring that the patient's feet are supported while sitting can help to decrease these forces.[93] Frequent repositioning is important to relieve pressure on bony prominences but must be done in a manner that minimizes friction and shear by utilizing lifting sheets and positioning wedges. It is also very important that everyone involved in the patient's care is made aware of the patient's risk of tissue injury in order to ensure that safe transfers and adequate safe positioning and repositioning occur.[7]

Transfers in particular should be assessed both at the beginning and end of the day when fatigue may impact the quality of the transfer. There are several tools available to aid in transfers and positioning, including transfer boards, trapezes and slider sheets, all of which help to reduce the forces of pressure, friction and shear. These tools, however, need to be used properly and by trained staff. Improved functional status translates into improved transfers, positioning and bed mobility. These skills are vital for the prevention and treatment of pressure injuries because poorly execut-

ed positioning, transfers or shifts in bed can result in increased tissue injury due to friction and shear.[7] Transfer techniques should therefore be assessed by physical and occupational therapists for all people with pressure injuries and those at risk for developing pressure injuries.[7]

Minimizing head-of-bed elevation and use of turning sheets for repositioning are also recommended.[60] If the patient has received surgical intervention, mobility should be increased gradually from 30-minute sitting intervals to sitting as tolerated over four to eight weeks,[39] according to the surgeon's recommendations and the condition of the skin. OT/PT involvement is beneficial to ensure that the individual is positioned on a pressure-redistributing cushion when sitting in a chair.[60]

The management of heels needs to be considered independently of the support surface.[7] A systematic review by Junkin and Gray found that pressure redistribution surfaces vary in their ability to prevent heel pressure injuries, but there was insufficient evidence to determine which surfaces were optimal.[96] A support surface tool has been developed based on the available evidence to assist clinicians to select the most appropriate support surface based on the person with a pressure injury's risk for developing pressure injuries and their level of mobility.[7,97] Evidence suggests that the use of a wedge-shaped cushion to suspend the heels off the bed is more effective in reducing the incidence of pressure ulcers than the use of a standard pillow.[98] Evidence also suggests that a well-designed heel ulcer prevention program can reduce the incidence of pressure injuries in an acute orthopedic environment.[99]

The effects of friction and shear are enhanced in the presence of moisture, and moisture from incontinence can be a risk factor for pressure injury development.[20] An individualized bowel and bladder program for patients with incontinence should be established,[7] including offering a bedpan or urinal in conjunction with turning schedules.[100]

As with all wound types, the clinician must establish effective pain management strategies to optimize comfort, especially prior to movement and positioning.

Positioning patients for the prevention and management of pressure injuries can be very challenging. The following positioning tips will assist the clinician in preventing or managing pressure injuries.[18]

- Follow a positioning schedule. Position every two to four hours while in bed; weight shift every 15 minutes when sitting.
- Avoid positioning the person with a pressure injury on bony prominences or on existing pressure injuries.
- Limit head of bed elevation greater than 30 degrees if medical condition permits.
- Use pillows or wedges to assist with proper positioning and body alignment. Do not use donut-type devices. Utilize assistive devices (such as bed rails, transfer boards, trapeze bars) to increase the patient's independence and safety with repositioning and transfers.
- Develop a modified sitting schedule based on equipment availability (with tilt/recline functionality), quality-of-life goals and evidence of wound healing.
- Ask an occupational therapist or physical therapist for patient-specific transfer techniques to minimize shearing effects and maintain the patient's independence.

- Inform the patient, family and caregivers about the positioning schedule and proper transferring and weight-shifting techniques.
- Ask an occupational therapist to assess the wheelchair and cushion for at-risk patients and for patients with known pressure injuries on the ischial tuberosities, coccyx or sacral area. Ensure feet are supported.
- Check your sling! Some types of slings are designed to be left under patients, while others are to be removed after transfer.

Managing Moisture of Intact Skin

The management of moisture of intact skin can be applied to all patient populations (see Table 7).

Table 7: Managing Moisture of Intact Skin

Dry skin	▪ Dry skin is a significant and independent risk factor for pressure injury development.[60] ▪ Skin emollients or non-sensitizing fragrance-free and alcohol-free moisturizers (e.g., urea, glycerin, alpha hydroxyl acids and lactic acid) are recommended to maintain supple hydrated skin and reduce the risk of skin damage.
Moisture-associated skin damage (MASD)	MASD is inflammation and erosion associated with skin exposure to mucus and/or saliva, ostomy effluent, perspiration, urine, stool or wound drainage. Erosion is attributable to moisture in the presence of various co-factors such as chemical irritants, mechanical forces and micro-organisms. Principles of prevention and treatment of MASD: ▪ Implementation of an interventional skin care program that removes irritants from the skin, extends the natural barrier function of the skin and protects skin from future contact with irritants is recommended. ▪ Control or diversion of the moisture source is essential. ▪ Utilization of moisture-wicking products or devices that move moisture away from at-risk or compromised skin is essential for preventing secondary cutaneous infection.[101]

cont'd.

