

Wound Care

C A N A D A

WINTER 2023
VOL.21 NO.2



THE OFFICIAL PUBLICATION OF WOUNDS CANADA

**The Power Of
Interprofessional
Wound Care Teams**

**Mobilizing Canada's
Skin Health
And Wound
Community**

**The Role Of Health
Education In Diabetic Foot
Complications**

**Pressure Injury Risk
Assessment Tools**

**Wound Sleuth: To
Swab Or Not To Swab?**





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1. Bowler PG, et al. Parsons, Wound Medicine 14 (2016) 6–11. 2. Metcalf DG et al. J. Wound Care 2016; Vol25, No3. 3. Metcalf DG, et al. Int Wound J 2017; 14: 203–213. 4. Malone M et al. 2017. JWC; 20–25.

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* When compared to AQUACE® Ag Extra™ dressing and other silver-only competitor dressings: ACTICOAT™ 7 and SILVERCEL™ Non-Adherent dressings.

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Wounds Canada (www.woundscanada.ca) is a non-profit organization of health-care professionals, industry participants, patients and care partners dedicated to the advancement of wound prevention and care in Canada.

Wounds Canada was formed in 1995 as the Canadian Association of Wound Care. The association's efforts are focused on four key areas: education, research, advocacy and awareness, and partnerships.

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News in Wound Care

Resources

Collaborating Towards A New Edition Of *The International Pressure Injury Guideline*

Wounds Canada will collaborate with the National Pressure Injury Advisory Panel (NPIAP), the European Pressure Ulcer Advisory Panel (EPUAP) and the Pan Pacific Pressure Injury Alliance (PPPIA) on the development of the fourth edition of the *International Pressure Injury Guideline*.

Working together as associate organizations, the cooperation will be reflected in the fourth edition of the *Guideline*.

Wounds Canada is delighted to support this cooperation and its important work by enhancing the focus on clinical expertise in this new edition, while recognizing the evolving needs in

wound care management. The *Guideline* aligns with Wounds Canada's mission and dedication to advancing research, care and patient outcomes.

Limb Preservation Journal Supplement Focuses On Indigenous Health-care

Based on insights shared during Wounds Canada's 2023 Limb Preservation Symposium last spring, a special supplement to the *Limb Preservation Journal* focused on Indigenous wound care was developed and published in September and released during Wounds Canada's National Conference. The supplement is filled with experiences of Indigenous health-care professionals and others serving this diverse and important community. It offers lessons to be learned not just for those working directly with Indigenous peoples, but for the limb preservation community in general.

Awareness and Advocacy

November Awareness Campaigns Focus On Important Issues

Wounds Canada ran two

awareness campaigns in the month of November for **STOP Pressure Injury Day** and **Diabetes Awareness Month**, to not only increase awareness of pressure injuries and diabetic foot but to promote methods of prevention, such as regular skin checks and best practices in management and treatment.

The first campaign titled *IT'S TIME to STOP Pressure Injuries* included collaborators such as the Alberta Health Services, Canadian Institute for Health Information (CIHI), Covenant Health, Health Association Nova Scotia, Registered Nurses' Association of Ontario and Winnipeg Regional Health Authority, while the second campaign for Diabetes Awareness Month was in collaboration with the Limb Preservation Alliance, launched officially at the beginning of the month. The Limb Preservation Alliance consists of the American Limb Preservation Society, the Canadian



Podiatric Association, D-Foot International and Wounds Canada.

Wounds Canada's awareness campaigns highlight content and expert resources through a combination of social media posts, dedicated web pages, and collaborations with health-related organizations.

In the new year, Wounds Canada will be partnering with more organizations to convey key messages about timely wound care management subjects.

CN Tower Lit Up

The CN Tower was lit up on November 15, 2023 in advance of STOP Pressure Injury Day taking place the following day.



New Faces at Wounds Canada

Christina Locmelis has joined Wounds Canada as Director of Communications & Membership. She is responsible for leading the communications team and executing Wounds Canada's overall communications strategy. Christina has extensive experience working in the not-for-profit/associ-

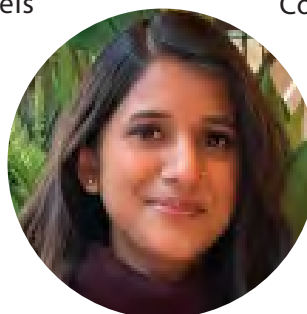


ation sector and has managed the successful development and implementation of multiple national and international award-winning awareness campaigns. She is a dedicated leader and strategist who excels at managing teams, engaging with members and stakeholders, generating awareness of organizational resources and activities and enhancing the public profile of organizations.

Christina holds a Master of Arts with specialization in Organizational Communication and a Bachelor of Arts in Communications with a minor in Psychology. Christina has also been an active volunteer for many worthy causes and various organizations and cur-

rently serves as a Director on the Board of the Canadian Foundation for Animal-Assisted Support Services.

Shagaana Giritharan joined Wounds Canada as Education Coordinator for the Skin Health Program in October. Previously, Shagaana worked as a medication delivery coordinator at Bayshore Specialty Pharmacy.



While pursuing her BA in Psychology at Toronto's York University, she worked as a student success team member for her school's Introduction to Psychology course. Outside of school and work, Shagaana is known for being a versatile dancer and respected teacher. She has been teaching the ancient Indian classical dance form Bharathanatyam, as well as other styles, to students of all ages, for almost five years now.



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For detailed product information, including indications for use, contraindications, precautions and warnings, please consult the product's Instructions for Use (IFU) prior to use.

References: 1. *Krönert GT, Roth H, Searle RJ. Efficiency in wound care: The impact of introducing a new foam dressing in community practice. EWMA Journal. 2016;16(2):7-12. 2. Cutting of ALLEVYN variants. Data on File Report DS/14/318/R-January 2015. 3. Data on File Report DS/15/025/R – May 2016, L. Daubney. Physical Testing ALLEVYN LIFE Gen2. 4. SECURA Protective Ointment [Instructions for Use]. 5. Schutt SC, Tarver C, Pezzani M. Pilot study: Assessing the effect of continual position monitoring technology on compliance with patient turning protocols. Nurs Open. 2017; 207, 1-8. 6. Forni C, D'Alessandro F, Gallerani P, et al. Effectiveness of using a new polyurethane foam multi-layer dressing in the sacral area to prevent the onset of pressure ulcer in the elderly with hip fractures: A pragmatic randomised controlled trial. Int Wound J. 2018; 15(3):383-390. 7. Rossington A, Drysdale K, Winter R. Clinical performance and positive impact on patient wellbeing of ALLEVYN Life. Wounds UK. 2013;9(4):91-95.

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As the leading wound care organization in Canada we provide you, our member, with the information and tools to help advance your career, your practice and your team. Your membership provides you with:

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DARCO International is a provider of wound care, post-op, and trauma solutions to the global foot and ankle community. Founded in 1985 by practicing podiatrist Dr. H. Darrel Darby, DARCO prides itself on being an industry innovator by

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- **BodyArmor® ProTerm Walker:** Designed for patients recovering from TMA, Chopart, and Lisfranc amputations, the BodyArmor ProTerm is an interim orthosis designed to assist patients in the healing process before transitioning to a prosthetic.
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Integra's Advanced Wound Care portfolio includes **MediHoney®** Antibacterial Dressings, the global leading medical-grade manuka honey-based product for the management of acute and chronic wounds and burns and **TCC-EZ®** Total Contact Cast System, a prefabricated and easy-to-use offloading device that supports patient compliance.

Derived from the nectar of the *Leptospermum* species, the manuka honey used on **MediHoney®** is selected, authenticated and processed using

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Medela

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Medela's Invia® Liberty™ and Invia® Motion™ NPWT Systems contain a double lumen with patented, electronically controlled feedback technology called **Intelligent Pressure Control™** and **Dynamic Exudate Removal™**.



• **Intelligent Pressure Control** utilizes the control lumen to

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• **Dynamic Exudate Removal** utilizes the removal lumen to prevent blockages and dynamically adapt to fluid fluctuations by adjusting airflow cycles (up to 20 times per 5 minutes), more accurately and efficiently removing fluid and innovating the standard of care.

Medela makes NPWT easier by focusing on the solutions that improve the patient experience and lessen administrative complexities. Our Invia™ NPWT Systems offer whisper-quiet technology and simple user interfaces with a range of pressure settings and therapy modes to support clinical flexibility. Our NPWT portfolio is completely interchangeable, providing patients with true continuity of care as they transition beyond acute care.

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Michael Quart was introduced to EdemaWear by Dr. Gary Sibbald. Both were among the early architects of what later become Wounds Canada. Quart Medical acts as the exclusive importer for EdemaWear. You can listen to the recent webinar by Dr. Sibbald and Pat Coutts discussing low compression vascular assessment and a recent peer reviewed study on EdemaWear in *Advances in Skin and Wound Care*. **Watch the low compression webinar with Dr. Sibbald & Pat Coutts:** <https://youtu.be/CjXOLhPxIvo>

Read the peer review study here: https://quart-medical.com/wp-content/uploads/Evaluation_of_Longitudinal_and_Tubular_Compression-Sibbald-et-al-2020-ASWC-distributed-by-WoundPedia-with-permission.pdf

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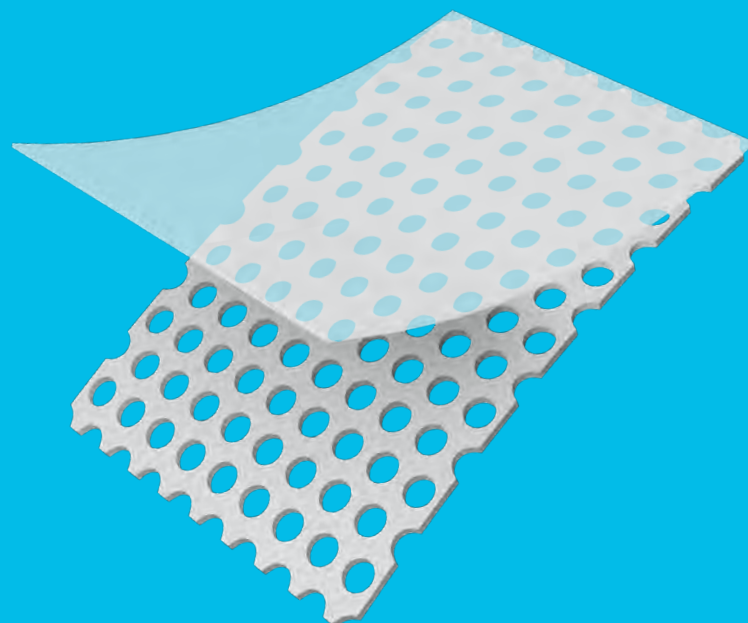
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SAVE THE DATE



Painful Non-healing Wounds In A 97-Year-Old Patient: Could It Be Angiosomal?

By Carol Ott MD FRCPC, Kennedy Ayoo MD, Andrea Moser MD MSc CCFP FCPC (COE) CMD and Giuseppe Papia MD MSc FRCSC FRSCS

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The Patient

A 97-year-old female resident of a long-term care facility presented to the Wound Care Clinic with two painful ulcers on her left foot that had appeared in the previous two months. On her 5th toe she has a small .8 x .8 cm wound that showed exposed bone (see Figure 1). On her heel she had a small wound (see Figure 2).

Past medical history included hypertension, asthma, hypothyroidism, osteoarthritis, B12 defi-

ciency and psoriasis on the soles of her feet. Her medications included: acetaminophen, amlodipine, enalapril, calcium carbonate, fluticasone 250mcg inhaler, clobetasol cream and Vitamin B12 100mcg IM monthly. Hydromorphone was used with limited success to relieve the pain.

Prior to developing these painful wounds, the patient was attending many recreational activities in the home and would go for daily walks around the facility with her friend. She was able to ambulate using her walker and had no cognitive impairment.

With the onset of the wounds, her mobility declined, notably her ability to ambulate outside



Figure 1. Left 5th toe wound.

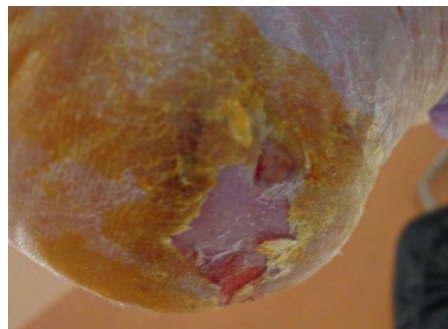


Figure 2. Left heel wound.



Figure 3. Left calf wound.

of her room. She remained independent in the other Activities of Daily Living (ADLs), notably dressing, eating, toileting and personal care and received minimal assistance with bathing.

She was now spending most her time in her room, sitting in a recliner. The home and family did most of the Instrumental Activities of Daily Living (IADLs) for her and she was able to phone others with the landline phone in her room (see Table 2). Family members brought forth concerns about the impact of the wounds on her activity level and on her mood.

The wound on the left 5th toe became infected. Treatment of the wounds consisted of several courses of antibiotics and topical dressings. Three months into treatment, a third painful wound appeared on her left calf (see Figure 3).

She was referred to a Vascular Surgeon six months into treatment as the wounds were not healing and continued to cause pain.

The Issue

Peripheral arterial disease (PAD) is usually caused by atherosclerosis that leads to stenosis or blockage of the major vessels supplying the lower extremities.¹ This constriction impedes blood flow to the legs and can result in symptoms such as pain, cramping and weakness, particularly during physical activities. Approximately 10% of the

worldwide population have peripheral vascular disease though the prevalence increases as we age,² making age the greatest risk factor for PAD (see Table 1).

Table 1. PAD Prevalence and Age

Age	PAD prevalence
60-69	7.0% (95% CI=5.6-8.4%)
70-79	12.5% (95% CI=10.4-14.6%)
80 and older	23.2% (95% CI=19.8-26.7%)

Source: Data from the National Health and Nutrition Examination Survey 1999-2004.³

Other Risk Factors For PAD

Additional risk factors for PAD include:³

- Current smoking
- Previous smoking
- Diabetes mellitus
- Decreased kidney function
- C-reactive protein > 3.0
- Hypertension

Symptoms Of PAD

Some patients with PAD may be asymptomatic but others suffer many medical issues such as claudication, ischemic rest pain, ischemic wounds, repeated revascularizations and limb loss.⁴ These symptoms can lead to a general decline in health status, poor quality of life and decreased abilities to perform both ADLs and IADLs (see Table 2).

Consultation with a vascular surgeon and vascular studies should be considered early in treatment of leg wounds and symptoms of PAD to decrease morbidity, improve quality of life and address issues with pain. The vascular surgeon can determine if bypass surgery or computed tomography angiography (CTA), with or without angioplasty, might be required if there is blockage in the main arterial vessels versus the distal peripheral vessels.

In our patient's case, it was determined that a CTA with angioplasty was indicated. The CTA showed that in the left leg that there was severe tibial arterial disease and superficial arterial stenosis and occlusion (see Figure 4). All were opened

Table 2. Activities of Daily Living and Instrumental Activities of Daily Living.⁵

ACTIVITIES OF DAILY LIVING (ADLs) Mnemonic - DEATH	INSTRUMENTAL ACTIVITIES OF DAILY LIVING (IADLs) Mnemonic - SHAFT
D - Dressing	S - Shopping
E - Eating	H - Housekeeping
A - Ambulating	A - Accounts
T - Toileting	F - Food Preparation
H - Hygiene	T - Telephone

by angioplasty to provide continuous flow to the angiosomes of the lesions (see Figure 4). The procedure was well-tolerated by our 97 patient and done under local anesthetic as a day procedure.

Angiosomes

The concept of angiosomes was introduced by Dr. Ian Taylor in 1987 and is now used in the fields of vascular surgery, plastic surgery and wound management.⁶ It is a concept that helps explain the relationship between arteries and the tissue territories they supply.⁶ An angiosome is a three-dimensional area of tissue containing skin, fat and muscle that is supplied by a source artery and drained by specific veins.