Fecal and urinary incontinence	Peri-care is paramount in maintaining skin integrity. ▪ Skin requires cleansing after each fecal incontinence episode because briefs can trap fecal output against the skin and accelerate skin breakdown. ▪ Soft wipes or sprays are recommended to minimize friction that may occur during peri-care. ▪ Application of topical barrier products to protect skin from moisture is recommended.[7] Excessive application of such products may interfere with the absorptive capacity of the incontinence brief. ▪ The co-efficient of friction for wet fabric on skin is more than double that for dry fabric; therefore, the risk for skin breakdown is increased when wet products are in contact with the skin.[28] ▪ Parslow et al. suggest, "briefs are not recommended for long-term fecal incontinence management because of the risk of incontinence associated dermatitis (IAD)."[7] For patients identified with IAD, the use of barrier products containing humectants (urea, glycerin, alpha hydroxyl acids and lactic acid) should be avoided since these products retain moisture in the skin and IAD causes the skin to already be overly hydrated.[20] ▪ Ratliff et al. suggest, "indwelling catheters and fecal management systems may be warranted for brief periods if urine and liquid stool contribute to skin breakdown."[20] ▪ Vigilant monitoring for signs of pressure injury is recommended with the use of incontinence products and devices as they may contribute to increased pressure.[102] Monitoring for pressure injury must be a consideration in care planning and implementation. ▪ Incontinence should not be managed by limitations in fluid and food intake. Monitoring of fluid intake is recommended to prevent dehydration, especially if vomiting, diarrhea, heavily draining wounds, excessive perspiration and other forms of insensible fluid losses occur.[60] ▪ Consultation with an advanced practice nurse and the team is recommended for management of persistent moisture-related skin irritation.
Heavy wound exudate	▪ Use of products or devices capable of containing/wicking exudate to maintain dry periwound skin and prevent maceration is recommended.[7] ▪ Use of protective barrier sprays, creams, ointments or solid barrier sheets is recommended to protect periwound skin from heavy wound exudate. ▪ Wound drains should be assessed frequently to ensure that drainage tubes are not leaking, kinked or blocked.[60]
Skin microclimate	▪ Consideration of therapeutic support surfaces such as mattresses and chair cushions is important to ensure optimal microclimate of the skin.[60] ▪ Incontinence briefs and pads should be compatible with the support surface, and layers of linen minimized or eliminated to ensure optimal microclimate for the skin. ▪ Chair cushions and covers should also be assessed for heat dissipation. Cushions and covers that permit air exchange to minimize temperature and moisture at the buttock interface are recommended.[60]

Specific Information for Care of Special Populations

Care for the elderly and vulnerable: Pressure injury prevention and treatment plans should be developed with consideration of the person's values and goals as well as their cognitive status to promote adherence.[18,47]

Care should include the use of barrier products to protect skin from excessive moisture, protection from medical devices, use of atraumatic wound dressings and the establishment of an individualized continence program. Repositioning (manual handling as well as equipment) and therapeutic support surfaces should address pressure redistribution and reduction of shearing forces.

Care for the patient with a spinal cord injury: Because of the patient's immobility and decreased sensation, the use of seating surfaces, transfer devices and mattress support surfaces are paramount to aid with pressure redistribution.[77]

Care for the patient in critical care: Support surfaces and repositioning are crucial for this vulnerable, largely immobile, patient population. Support surfaces should be selected based on the patient's need for microclimate control, shear reduction, pressure redistribution, turn, assist and percussion.[47]

Patients who cannot be turned for medical reasons should also be evaluated for a therapeutic support surface. According to the NPUAP, "In some instances individuals cannot be safely repositioned due to temporary oral-pharyngeal airway, spinal instability or the risk of fatality due to hemodynamic status. Indications of an individual being too hemodynamically unstable for repositioning include being actively fluid resuscitated to maintain systemic blood pressure, active hemorrhaging, life-threatening arrhythmia, or changes in hemodynamic parameters that do not stabilize with ten minutes of repositioning."[47] Regular repositioning should be implemented as the patient stabilizes.[47]

Repositioning schedules that employ slow, gradual turns should be initiated for each patient with consideration of their current oxygenation and hemodynamic tolerance to position change. For patients who cannot tolerate major changes in body position, small frequent shifts in body position are beneficial to promote reperfusion.[47] Patients should be positioned off pressure injuries as much as possible. The lateral rotation support surface function is not recommended for patients with existing pressure injuries. If the lateral rotation feature of the support bed needs to be used, the patient should be secured with bolster pads to prevent sacral shear.[47] Heels should be floated off the bed surface to reduce pressure injury development. Knees should be slightly flexed to prevent popliteal vein obstruction and avoid pressure over the Achilles tendon.[47]

Care for pediatric populations: The presence of medical devices requires interventions to prevent and address pressure under splints, braces, traction boots, tracheostomy plates and arm boards.[50]

Schluer et al. found increased pressure injuries under blood pressure cuffs, transcutaneous oxygen pressure probes, nasal prongs, CPAP masks and plaster casts.[49]

Individualized pressure injury interventions should be based on the needs of the pediatric patient. Other medical devices such as orthotics, wheelchairs and wheelchair cushions should be frequently reassessed in growing children.

Care for bariatric populations: Due to the increased difficulty obese patients may have with moving, it is important for organizations to have bariatric management strategies to safely optimize manual handling techniques. Friction and shear injuries are increased, as patients often drag their heels and sacrum during transfers. Patients and all other team members should have access to equipment (such as beds, chairs and commodes) with the appropriate size and weight specifications to accommodate the patient's girth.[47]

All skin folds and surfaces should be assessed and addressed regularly, as pressure injuries may also develop over areas of high adipose tissue concentration such as across the buttocks and between skin folds.[47]

Care for patients during peri-operative stage: While specific patient positioning is crucial for access and exposure to the surgical site, special attention is required when positioning the patient on the operating table to protect pressure points during surgery,[60] redistribute pressure and minimize the effects of shearing as much as possible.[103,104] High specification reactive or alternating pressure support surfaces are recommended for patients identified as being at risk. Protection of accessible bony prominences and heel elevation with protection of the Achilles tendon are also recommended.[47]

Care for patients at end of life: While palliative care focuses on symptom management and comfort measures, the prevention of pressure injuries is an important aspect of care. However, during the time of active dying, the patient's wishes for pain control and comfort may outweigh the desire for pressure injury prevention.[47]

Other comfort measures may include skin emollients to maintain adequate skin moisture and prevent dryness. Pre-medicating the person with a pressure injury prior to repositioning, respecting the patient's choices in turning schedules and utilizing a support surface may be beneficial. Hydration goals should be compatible with the patient's condition and wishes.[105]

Wound care for existing pressure injuries should focus on reduction of pain, minimizing odour, managing exudate and other symptoms that may impact quality of life.[47]

The patient's choices regarding turning should be respected and include whether they have a "position of comfort" after an explanation of the rationale for turning. The family and caregivers should be made aware of the goals and plan of care. Social work and spiritual care are important resources to consider for this population.

Management options for wounds that are non-healable because of factors such as an inability to effectively offload sitting pressures for a person with a Category/Stage 4 ischial pressure injury due to restricted finances should focus on the promotion of quality-of-life improvements such as comfort and management of wound symptoms as identified by the patient.

Special Considerations

Medical device-related pressure injuries: The NPUAP states, "Medical device-related pressure injuries result from the use of devices designed and applied for diagnostic or therapeutic purposes. The resultant pressure injury generally conforms to the pattern or shape of the device."[13]

Routine skin inspection should include areas beneath medical devices for edema and potential skin breakdown if not medically contraindicated. Device-related injuries should be categorized/staged according to the degree of tissue injury. All staff members should be educated on the correct size of device to be used and proper positioning and placement of the device based on location, presence of existing pressure injuries and patient's mobility status. High-risk areas such as the nasal bridge should be cushioned with protective dressings.[106]

Mucosal membrane pressure injuries: The NPUAP states, **"**Mucosal membrane pressure injuries are located on mucous membranes with a history of a medical device in

use at the location of the injury. Due to the anatomy of the tissue these injuries cannot be staged."[13]

Mucosal inspection should occur in conjunction with skin assessment and areas of compromised mucosa documented for health-care team awareness and continued monitoring. All staff members should be educated about appropriate anchoring techniques according to anatomical location to prevent friction from movement, shearing and pressure.

Pain: Pain is often considered one of the most problematic aspects of wound management, and pharmacotherapy continues to be the mainstay of pain management.[107] Appropriate agents should be selected based on severity and specific types of pain according to the World Health Organization's analgesic ladder.[108] Some evidence suggests that topical agents (ibuprofen,[109] morphine[107] or dressings) play a role in alleviating wound-related pain.[110]

Surgical management of pressure injuries: Surgical intervention represents an option to close recurrent, multiple or non-healing Category/Stage 3 and 4 chronic pressure injuries provided it is consistent with the goals of care.[39] The decision-making process should be done in collaboration with the person with a pressure injury and the wound care team. Potential risks and benefits must be discussed within the team to ensure that the patient's expectations and condition are understood and optimized prior to surgery. Psychosocial factors that may impact surgical wound healing and the patient's willingness/ability to participate in all post-operative activities must also be considered and addressed prior to surgery.[60]

The focus of post-operative flap care should be protecting the blood supply to the incisions from pressure and tension through the use of advanced pressure redistribution techniques These techniques might include the use of a therapeutic support surface capable of reducing shear and pressure and controlling the microclimate over the operative site.