An understanding of angiosomes is important in vascular procedures to help improve wound healing by allowing the vascular surgeon to direct revascularization efforts to the territory supplying the wound.⁷

The arterial supply to the leg consists of six angiosomes which originate from three tibial arteries and their branches (see Figure 5):

1. **Anterior tibial artery** supplying the dorsum of the foot.
2. **Peroneal artery** supplying the lateral portion of the foot with some contribution to the heel.
3. **Posterior tibial artery** supplying the plantar surface of the foot. The posterior tibial artery further divides into a medial plantar, lateral plantar and calcaneal branch which supply the medial plantar surface, lateral plantar surface and the heel respectively.

Adjacent angiosomes are anatomically linked through choke vessels and direct arterial-arterial connections, establishing a unified network wherein a single source artery can supply multiple angiosomes.⁷ This arrangement allows blood to bypass interruptions within the vascular tree.⁷ While direct in-line flow is preferred, the redundancy in lower extremity perfusion allows for multiple lower extremity revascularization options when perfusion through the specific angiosome supplying a wound cannot be restored.⁷

Why Might Some Older Adults Not Be Sent To Vascular Surgery For Assessment of PAD?

Ageism is the discrimination or stereotyping of individuals based on their age. Health-care providers may misinterpret or downplay the symptoms of PAD in their older adult patients attributing the symptoms to aging or other factors. Health-care providers should be educated about the prevalence of PAD in older adults and the potential benefits of angioplasty.

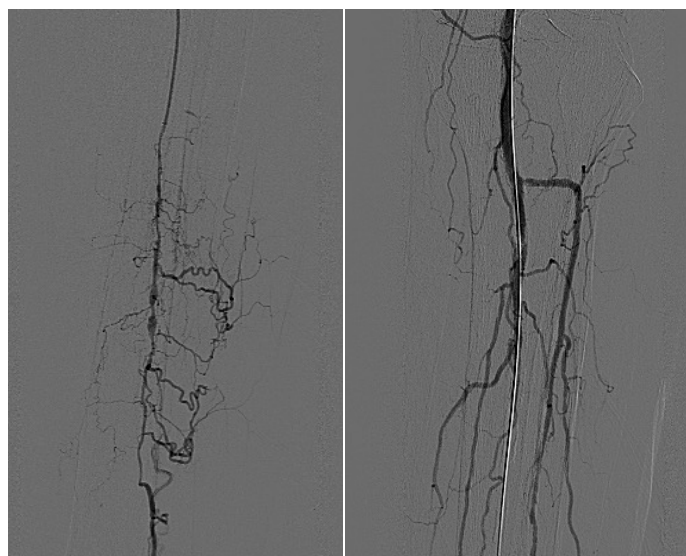


Figure 4. Lower extremity angiograms. Pre-procedure (left, ABI=0.28); Post-procedure (right, ABI=0.57).

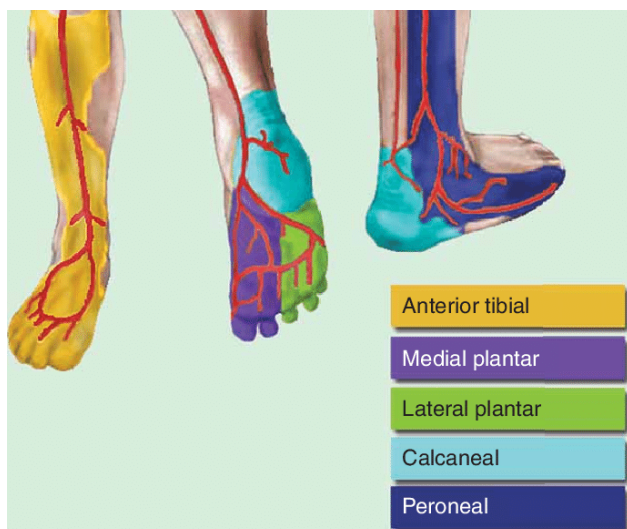


Figure 5. The Angiosome concept: Illustration of the lower extremity angiosomes represented as a topographic map divided into five territories, supplied by the three main arteries and their branches.⁸

Back To Our Patient...

All the patient's wounds healed over a period of five months and pain resolved. The patient was able to return to her previous mobility status – walking around the long-term care home using her walker and accompanying her friend, a fellow resident. Her mood also greatly improved and she was able to return to attending recreational functions at the home. Surgical intervention leading to subsequent healing led to a significant improvement in her overall quality of life.

She had not been referred to vascular surgery for the first six months of her treatment and this delay could have led to a permanent decrease in her functional capacity. She died at age 101 of another unrelated short illness. 🚫

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Coloplast Sponsored Learning: Treating Wounds with Triad™

Presenter: Laurence Quintin BScN NSWOC

The Challenges Of Difficult-To- Dress Wounds

Wound care practitioners often encounter difficult-to-dress wounds; 57% of wound care nurses reported that they manage difficult-to-dress



wounds everyday.¹ Difficult-to-dress wounds are those that are on wet or irregular body surfaces, where it is difficult to keep dressings in place between scheduled changes. For example, stage 2 and 3 pressure injuries in the ischial or coccyx regions are difficult to dress due to the anatomical location and the possibility of the dressing being soiled (e.g., incontinence).

There are practical and financial challenges to managing difficult-to-dress wounds. It requires more work and skill for a health-care practitioner to apply a dressing on these wounds. These dressings can also become soiled often (e.g., due to incontinence) leading to frequent dressing changes. This increases workload for the health-care practitioners and cost. Delayed wound

healing associated with difficult-to-dress wounds also contribute to an increase in overall cost of care.

Triad: The Solution To Difficult-to-Dress Wounds

What is Triad: Triad is a zinc-based hydrophilic (water-loving) paste that can absorb low- to moderate-level of wound exudate. It is a sterile protective coating designed to be applied directly from the tube on to broken skin and/or the wound without the need of a secondary dressing. It can also be applied to the periwound skin. Triad contains carboxymethylcellulose (CMC) that allows it to adhere to wet skin. Triad also contains dimethicone that can provide moisture to the skin and petrolatum and zinc oxide which can reduce skin irritation. Triad can be 'changed' at every hygiene care or left on the wound for up to 5-7 days. It can be removed with a pH-balanced wound cleanser (e.g., Sea-Cleans®) and gentle scrubbing.

The Indications For Triad

Triad is indicated for the local management of:

- Pressure ulcers/injuries
- Venous stasis ulcers
- Dermal lesions/injuries
- Superficial wounds and scrapes
- First- and second-degree burns
- Partial- and full-thickness wound

Wound on *irregular surfaces*:

Triad is designed to be applied directly from the tube onto the wound surface. A secondary dressing is not required (but can be applied in certain cases). Triad is easy to apply and can be used on wounds on irregular surfaces of the body, including but not limited to, the gluteal cleft, coccyx, perineum, buttocks, groin, face, hands, and feet.



A sterile coating that offers a unique approach for difficult-to-dress wounds



Apply anywhere



Adheres to wet skin



Keeps the wound covered

Broken skin in the presence of incontinence:

Urinary and fecal incontinence can lead to incontinence-associated dermatitis (IAD). IAD can cause skin breakdown and predispose wound infections. Triad provides a sterile coating on broken skin. The CMC in Triad allows it to adhere to wet skin while keeping the wound or broken skin covered and protected from incontinence. It also contains dimethicone that can moisturize the skin and petrolatum and zinc oxide to reduce skin irritation.

**Necrotic tissue such as slough or eschar:**

Necrotic tissue is a barrier to wound healing. When appropriate, necrotic tissue should be removed to facilitate healing. Triad is a hydrophilic (water-loving) paste. The CMC allows Triad to absorb low to moderate levels of wound exudate or broken-down tissue. It also allows natural moisture to spread evenly across the entire wound surface, maximizing contact and creating a moist wound healing environment. The moist wound environment can in turn facilitate autolytic debridement of necrotic tissue. Triad is not indicated for use on third-degree burns or infected wounds. It should also be avoided for wounds where debridement is not recommended or indicated (e.g., arterial wounds).