The recurrence rates for pressure injuries treated with plastic surgery have been reported to be high (13 – 31%) in studies by Kierney et al.[111] and Schryvers et al.[112] However, a more recent review by Sameem et al. showed lower recurrence rates.[113] Currently, the literature does not provide an RCT on the subject and therefore the effectiveness of surgery for the treatment of chronic pressure injuries is unclear.[114]

4.2 Optimize the local wound environment.

4.2.1 Cleansing

Discussion: Optimizing local wound healing is multifaceted. Expert opinion recommends that:

- Pressure injuries and surrounding skin be cleansed[115] using solutions with low toxicity such as saline, water[40,68] or acetic acid (0.5%–1.0%).
- Tap water should not be used for wound cleansing for immune-compromised individuals.
- Irrigation of wounds should be avoided when you cannot see where the solution is going or cannot retrieve/aspirate the irrigation solution.[40,68]
- Cleansing solutions containing surfactants and/or antimicrobials can be effective in critically colonized or infected wounds.[20,60]

4.2.2 Debriding

Discussion: Debridement of healable pressure injuries continues to be recommended. The appropriate method of debridement needs to be determined based on the patient, the wound, the environment, the scope of practice of the person conducting the debridement and the resources available for the various debridement methods (e.g., autolytic, mechanical, enzymatic, biological, sharp/surgical).[40,68] Surgical debridement is recommended in the presence of advancing cellulitis, crepitus, fluctuance and/or sepsis from wound-related infection and considered with the presence of undermining, tunnelling or extensive necrosis.[60] It is recommended that dry, stable eschar on ischemic limbs not be debrided.[60] For non-healable wounds, only conservative debridement should be performed.

4.2.3 Managing bacterial balance

Discussion: Bacterial balance is essential for wound healing. Vowden and Cooper state that wound deterioration or failure to progress toward healing is an indicator of potential wound infection when other potential causes have been managed.[116] Therefore, the rate of healing in conjunction with subtle or overt signs of infection can help to guide intervention decisions.[117]

Standard medical practice for osteomyelitis also includes a prolonged course of antibiotics of at least a six-week duration. If surgical intervention is planned the infected bone should be resected prior to surgical closure.[118]

4.2.4 Managing moisture balance

Discussion: Moisture balance within the wound base can be achieved through dressing selection. Dressings should be selected according to the amount of available moisture within the wound bed and the cause of any excess of wound drainage. An increase in wound exudate may be the result of recurrent trauma, unmanaged co-morbidities such as congestive heart failure or wound infection. These co-morbidities should be addressed.

4.3 Select the appropriate dressing and/or advanced therapy.

Discussion: A systematic review by Clark et al. studied the evidence regarding the use of prophylactic dressings for the prevention of pressure injury. They report that "Several cohort studies, weak RCTs and case series all suggested that the introduction

of a dressing as part of pressure ulcer prevention may assist to reduce pressure ulcer incidence associated with medical devices especially in immobile intensive care unit patients."[119] Silicone dressings, film and foam dressings have been studied for their use as a preventative measure to protect bony prominences for those at risk of pressure injury. Clarke et al. commented on dressings for wound healing by stating they "did not identify clinical evidence that one dressing type was more effective than other dressings."[119] One RCT was identified that suggested that dressings can be of use for preventing wounds. This study found that the "placement of a soft silicone foam dressing over the sacrum significantly reduced the incidence of pressure ulcers compared to similar patients who received preventive care but no dressing."[119]

Dressings/devices should be selected to contain wound exudate and maintain exudate off periwound skin with slight moisture at wound base.[120] It is also important to choose products that will prevent trauma or injury to fragile/friable tissue—including the periwound area—such as those that are silicone based or non-adherent.[68]

Emerging evidence suggests that a dressing with a slippery backing placed over areas at risk for pressure injury development may help to reduce friction and shear and lower the incidence of pressure injuries.[121]

Dressing considerations for non-healable wounds may include the use of products that reduce moisture and bacteria, are atraumatic to reduce painful removal and contribute to conservative debridement. The use of advanced active therapies is often contraindicated when goals are not related to healing.[40,68]

There are various categories of antimicrobial dressings, including antiseptics and products containing silver, honey, slow-release iodine and polyhexamethylene biguanide (PHMB). Topical antimicrobial dressings are to be discontinued once critical colonization has been corrected or if a beneficial effect is not evident after two to four weeks of use.[40,68] Topical dressings exist to reduce matrix metalloproteinases (MMPs) and can be used in combination with topical antimicrobials or systemic anti-inflammatories/antimicrobials.[40,68]

Advanced Therapies and Devices:

Advanced therapy options are available to promote healing.[68]

A person with a chronic pressure injury may be a candidate for advanced therapies. These are therapies that support, enhance or replace traditional therapies. Their level of evidence varies depending on the modality.[36] An extensive review of the scientific literature was conducted for randomized controlled trials, multi-centre trials and meta-analyses that examined the effectiveness of various modalities on healing (wound closure) of chronic pressure injuries. New modalities and elements of discussion are included in this recommendation and are summarized in Table 8.

Table 8: Advanced Therapies

Electrical stimulation therapy (EST) (Level of Evidence: Ia)[122]	EST has been demonstrated to be effective in enhancing the healing of recalcitrant Category/Stage 2, 3 and 4 pressure injuries.[60] There are 12 randomized controlled studies involving the study of a total of 404 subjects. No new trials were identified for this update. Ten of the 12 studies report that EST accelerated wound healing compared with subjects in the control group. The results of these clinical trials are to be combined in a meta-analysis.[123] Preliminary findings demonstrated a significant increase in closure rates of pressure injuries of EST compared with controls.[124]
Platelet-derived growth factor (PDGF-BB) (Level of Evidence: IIa)	The clinical evidence on platelet-derived growth factor (PDGF) suggests that PDGF-BB may improve healing of pressure injuries. However, the evidence is not sufficient to recommend this treatment for routine use.[60] In the past, three trials (RCTs) examined the impact of using PDGF on pressure injuries. Only one reported a significant increase in wound healing rate for chronic pressure injuries treated with PDGF-BB.[125]
Electromagnetic therapy (EMT) (Level of Evidence: IV)	EMT could be considered a treatment for recalcitrant Category/Stage 2, 3 and 4 pressure injuries. The literature reports two randomized controlled trials (RCTs), involving 60 participants. Both trials compared the use of EMT with sham EMT, although one of the trials included a third arm in which only standard wound care was applied. The results of this review provided no strong evidence of benefit in using EMT as an adjunctive modality to treat chronic pressure injuries.[123]
Negative pressure wound therapy (NPWT) (Level of Evidence: IV for NPWT as an adjunctive modality in the treatment of chronic wounds; III as a pre-surgical procedure)	The evidence for the use of negative pressure wound therapy with pressure injuries is not sufficient to recommend its use. In three studies, the wound improvement was similar with NPWT when compared with standard care.[122] NPWT may be considered in the preparation of pressure injuries prior to surgical closure, with the aim of reducing the wound surface area and to stimulate wound bed vascularization, but no RCTs have been published to support this application. As found in the Cochrane Review published in 2008 and reviewed in 2011, there are now seven trials (RCTs) that report the effects of NPWT on chronic wounds but only one on patients with chronic pressure injuries.[127] At present, there is no meta-analysis published on the effects of NPWT on chronic pressure injuries specifically.

cont'd.

5. Ultraviolet light C (UVC) (Level of Evidence: Ib)	One small RCT (n = 16) demonstrated that UVC combined with standard wound care generated a greater effect on wound healing of chronic pressure injuries[128] than standard wound care alone; however, no evidence exists to clarify whether UVC or ultrasound, used alone, exerts any beneficial effect.[129] One study reported a significant reduction in semi-quantitative swab results following a single treatment with UVC.[130] If one of the goals of care is to reduce bacterial burden in clean but critically colonized Category/Stage 3 and 4 pressure injuries, UVC may be considered but should not be used instead of other products, dressings or therapies to reduce bacterial burden.[60]
6. Warming therapy (Level of Evidence: Ib)	Two RCTs support the use of the warming therapy or noncontact normothermic wound therapy (NNWT) in the treatment of chronic pressure injuries. Subjects received three treatments daily during which the dressing was warmed for one hour. The results of the two trials are similar and report an increased healing rate for the warming therapy group.[131,132]
7. Laser (Level of Evidence: IV)	Two trials (RCTs) on the use of laser as an adjunctive therapy in the treatment of chronic pressure injuries reported no difference between laser therapy and standard wound care, which presents a contradiction to what may be believed in clinical practice.[122,128,133]
8. Topical oxygen therapy (TOT) (Level of Evidence: III)	Only one research study has been completed on the subject and it included only three patients.[134] Results showed a positive effect on the healing rate, but more research is needed to confirm that TOT is a useful adjunctive modality in the treatment of chronic pressure injuries.
9. Ultrasound therapy (Level of Evidence: IV)	Three RCTs involving 146 subjects have been published on the use of ultrasound therapy in the treatment of chronic pressure injuries. Results showed no significant difference in healing rates between the ultrasound treated and the control group.[122,135]
10. Hyperbaric oxygen therapy (Level of Evidence: IV)	Hyperbaric oxygen therapy is considered useful for ischemic wounds, but there is a lack of data concerning the correlation of this modality and the treatment of chronic pressure injuries. No RCTs on the subject have been found.[136]
11. Skin equivalents (Level of Evidence: IV)	The literature review did not find a single published RCT exploring the effect or benefit of skin equivalents on chronic pressure injuries. There is insufficient scientific evidence to support their use at this time.[20]
12. Proteases modulating (Level of Evidence: IV)	The literature review did not find a single published RCT exploring the effect or benefit of protease modulating products on chronic pressure injuries.