**Maceration of periwound skin:**

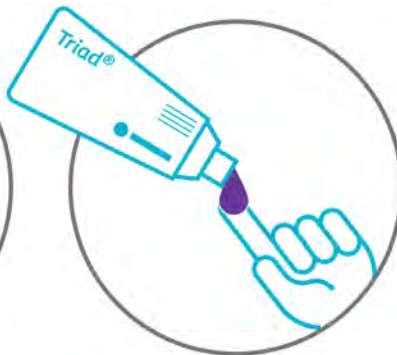
42% of chronic wounds are macerated.¹ Wound and periwound maceration can delay wound healing. Triad contains CMC which allows it to adhere to macerated skin. Triad can be applied to periwound skin to protect it from wound exudate.



To access the full presentation, click here: https://drive.google.com/file/d/1WpzMfYd6tYx2iUnR_kpDbRC8XMx-WT5hh/view?usp=share_link

How To Apply Triad

1. Always cleanse the wound before applying Triad.



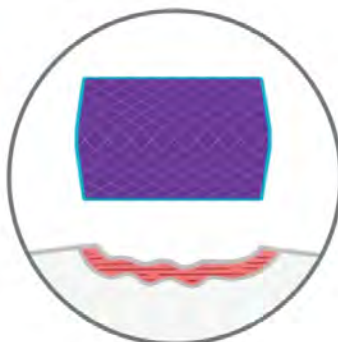
2. Triad can be applied directly from the tube or by using a gloved finger.



3. Gently spread Triad evenly over the area of application to the thickness of a dime.



1. For wounds with depth, gauze impregnated with Triad may be used.



2. Fold or fluff the gauze to fit within the wound bed.



3. Cover the wound with a secondary dressing.

How To Remove Triad™



1. Use pH-balanced wound cleanser to soften Triad.



2. Gently wipe to remove without scrubbing.



3. For complete removal repeat as needed.

***Laurence Quintin BScN, NSWOC** has been a nurse clinician at the Jewish General Hospital in Montreal since 2013. She began her career on a general surgery, colorectal, urology and gynecology-oncology department, where she discovered her interest in ostomies. In 2016, she went on to pursue her studies in Enterostomal Therapy (ET) with the Canadian Association of Enterostomal Therapy (now known as Nurses Specialized in Wound, Ostomy and Continence Canada). Throughout her career as an ET nurse, Laurence has worked in various clinical settings, including acute care, long-term care, and home care.



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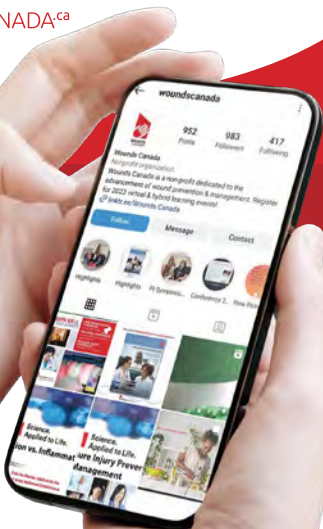
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Pressure Injury Risk Assessment Tools: A Literature Review

By Corey C Hanson, Janet L Kuhnke RN BA BScN MSc NSWOC Dr Psychology, Jasmine Hoover BSc MLIS, Mariam Botros DCh DE IIWCC MEd, Peter Athanasopoulos and Karen Sidholm

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Introduction

Definition: A pressure injury (PI) is defined by the National Pressure Injury Advisory Panel¹ as “localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device” and results from the presence of intense and/or prolonged pressure or shear.

PIs can present as intact or broken skin, are often painful and are graded in stages (1 to 4) based on their size and the severity and depth of tissue layers affected.¹ PIs are a burden to both patients and health-care systems, due to their resulting pain,¹ impact on mobility and quality of life,² extended hospital stays and high treatment costs.^{3,4,5,6}

Costs: The net and average costs of PIs in

Canada are unknown.⁷ However, costs of hospital-acquired PIs in Ontario, Canada, are reported to range from \$44,000 (CAD) for stage 2 PIs to \$90,000 (CAD) for stage 4 PIs.^{2,7} In the United States it is estimated that, in 2007, stage 3 and 4 PIs increased hospital admission costs by at least \$40,000 (USD) and, in 2011, it was reported that annual costs associated with PIs ranged from \$9.1-\$11.6 billion (USD).³ Annual PI-related expenses account for approximately £1.4-£2.1 billion in the United Kingdom⁴ and \$983 million (AUD) in Australia.⁶ Current best practice guidelines recommend identifying patients at risk for developing PIs in order to develop and implement interventions to mitigate PI risk factors and prevent PI development.^{8,10} This is done by utilizing PI risk assessment scales (PIRAS), with the most often used scales being the Waterlow Score, Norton Scale and Braden Scale.^{9,10}

Search Strategy: A review of the literature was conducted on available PIRAS. Reviewed articles included meta-analyses, systematic reviews and clinical trials. A primary search with conducted primarily with Google Scholar which has been found to have the fullest coverage of scholarly articles across subject areas such as Martin-Martin and colleagues (2021)⁷⁸ discuss. Academic Search Ultimate and Cumulative Index to Nursing and Allied Health Literature (CINAHL) were also used.

Pressure Injury Risk Assessment Scales

Through literature review, a total of 42 unique PIRAS were identified during this study. These were developed for use in pediatric, critical and intensive care, medical units and other health-care settings. Of the identified PIRAS, 13 were specifically developed for use in a pediatric setting. All other identified PIRAS were designed for use in adult populations. Table 1 describes the adult PIRAS identified in the literature. Pediatric PIRAS are described in Table 2. The variety of adult and pediatric PIRAS is reflective of the various risk factors considered and presence in a range of health-care settings and patient populations and has also been reported to result from the use of inadequate development methods, the modifica-

tion and adaptation of existing and dated PIRAS, and the use of out-dated literature reviews and research.¹¹ It is important to consider this, as well as all assessment items included in the multitude of existing PIRAS when developing a new tool for assessing PI development risk (For methodology, please contact the corresponding author).

Adult Pressure Injury Risk Assessment Scales

A total 29 PIRAS were identified pertaining to adult populations in various settings (Table 1). The relevance of the identified PIRAS in the literature varied. The most widely cited, referenced, and discussed PIRAS were the Braden, Norton, and Waterlow scales. Several identified PIRAS, such as the Decubitus Ulcer Potential Analyzer,¹² Pressure Area Scoring System,¹³ the S.S. tool¹⁴ and the Birty Pressure Areas Risk Assessment Scale,¹⁵ had limited information available and related research was scarce. This was also observed by Keller et al. (2002).¹⁶ The Braden and Norton scales were found to form the foundations of numerous other PIRAS, including the Waterlow Scale,^{9,17} the Cubbin & Jackson,¹⁸ the Douglas Risk Assessment Tool (all based on the Norton Sale)¹⁹ and the Hunters Hill Marie Curie Centre Pressure Sore Risk Assessment Tool (based on the Waterlow and Braden PIRAS).¹⁹ The Decubitus Ulcer Potential Analyzer was based on the Gosnell, Norton and Braden scales.^{12,16} The Northern Hospital Pressure Ulcer Prevention Plan¹⁰ and S.S. Tool¹⁴ were developed using statistical modelling. The Fragment score²⁰ was developed through the adaptation of Norton and Braden scales, and statistical modelling. The Braden²¹ and the PURPOSE-T¹¹ were developed using factors identified in the literature.

Pediatric Pressure Injury Risk Assessment Scales

Thirteen unique PIRAS were identified for use in pediatric settings (Table 2). Similar to the adult PIRAS, the relevance of individual PIRAS in the literature varied. The most widely discussed pediatric PIRAS were the Braden Q,²² Starkid,²³

Table 1. Description of PIRAS identified in the literature and their respective settings.