4.4 Engage the team to ensure consistent implementation of the plan of care.

Discussion: Instruction needs to be directed to all levels of care providers, including the person with a pressure injury, family and caregivers, to maintain the plan of care. Education on the prevention and management of pressure injuries should be designed to incorporate the principles of age-specific learning and the level of information required. The mode of delivery must be flexible to accommodate the needs of the learner. To maximize retention of information and to facilitate translation into practice,[36] information needs to be presented at a level that is appropriate for the target audience.

Patients and caregivers: Collaboration among the person with a pressure injury and the rest of the team in the development and implementation of the plan of care is essential.

Persons at risk for pressure injury development and those with an existing pressure injury and their caregivers require information regarding the causes and risk factors for pressure injuries as well as their risk for re-injury and ulcer recurrence. Both formal and informal educational methods are beneficial, including the use of standardized patient-education materials on pressure injuries (pamphlets/packages/modules) as well as individualized demonstration and review of prevention/management techniques.

Patients and caregivers need to know how to conduct a daily skin inspection (examination), how to use pressure management techniques (such as weight shifts, correct positioning, offloading) and must be aware of the importance of adequate nutrition and hydration.[39] Patients should also be encouraged to reposition themselves. Education should also include information regarding appropriate use of therapeutic surfaces, the roles of various health professionals, strategies to manage pain and discomfort, expected outcomes and duration of treatment, if known.[7,20,36,39,60,100,137]

Health-care professionals: Comprehensive educational programs need to be developed for health-care professionals, with implementation across the continuum of care[7] to ensure accurate, consistent and uniform assessment as well as documentation of the extent of tissue damage and the role of the interdisciplinary team.[39]

These programs should outline the roles of health-care professionals in the prevention of pressure injuries, including skin inspection for signs of pressure injuries, skin care regimens, pressure management, reduction of friction and shear injuries, positioning

and transfer techniques[39] and monitoring for poor nutritional status.[20] Critical analysis of current practice and outcomes, formation of an interdisciplinary team, development of simple prevention protocols, selection of therapeutic pressure redistribution surfaces and mandatory staff training[138] have all been identified as essential for program success.

Detailed components of education for health-care professionals include instruction on how to achieve accurate and reliable risk assessments by incorporating clinical judgment of risk factors, and how to conduct comprehensive skin assessments, including special assessment techniques for unblanchable erythema, especially for those with darker skin tones.[60] The importance of documentation of all risk and skin assessments and the necessity for ongoing assessment to detect early signs of pressure damage are described as essential in ensuring accurate communication within the integrated team, providing evidence that care planning is appropriate and is serving as a benchmark for monitoring progress.[60]

Magnan and Maklebust identified a relationship between scores on Braden subscales and nurses' selection of commonly used best-practice interventions for pressure injuries prevention.[139] Data analysis provided evidence that accurate risk assessment promoted increased attention to preventative measures, thereby reinforcing the importance of staff education programs focused on both accuracy of pressure injury risk assessment and aggressive preventative interventions.[139]

Educational programs also need to include strategies to differentiate pressure injuries from other types of wounds and the appropriate use of a classification system, including the appearance of different tissue types. Training regarding repositioning strategies and the use and maintenance of pressure management devices are essential for all those involved in the prevention and care of pressure injuries, including the person at risk of or with a pressure injury.[39,60]

Prevention programs should be structured, organized, comprehensive, sustainable and be updated on a regular basis to incorporate new evidence and technologies.[7] Integrating a process for continuous program evaluation into the planning process is essential.[7]

The creation of pressure injury prevention teams, use of champions to assist with local implementation of pressure injury prevention programs, establishment of goals for pressure injury reduction and maintenance of data on identification, prevention and outcomes assists facilities with the evaluation of their nursing practice based on nurse-sensitive indicators.[7] Identification of facility-wide barriers, including failure to consistently differentiate community-acquired versus hospital-acquired pressure injuries, is also important for the creation of successful programs.[140]

Additional quality improvement strategies to facilitate culture change include skin-care-unit-based council meetings and activities, lectures, newsletters, informal one-on-one bedside clinical instruction, networking opportunities, positive feedback and re-instruction.[7]

Technology-assisted education, including web-based training modules and resources, has been identified as an effective method to improve knowledge and the abilities of health-care professionals in pressure injury risk assessment and pressure injury identification and staging.[141]

Step 5: Evaluate Outcomes

Step 5: Evaluate Outcomes

Recommendations

5.1 Determine if the outcomes have met the goals of care.

Discussion: Through the use of validated tools, the clinician can determine if the goals of the prevention or treatment plan have been met. Prevention of pressure injuries is the ultimate goal; however, if wounds occur, signs of progress toward healing should be evident for most wounds within two weeks of treatment.[20,60,65,142,143]

5.2 Reassess patient, wound, environment and system if goals are partially met or unmet.

Discussion: Goals of care such as wound closure, quality-of-life issues and symptom control may not occur until all of the underlying causes have been optimized. It is important to return to the assessment and recommendations and re-evaluate, and potentially revise, the treatment plan to address gaps and areas for modification.