Pressure Injury Risk Assessment Scale	Setting	Reference
Andersen	Not specified	Andersen et al., 1982; ³⁷ Keller et al., 2002 ¹⁶
Braden	Medical and Surgical	Adibelli & Korkmaz, 2019; ³⁸ Bergstrom et al., 1987 ²¹
CALCULATE	Critical and intensive care	Richardson & Barrow, 2015; ³⁹ Richardson & Straughan, 201 ⁴⁰
Centraal Begeleidingsorgaan voor de Intercollegiale Toetsing (CBO)	Geriatric; Long-term care	Keller et al., 2002; ¹⁶ Van Marum et al., 2000; ⁴¹ Verschueren et al., 2011 ⁴²
Conscious level, Mobility, Haemodynamics, Oxygenation, Nutrition (COMHON) Index	Critical and intensive care	Fulbrook & Anderson, 2015 ⁴³
Cubbin & Jackson Scale (revised in 1999)	Critical and intensive care	Cubbin & Jackson, 1991; ⁴⁴ Jackson, 1999 ⁴⁵
Douglas	Critical and intensive care	Keller et al., 2002; ¹⁶ McGill & Chaplin, 2002; ¹⁹ Prichard, 1986 ⁴⁶
DUPA	Critical and intensive care	Jiricka et al., 1995; ¹² Keller et al., 2002 ¹⁶
Fragment	Medical and Surgical; Critical and intensive care; Neurology; Dermatology	Perneger et al., 2002 ²⁰
Gosnell	Critical and intensive care; Spinal cord injury	Najmanova et al., 2021; ⁴⁷ Zhang et al., 202 ⁴⁸
Hunters Hill Marie Curie Centre (HHMCC)	Palliative Care	Chaplin, 2000; ⁴⁹ McGill & Chaplin, 2002 ¹⁹
InterRAI	Geriatric; Long-term care	Poss et al., 2010 ⁵⁰
Knoll Tool	Medical and Surgical	Aronovitch et al., 1992 ⁵¹
Maelor (previously known as Medley)	Medical and Surgical; Geriatric; Long-term care	Gleeson, 2015; ³¹ Johansen et al., 2014 ³²
Modified Braden	Medical and Surgical	Kwong et al., 2005 ⁵⁵
Modified Knoll	Medical and Surgical	Armstrong & Bortz, 2001; ⁷⁷ Aronovitch et al., 1992 ⁵¹
Modified Norton	Medical and Surgical	Gunningberg et al., 200 ⁵²
Northern Hospital Pressure Ulcer Prevention Plan (NHPUPP)	Medical and Surgical	Page et al., 201 ¹⁰
Norton	Medical and Surgical	Anthony et al., 2008; ⁵³ Norton et al., 1962 ⁵⁴
Pressure Area Scoring System (PASS)	Critical and intensive care	Batson et al., 1993; ¹³ Keller et al., 2002 ¹⁶
Pressure Sore Prediction Score (PSPS)	Medical and Surgical	Hamilton, 1992; ⁷⁶ Keller et al., 2002 ¹⁶
PURPOSE-T	Medical and Surgical; Community	Coleman et al., 2017 ⁵⁶

Pressure Injury Risk Assessment Scale	Setting	Reference
Ramstadius Tool	Medical and Surgical	Sharp & McLaws, 2006 ⁵⁷
S.S. Tool	Critical and intensive care	Suriadi et al., 2008 ¹⁴
SCIPUS	Spinal Cord Injury; Rehabilitation	Delparte et al., 2015 ⁵⁸
Shape Risk Scale	Medical and Surgical; Bariatric	Soppi et al., 2012 ⁵⁹
Sunderland	Critical and intensive care	Lowery et al., 1995 ⁶⁰
Walsall	Community	Chaloner & Franks, 1999 ⁶¹
Waterlow	Geriatric	Anthony et al., 2008 ⁵³ ; Jalali & Rezaie, 2005; ¹⁷ Waterlow, 1985 ⁹

and Glamorgan scales.²⁴ Some scales, such as the Bedi,²⁵ Derbyshire,²⁶ Burn Pressure Ulcer Risk Assessment Scale^{2,7} and Cockett²⁸ were not as relevant in the literature in comparison. This was also observed by Kelechi et al.,²⁹ and Kottner et al.³⁰ The majority of pediatric PIRAS identified were based upon or are modifications of existing scales, such as the Braden and Waterlow scales, or are combinations of multiple scales. This is seen in the Bedi scale,²⁵ which was developed by modifying the adult Waterlow scale to fit a pediatric population,³⁰ and the Derbyshire, which was developed by combining items from both the Maelor^{31,32} and adult Waterlow scales. The Burn Pressure Ulcer Risk Assessment Scale²⁷ utilized a modified Delphi technique, which considered the opinions and experiences of field experts, in the development of their scale.³⁰ As previously reported by Kottner et al.,³⁰ several scales were based on literature reviews, including the and pediatric Waterlow,³³ Barnes,³⁴ Cockett²⁸ and Garvin³⁵ scales and findings from their research, as seen in the Glamorgan scale.³⁶

Risk Determination

All PIRAS, with the exception of the Ramstadius tool, utilized numerical scales to determine risk level for PI development. The Ramstadius tool has been described as a combination of a PIRAS and intervention protocol using specialized mattresses and regular repositioning in at-risk patients.⁶⁷ Each assessment item in the

Ramstadius tool simply requires a “yes” or “no” answer.⁵⁷ Numerical scales differed by PIRAS as to whether higher PI risk was indicated by lower or higher score. Lower scores being associated with higher risk were seen in PIRAS including the Braden,^{21,38,68} Norton,^{53,54,68} Cubbin & Jackson,^{44,45} Sunderland,⁶⁰ Gosnell,^{17,69} Starkid²⁹ and Braden Q scales.^{29,62} Scales in which a higher score was indicative of higher risk include the Waterlow,⁶⁸ Walsall,⁶¹ Hunters Hill Marie Curie Centre,⁴⁹ Spinal Cord Injury Pressure Ulcer Scale⁵⁸ and COMHON Index.⁷⁰ Additionally, risk levels and the pertaining score ranges varied by PIRAS. However, risk level consistently and expectedly increased as a scale’s score approached its critical value (highest or lowest). Each of the identified PIRAS assigned weight to all included items that contributed to patient scoring, with the exception of the Gosnell scale.^{47,48} In the Gosnell scale, all prescribed medications, food and fluid intake, vital signs and implemented interventions are included in the assessment, but bear no weight in its scoring.

Adult Risk Assessment Scale Items

A total of 50 different items were identified and used in the adult PIRAS identified. Table 3 describes the assessment items of all adult PIRAS identified in this literature review. The five most frequently occurring items in adult PIRAS were mobility (occurring in 24 of 29 identified PIRAS), mental state (19 of 29), bowel and/or bladder

Table 2. Description of pediatric PIRAS identified in the literature and their respective settings.

Pressure Injury Risk Assessment Scale	Reference
Barnes	Barnes, 2004; ³⁴ Kottner et al., 2013 ³⁰
Bedi	Bedi, 1993; ²⁵ Kottner et al., 2013 ³⁰
Burn Pressure Ulcer Risk Assessment Scale	Gordon, 2008; ²⁷ Kottner et al., 2013 ³⁰
Braden Q	Anthony et al., 2010; ⁶² Curley et al., 2003; ²² Kelechi et al., 2013 ²⁹
Cockett	Cockett, 1998; ²⁸ Kottner et al., 2013 ³⁰
Derbyshire	Pickersgill, 1997 ²⁶
Garvin	Ferreira et al., 2018; ⁶³ Garvin, 1997 ³⁵
Glamorgan	Willock et al., 2007 ²⁴
Neonatal Skin Risk Assessment Scale	Huffines & Logsdon, 1997; ⁶⁴ Kottner et al., 2013 ³⁰
Pattold Pressure Scoring System	Olding & Patterson, 1998; ⁶⁵ Kottner et al., 2013 ³⁰
Pediatric Waterlow	Waterlow, 1998 ³³
Pediatric Pressure Ulcer Prediction and Evaluation Tool (PPUPET)	Sterken et al., 2015 ⁶⁶
Starkid	Kelechi et al., 2013; ²⁹ Suddaby et al., 2005 ²³

incontinence (18 of 29), nutrition status (15 of 29) and activity (14 of 29). Several items were unique to a single PIRAS, including patient sex, carer input, body shape and hygiene. Activity, mobility, mental state and incontinence were identified PI risk factors found frequently in PIRAS, as reported in a review by Keller et al.¹⁶ This is congruent with the most frequent assessment items identified in the current review. The authors also reported that number of and duration of surgeries, low preoperative serum protein and albumin levels, altered sensory perception, skin moisture, impaired circulation, inotropic medications, diabetes mellitus, being too unstable to turn and a high Acute Physiology and Chronic Health Evaluation (APACHE) II score may also increase the risk of PI development.¹⁶ Impaired mobility and urinary incontinence have been reported as significantly associated with PI development.⁵⁷ However, fecal incontinence has only been weakly associated with PI development, yet fecal and urinary incontinence are commonly assessed under a single PIRAS item:

incontinence.⁵⁷ It is important to consider the fact that fecal continence, along with sweat and discharge from wounds, also contributes to another assessment item found in various PIRAS: skin moisture.¹⁶ While fecal incontinence alone may not be a major factor in PI development, it contributes to PI development alongside other minor factors commonly seen in medical, surgical and critically ill patients. While urinary incontinence is significantly associated with PI development, it has been suggested this is not as relevant in critical care settings, as most patients have a urinary catheter in place.¹⁶ While this may reduce a patient's risk for PI, it increases their risk for urinary tract infections, which are the most common health-care-associated infection and account for 36% of total health-care-associated infections, with urinary catheter-related cases accounting for 80% of total cases.⁷¹

A previous study by Page et al.,¹⁰ through literature review of demographic and clinical factors associated with PI development, identified factors with clinical relevance included age of 65 years

or greater, inability to independently move in bed, altered cognition or level of consciousness, impaired sensation, diabetes mellitus, peripheral vascular disease, impaired skin integrity, moisture, incontinence (fecal and/or urinary was not indicated), skin frailty, admission to intensive care and low body mass index. Univariate analysis and multivariate analysis identified the significant items used in their tool, The Northern Hospital Pressure Ulcer Prevention Plan, as: assistance to move in bed required, admission to intensive care, age of 65 years or greater, altered cognition or level of consciousness and impaired sensation.¹⁰ An age of 65 years or older was also reported to have a significant association with PI development by Webster et al.,⁷² along with dietary referrals and being admitted from a location other than the patient's home. While skin status has been reported to be an important predictor of PI development,⁷³ it is inconsistently included in PIRAS.¹¹ This is congruent with the observations of the current study, in which skin status was included in 12 of 28 PIRAS. In addition to skin status, Coleman et al.,⁷³ also identified mobility and activity, perfusion and diabetes, skin and PI status. Skin moisture, age, hematological measurements, nutrition and health status were also described to be important risk factors for PI development. Temperature and immunity were also thought to be important but were said to require further research, while little evidence was found supporting the role of race and gender in PI development.⁷³ While caregiver input was only found to be an assessment item in the Walsall PIRA,⁶¹ the input and involvement of caregivers and patients is also important,¹¹ as this promotes their inclusion in making decisions related to and planning care.⁷⁴

Pediatric Risk Assessment Scale Items

A total of 30 different items were identified and used for assessment in the identified pediatric PIRAS. The assessment items of the pediatric PIRAS identified in this study are identified in Table 4. The four most frequently occurring items in pediatric PIRAS were mobility (includ-

ed in all 14 pediatric PIRAS), nutrition (11 of 14), skin status (8 of 14) and bowel and/or bladder incontinence (7 of 14). The fifth most frequently occurring items were poor perfusion, moisture, low weight, and devices, tubing, or lines pressing on the skin, all of which were identified in six pediatric PIRAS. Items unique to individual pediatric PIRAS included percentage of body surface area burned, prior or current PI, age, gestational age and current infection. Mobility, nutrition, skin status, incontinence were also found to be commonly included in identified pediatric PIRAS. A review by Kottner et al.,³⁰ had identified 12 pediatric PIRAS and approximately 33 assessment items, with 14 items occurring in only one PIRAS each. The review reported that mobility, nutrition, incontinence, weight and skin status were the most frequently occurring assessment items. Additionally, mobility was part of each PIRAS. This is congruent with the findings of this research, as mobility was an item in each of the 14 pediatric PIRAS identified in the current review. This emphasizes the importance of mobility in PI development, especially when considering the established relationship between mobility and PI development.⁸ Therefore, mobility is of particular importance when assessing a pediatric patient's PI development risk or developing a pediatric PIRAS. The similarities between the current review and the findings of Kottner et al.,³⁰ also indicate the importance of nutrition, skin status, incontinence and weight in the assessment of PI development in pediatric populations.

Limitations

Article availability and database restrictions may have resulted in some indirect and unintended bias. However, every possible effort to circumvent database restrictions was taken. Yet, it is possible that relevant articles, additional PIRAS, or publications in other databases or gray literature could have been missed. Additionally, where the authors were only able to review articles available in English, it is possible that relevant publications were missed due to a lack of multilingualism.

Table 3. Items considered by the identified adult PIRAS.

Item	Pressure Injury Risk Assessment Scale									
	Andersen	Braden	CALCULATE	CBO	COMHON	Cubbin & Jackson	Douglas	DUPA	Fragment	Gosnell
Mobility	x	x		x	x	x		x	x	x
Incontinence	x		x ^b	x		x	x			x
Mental State	x			x	x	x	x	x	x ^b	x
Nutrition Status			x		x	x	x	x		x
Activity		x					x	x		x
Skin Status	x					x	x			documented
Hemodynamic Status	x		x ^c			x				
Weight/BMI						x	x			
Age	x			x		x			x	
Sensory perception		x						x		
Respiration/Oxygenation			x		x	x	x			
Moisture		x						x		
Predisposing disease, medical condition					x					
Pain							x			
Prescribed medications ^a				x			x			documented
Friction or Shear		x						x	x	
Temperature				x						
Appetite/Food Intake										documented
Perfusion/Cardiac Insufficiency			x					x		
Fluid Intake	x									documented
Diabetes/Hyperglycemia				x			x			
Other Items Considered			x ^d	x ^e		x ^f				

^aSteroids, cytotoxic medications (chemotherapy medications), nonsteroidal anti-inflammatory drugs anticoagulants, sedatives, pain medications, tranquilizers, antibiotics; ^bFecal incontinence only; ^cSerum albumin and protein; ^dMechanical ventilation, surgery date, dialysis; ^eNeurology; ^fHygiene

Conclusion

PI prevention and risk assessment continue to be best practice worldwide. However, there is more to PI prevention than simply completing a risk

assessment form: it is important to consider and identify the individual risk factors for PI development and mitigate them as much as possible. Yet PIRAS continue to form the basis of PI prevention, and for good reason, as they have been shown to

Table 3 (Cont.). Items considered by the identified adult PIRAS.