Reassess the patient, wound and environment:

Validated and reliable tools that have been tested for responsiveness are essential to assist the wound team evaluate wound healing and other wound-related goals. If wound closure is expected, goals should be based on the patient's condition and ability to heal. If there is no evidence of progress toward healing within two weeks, reassessment of the wound, plan of care and patient is required.[60]

Although rare, chronic pressure injuries that are not healing as expected can become malignant and form a Marjolin's ulcer. A biopsy of the wound during reassessment can reveal this.

Reassess the system:

A root cause analysis (RCA) process, as recommended by the NPUAP, provides a systematic process to assist a facility to "gain insight into the development of a pressure ulcer through a review of the timeline of events. The RCA is not intended for the analysis of all facility-acquired pressure injuries but as a review of the development of a Category/Stage 3, Category/Stage 4 or DTI." [144] Such a review can help to identify why a PI developed and what strategies, including improvement to the facility's skin management program, can be implemented to prevent further pressure injuries. The NPUAP emphasizes that an RCA "is not intended as a punitive function but rather as a learning and growth opportunity for facility staff" and that the information uncovered can be useful to create strategies for risk management.[144]

The NPUAP also recommends that quality councils track trends using event forms such as the RCA to identify and investigate facility-acquired pressure injuries.[145] These trends can then be compared with similar facilities to assist with benchmarking.

Soban et al.[146] identified five essential components of pressure injury prevention toolkits found in the Veterans Health association (VHA) handbook[147] and the Agency for Healthcare Research and Quality (AHRQ) toolkit for PI prevention.[148] These components include policy, committee/team, wound specialist/team, monitoring performance and staff education. Evaluation of these components on a regular basis is crucial to ensure pressure injury prevention program success and show improvement over time.

Evaluation of prevention equipment and supplies: Equipment used by patients/clients needs to be maintained and re-evaluated regularly. Most equipment manuals will provide information on preventative maintenance requirements as well as the life expectancy of the equipment. The appropriateness of a well-maintained piece of equipment for a specific client also needs regular evaluation. Ideally, this evaluation should occur annually.

Evaluation of supplies should also occur regularly. Cost effectiveness, rather than straight cost, should be considered in conjunction with patient satisfaction and care provider satisfaction.

Evaluation of policy/programs: The RNAO has made the following recommendation for the evaluation of policies and programs: "Organizations must lead and provide the resources to integrate pressure injury management best practices into standard and interprofessional clinical practice, with continuous evaluation of outcomes."[18] The provision of "organizational support including identification of barriers to implementation, decision support tools, a communication mechanism and standardized metrics were identified as key to the successful implementation of pressure injury best practices."[18] Collaboration with the integrated team to support best practices and identify resources was also highlighted as an important component of quality management of pressure injuries.

Staff-to-patient ratios have also been identified as having an impact on pressure injury occurrence. A systematic review by Backhaus et al. found that the availability of more staff resulted in a decrease in pressure injury development.[149] Similarly, a study by Lui et al. identified that hospital-acquired pressure injuries "significantly increased when the patient-to-nurse ratios exceeded 7:1," demonstrating an association between a higher incidence of pressure injuries and high patient-to-nurse ratios, as well as the number of overtime hours worked.[18,150]

Prevalence and incidence studies using validated collection tools and focused audits have been identified as useful methods to monitor performance, interventions and outcomes, as well as embedding prevalence of pressure injury studies into assessment of risk/quality and professional practice.[62] Quality indicators such as those identified by national accreditation organizations should also be used to monitor outcomes.[7]

Review of patient records has not presented valid and reliable data about pressure injuries and often under-predicts prevalence rates. It is recommended that more attention be focused on the quality of documentation of the data to enable the reliable use of the electronic patient record for data collection in the future.[7]

Evaluation of committee and teams: Quality reviews assist with the assessment of teams and culture. Sullivan identified key recommendations to prevent hospital-acquired pressure injuries with a "focus on accountability, continued measurement of performance, staff autonomy with interventions, consistency in staff training relating to documentation and recognition of front-line staff success."[54]

According to Bales et al., sustainability requires an environmental assessment to determine the existence of strong leadership, involvement of staff in decision-making and a desire of the team to develop and foster relationships.[56]

Hospitals with a wound care specialist staff resource had a high association of successful performance monitoring, staff education and lower pressure injury rates. Further

studies are needed to investigate the relationship between key operational components to prevent pressure injuries and the influence of a wound-care specialist.[146]

Staffing should also be considered when evaluating a pressure injury program. Trinkoff et al. noted that higher turnover of CNA staff was linked to higher rates of pressure injuries.[151]

Culture: Successful pressure injury prevention programs require assessments of communication and routines. Niederhauser et al. recommend evaluating routine care and communication strategies to improve programs.[152] Evaluating practices and bundling common care activities can successfully assist caregivers with prevention activities when added to routine practices already built into their day.