	Pressure Injury Risk Assessment Scale										
Item	HHMCC	InterRAI	Knoll Tool	Maelor	Modified Braden	Modified Knoll	Modified Norton	NHPUPP	Norton	PASS	PSPS
Mobility	x	x	x	x	x	x	x	x	x		x
Incontinence		x ^b	x	x		x	x		x		x
Mental State			x	x		x	x	x	x		x
Nutrition Status	x			x	x	x					x
Activity	x	x	x	x	x	x	x		x		x
Skin Status	x			x	x						
Hemodynamic Status	x										
Weight/BMI		x			x						
Age								x			
Sensory perception	x				x			x			
Respiration/Oxygenation		x									
Moisture	x				x						x
Predisposing disease, medical condition			x			x					
Pain		x		x							
Prescribed medications ^a											
Friction or Shear	x				x						
Temperature											
Appetite/Food Intake						x	x				
Perfusion/Cardiac Insufficiency											
Fluid Intake						x	x				
Diabetes/Hyperglycemia										x	
Other Items Considered		x ^c	x ^d			x ^d	x ^{d,e,f}	x ^g	x ^d	x ^{h,i,j}	x ^d

^aSteroids, cytotoxic medications (chemotherapy medications), nonsteroidal anti-inflammatory drugs, anticoagulants, sedatives, pain medications, tranquilizers, antibiotics; ^bFecal incontinence only; ^cHistory of PI; ^dPhysical condition; ^eSurgery date; ^fadmission date; ^gICU admission; ^hepinephrine and/or norepinephrine infusion; ⁱrestricted movement; ^jtoo unstable to turn

be more effective in predicting PI risk than clinical judgement alone.⁷⁵ While the variety of adult and pediatric PIRAS is reflective of the risk factors considered in different settings and patient populations, it has also been reported to stem from

the use of inadequate development methods, the modification and adaptation of existing and dated PIRAS, and the use of outdated literature reviews.¹¹ The five most frequently occurring items in adult PIRAS were mobility, mental state,

Table 3 (Cont.). Items considered by the identified adult PIRAS.

	Pressure Injury Risk Assessment Scale							
Item	PURPOSE-T	Ramstadius Tool	S.S. Tool	SCIPUS	Shape Risk Scale	Sunderland	Walsall	Waterlow
Mobility	x	x		x			x	x
Incontinence	x			x		x	x	x
Mental State				x	x	x	x	
Nutrition Status	x					x	x	x
Activity				x				
Skin Status	x	x				x	x	x
Hemodynamic Status		x		x ^j		x		x
Weight/BMI					x	x		x
Age		x		x				x
Sensory perception	x				x			x
Respiration/Oxygenation		x				x		
Moisture	x			x				
Predisposing disease, medical condition	x			x		x	x	
Pain	x						x	
Prescribed medications ^a	x	x						
Friction or Shear	x ^b							
Temperature		x	x		x	x		
Appetite/Food Intake								
Perfusion/Cardiac Insufficiency	x							
Fluid Intake								
Diabetes/Hyperglycemia				x				
Other Items Considered	x ^{c,d,e,f}	x ^{g,h}	x ^{b,i}	x ^{i,k,l,m}	x ⁿ		x ^o	x ^{g,i,k,p,q}

^aSteroids, cytotoxic medications (chemotherapy medications), nonsteroidal anti-inflammatory drugs, anticoagulants, sedatives, pain medications, tranquilizers, antibiotics; ^bincludes pressure from devices, lines, and tubes; ^chistory of PI; ^dclinical judgement; ^eedema; ^fepidural; ^gsex; ^hexisting PI; ⁱtobacco consumption; ^jalbumin and hematocrit; ^kcomplete SCI; ^lautonomic dysreflexia; ^mhospitalization; ⁿbody shape; ^ocarer input; ^psurgery date; ^qcachexia

bowel and/or bladder incontinence, nutrition status and activity. The four most frequently occurring items in pediatric PIRAS were mobility, nutrition, skin status and bowel and/or bladder

incontinence. The fifth most frequently occurring items were poor perfusion, moisture, low weight, and devices, tubing or lines pressing on the skin, all of which were identified in six pediatric PIRAS.

Table 4. Items considered by the identified pediatric PIRAS.

	Pressure Injury Risk Assessment Scale						
Item	Barnes	Bedi	BPURAS	BRADEN Q	Cockett	Derbyshire	Garvin
Mobility	x	x	x	x	x	x	x
Nutrition			x	x	x		x
Skin status	x	x			x	x	
Incontinence	x	x	x		x	x	
Device-related pressure	x		x		x		
Poor perfusion		x		x			
Weight (low BMI)	x	x	x ^g		x	x	
Hemodynamic status	x	x	x		x		
Sensory perception	x			x			x
Moisture				x			x
Activity				x			
Friction/shear/pressure	x			x			
Majory Sx/trauma/illness	x	x			x		
LOC/Mental state		x			x		
Respiratory status					x		
Temperature					x		
Appetite		x				x	
Medication		x				x	
Sedation	x				x		
Other Items Considered		x ^{a-d}	x ^{e-f}				

^aage; ^bcachexia; ^ccirculatory/vascular disease; ^dinfection; ^epercentage of body surface area burned; ^fprior or current PI; ^gdefined as increased bony prominences

The relevance of these factors among various PIRAS indicate their importance in PI development and prevention. These factors should be heavily considered when attempting to mitigate PI development in all patients, regardless of PIRAS utilized in that setting. Additionally, these factors should be considered if and when developing a novel PIRAS for use in an adult or pediatric setting.



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Table 4 (Cont.). Items considered by the identified pediatric PIRAS.

	Pressure Injury Risk Assessment Scale					
Item	Glamorgan	Neonatal Skin	Pattold	Pediatric Waterlow	PPUPET	Starkid
Mobility	x	x	x	x	x	x
Nutrition	x	x	x	x	x	x
Skin status		x	x	x	x	
Incontinence	x		x			
Device-related pressure	x			x	x	
Poor perfusion	x	x			x	x
Weight (low BMI)	x		x			
Hemodynamic status	x ^a		x			
Sensory perception					x	x
Moisture		x			x	x
Activity		x			x	x
Friction/shear/pressure					x	x
Majory Sx/trauma/illness				x ^c		
LOC/Mental state		x				
Respiratory status			x	x		
Temperature	x		x			
Appetite						
Medication						
Sedation						
Other Items Considered		x ^b		x ^{d,e}		

^aalbumin; ^bgestational age; ^chead injury, illness; ^dphysical disability; ^eICU admission

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Prevent pressure injuries

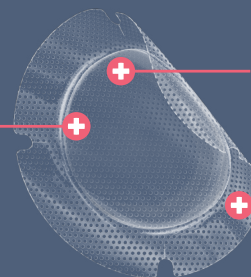
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Convatec Sponsored Learning:

Recognizing Granulitis And Addressing Biofilm In Hard-to-Heal Wounds.

Wound Hygiene: The Journey So Far

Presenter: Christine Murphy PhD MCISc(WH) RN WOCC(C)* and Philip Bowler MPhil, BSc**

Terminology Affects Possibility: Chronic Vs. Hard-To-Heal Wounds

Chronic wounds are common and costly to treat. The word “chronic” implies that the wound is long-standing. It also instills a sense of hopelessness. The term “hard-to-heal” is a more appropriate term to describe wounds that are slow to heal for various reasons, including complex medical history and biofilm. The wound is a battlefield. It is not a garden. Wounds that are hard-to-heal require proactive management. Such management includes wound hygiene (including biofilm management).

What Is Biofilm?

Biofilm is the principal cause of hard-to-heal wounds.¹ Biofilm is the natural and preferred mode of bacterial life. Aggregates of bacteria first attach to a living or non-living surface. Then they secrete a sugary, slimy matrix, known as the extracellular polymeric substance (EPS) around themselves. This matrix protects them from extreme conditions, including heat, dryness, host immune response and antimicrobial agents. Lastly, bacteria from the biofilm can disperse and become planktonic (free-floating) again, causing a secondary infection and further tissue damage.