The Attitude towards Pressure ulcer Prevention instrument (APuP) may help to illuminate some of the barriers to prevention. This instrument has been designed to measure five factors:[153]

1. Attitude toward personal competency to prevent pressure ulcers
2. Attitude toward the priority of pressure ulcer prevention
3. Attitude toward the impact of pressure ulcers
4. Attitude toward responsibility in pressure ulcer prevention
5. Attitude toward confidence in the effectiveness of prevention

With appropriate, multifaceted education, adherence to guidelines increases.[154] Paquay et al. also found that while almost all recommended prevention strategies were implemented, repositioning in bed and in the armchair decreased significantly, likely because the nurses mistakenly believed the pressure management materials in place were sufficient and therefore repositioning was unnecessary.[154] Knowledge of pressure injuries and pressure injury prevention is not enough—the attitudes of nurses toward pressure injuries are significantly correlated with the implementation of prevention activities.[154]

Evaluation of education programs and the health-care team: Interdisciplinary education should be standardized and reviewed for application of knowledge.[18] The RNAO recommends pre- and post-assessment of knowledge related to pressure injury prevention. Assessments of knowledge transfer to practice should be assessed through audits and case study exercises. Recommendations related to frequency or timing of post evaluations is lacking in the literature. The RNAO recommends post-test assessment of knowledge, attitudes and skill to reinforce previous learning.[18]

The Pieper Pressure Ulcer Knowledge Test (PPUKT) is a valid and reliable tool to assess knowledge of pressure injury prevention and management and has been in use since 1995.[155] In 2014, Pieper and Zulkowski added improvements to their test and renamed it the Pieper/Zulkowski

Pressure Ulcer Knowledge Test (PZ-PUKT), however this has not been tested for validity and reliability.[156]

5.3 Ensure sustainability to support prevention and reduce risk of recurrence.

Discussion: Sustainability of an individualized pressure injury prevention protocol or maintenance of a healed pressure injury is dependent on access to appropriate equipment and services, collaboration among the person with or at risk for a pressure injury, their caregivers, service providers and the interprofessional team of health-care professionals. Ongoing evaluation as well as clear, effective communication regarding the plan and follow-up is required by all involved across the continuum of care.

At the system and institutional levels, successful sustainability of pressure injury prevention programs was described by Bales and Padwojski as dependent on strong leadership and management skills to identify prevention as a key priority within organizations, involvement of staff in decision-making and interdisciplinary participation to ensure optimal outcomes.[56,158] In addition, a systematic review by Sullivan et al. identified that measures of performance such as conducting quarterly prevalence studies and continually monitoring all hospital-acquired pressure injuries were key components to sustaining improvements.[54] Prompt identification of pressure injuries that fail to progress to sustained closure is essential for reassessment and evaluation of the treatment plan to ensure that all potential underlying causative and contributing factors are optimized. As well, a rapid response to Category/Stage 1

injuries, including pressure management strategies, will provide a sustainable, cost-effective model to support improved outcomes.

An example of a successful and sustainable pressure injury prevention program is the the previously mentioned PUAP program, which demonstrated a pressure injury reduction rate up to 57% (prevalence) and 71% (incidence).[55]

Conclusion

Prevention of pressure injuries is of paramount importance. Despite a focus on prevention to date, pressure injury incidence rates have not significantly decreased. An integrated approach focused on prevention is required across all areas of the health-care system to make a significant difference in incidence rates. For optimal acceptance and effectiveness, integrated teams need to include other departments such as purchasing and housekeeping as well as stakeholders such as the patient and families. Collaboration and communication across all departments and sectors of care are vital to ensure that outcomes are patient-centred and optimal for the prevention and management of pressure injuries.

Immediate implementation of pressure management strategies have been shown to be effective when a Category/Stage 1 pressure injury is identified, yet our systems may not be set up to support this rapid response even though it is important that systems be structured to facilitate it. It is also important to return to the basics of prevention: look at all surfaces upon which the person at risk for or with a pressure injury sits or lies as well as transfer techniques during all points of care, such as in acute care, operating and interventional room tables, emergency room stretchers, ambulatory departments, rehabilitation settings, community and long-term care. Focusing on treating the potential causes of pressure injuries is paramount, while at the same time remembering that not all pressure injuries are preventable.

In all cases of injury prevention or management, customized plans of care should be implemented.

The use of metrics to monitor clinical outcomes is essential to drive culture and practice changes that may be necessary to prevent and manage pressure injuries. Identification of facility barriers and implementation of strategies to resolve these issues are imperative to support the changes required.

A useful resource for clinicians, Pressure Injury Prevention Points, can be found at www.npuap.org/wp-content/uploads/2016/04/Pressure-Injury-Prevention-Points-2016.pdf.

Pressure injury prevention and management have now been recognized as measures of quality by Accreditation Canada in both long-term care and hospitals, and nationally hospital pressure injury rates are being reported, with facilities being named.

It is time to ensure that pressure injury prevention becomes a critical component of all aspects of safe patient care.

Prevention is key!

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