Biofilm Is:

- The predominant and preferred form of bacterial life

- Stubborn (i.e., hard to remove physically)
- Persistent and promotes host inflammatory response
- Associated with chronic infections
- The principal cause of hard-to-heal wounds

Biofilm And Wound Healing

Biofilm acts like a parasite inducing prolonged tissue inflammation (Granulitis) and requires ongoing management to reduce its presence. Thus wound hygiene directly targets the root cause of the hostile environment which stalls healing in the majority of hard-to-heal wounds. Biofilm are difficult to remove physically and can impair epithelial cell migration and granulation tissue formation.² The EPS protects the biofilm from harsh external environments, including host immune response and antimicrobials. During the initial phase of normal wound healing, neutrophils, a type of

Biofilm Development

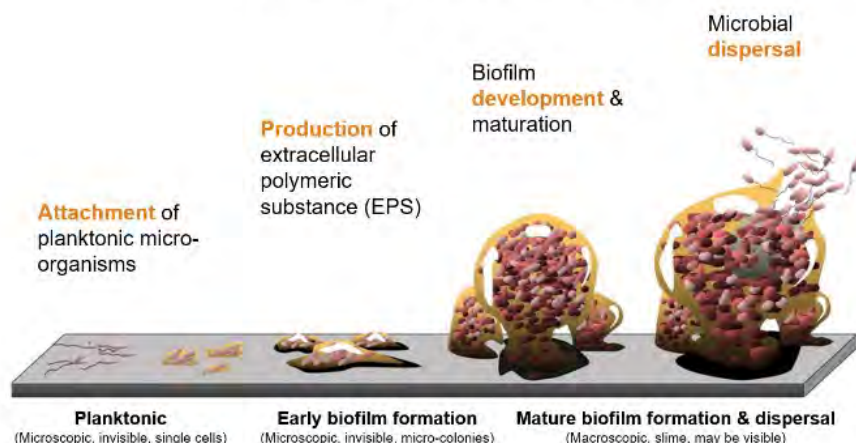


Table 1. Inflammation and infection in acute and hard-to-heal wounds

	Acute wound infection	Chronic wound infection
Causative agent	<ul style="list-style-type: none"> Metabolically active planktonic microbial cells 	<ul style="list-style-type: none"> Metabolically passive and sessile biofilm microbial cells
Infectious process	<ul style="list-style-type: none"> Invasion of host viable tissue via virulence expression (e.g., microbial enzymes, toxins) 	<ul style="list-style-type: none"> Biofilm (parasitic) persistence on host tissue³² Persistent inflammation, continuous oxidative damage, fibroblast senescence, degradation of growth factors, sustained NET release^{28,33}
Inflammatory response	<ul style="list-style-type: none"> Host-controlled response Neutrophil recruitment to tissue site Increase in intracellular oxidative burst and microbial killing NET activation and release (NETosis)²⁸ 	<ul style="list-style-type: none"> Microbe-controlled response Low-grade inflammatory response (IL-1β and TNF-α expression) compared with acute wounds²⁴ Neutrophil aggregation around biofilm, ineffective action leading to host cell senescence and oxidative damage³³ Persistent NETosis²⁸
Clinical manifestation	<ul style="list-style-type: none"> Erythema Heat Pain/tenderness Oedema 	<ul style="list-style-type: none"> Delayed wound healing^{17, 33–36} Wound breakdown³⁵ Dull/dark red granular or discoloured tissue^{34,35} Increased exudate^{32,34,35} Friable, unhealthy granulation tissue/bleeding^{35,36} Increased exudate/purulence^{32,34,35} Increased pain^{34–36} Increased malodour^{35,36} Hypergranulation³⁶ Epithelial bridging and pocketing in granulation tissue³⁶

NET—neutrophil extracellular trap; IL-1 β —interleukin 1 β ; TNF- α —tumour necrosis factor- α

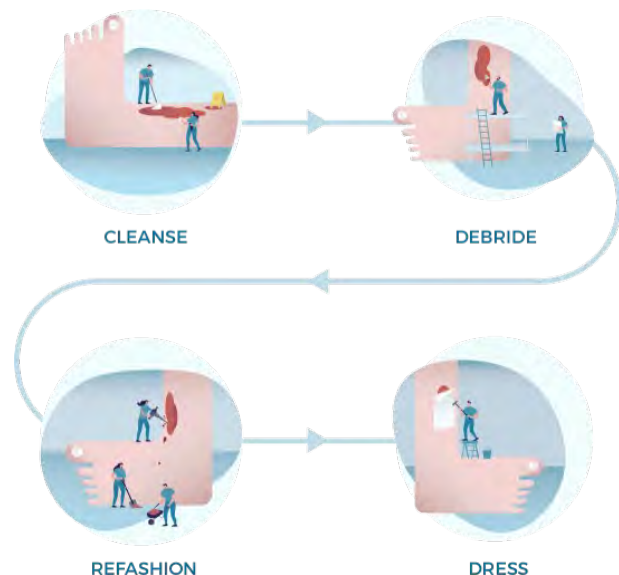
white blood cell, are the first line of defense against bacteria. They induce host-controlled inflammation to eliminate the bacteria and initiate healing. In the presence of biofilm, the EPS prevents the neutrophils from accessing the bacteria.

This leads to neutrophils becoming ‘frustrated’, releasing enzymes and toxins that ultimately damage host tissue while the bacteria remain protected within the EPS. This process is known as microbe-controlled inflammation. It delays wound healing and causes chronic wound infections. The differences between host-controlled and microbe controlled inflammation and their ultimate clinical manifestations are shown in Table 1.

Recognizing Granulitis: Biofilm And Wound Hygiene

Granulitis is a biofilm-induced, prolonged inflammatory condition.⁶ It is similar to gingivitis – gum inflammation caused by biofilm. Granulitis is, in essence, inflammation of the granulation tissue in the wound. It can lead to the formation of unhealthy granulation tissue (i.e., discoloured tissue, friable tissue, hypergranulation tissue, epithelial bridging/pocketing). Management of granulitis requires early and frequent local wound management and wound hygiene.

Wound hygiene involves four steps – cleanse, debride,



refashion and dress.⁷ Table 3 provides guidance for wound hygiene and the management of biofilm.

AQUACEL® Ag+ Extra™: Use As Part Of Your Anti-Biofilm Strategy

As previously mentioned, the EPS of the biofilm prevents antimicrobials and host defense mechanisms from accessing the bacteria. In order to address biofilm, the EPS needs to be degraded or dispersed. Surfactants (i.e., detergents) and metal chelators (e.g., EDTA) have been

PRESENTATION DIGEST

Table 2. Guidance For Performing Wound Hygiene Tasks⁸

Tissue Type	Recommended cleansing intensity	Recommended debridement methods	Recommended refashioning intensity
Necrotic	Vigorous (using physical force)	Intensive: <ul style="list-style-type: none"> • Surgical • Sharp selective (curette, scalpel, scissors, forceps) • Larval* • Mechanical debridement (including soft debridement pad, gauze or wipes) 	Agitate the wound surface to pinpoint bleeding
Sloughy	Vigorous	Intensive: <ul style="list-style-type: none"> • Surgical • Sharp selective (curette, scalpel, scissors, forceps) • Larval • Mechanical debridement (including soft debridement pad, gauze or wipes) 	Agitate the wound surface to pinpoint bleeding
Unhealthy granulation	Vigorous	Intensive: <ul style="list-style-type: none"> • Surgical • Sharp selective (curette, scalpel, scissors, forceps) • Larval • Ultrasonic debridement • Mechanical debridement (including soft debridement pad, gauze or wipes) 	Agitate the wound surface to pinpoint bleeding
Healthy granulation	Moderate or gentle, depending on confidence and competence	Gentle: <ul style="list-style-type: none"> • Mechanical cleansing/debridement (including soft debridement pad, gauze or wipes) 	Selectively rub in circular motion over wound bed and periwound skin, as needed
Epithelialisation	Gentle	Not required	Not required

found to be useful in dissolving the EPS of biofilm. The AQUACEL® Ag+ Extra™ dressing contains three components:

- Exudate management: Hydrofiber® technology
- Biofilm management: EDTA (metal chelator) and benzethonium chloride (surfactant)
- Infection management: Ionic silver

AQUACEL® Ag+ Extra™ can be used as step 4 of the Wound Hygiene protocol. It is able to manage biofilm, infection, and exudate, and has been shown scientifically and clinically to facilitate healing in hard-to-heal wounds.



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National Wound Community Think Tank: Mobilizing Canada's Skin Health And Wound Care Community

By John Hwang MD MSc FRCSC, Crystal McCallum RN MCISC and Darren Levine EdD

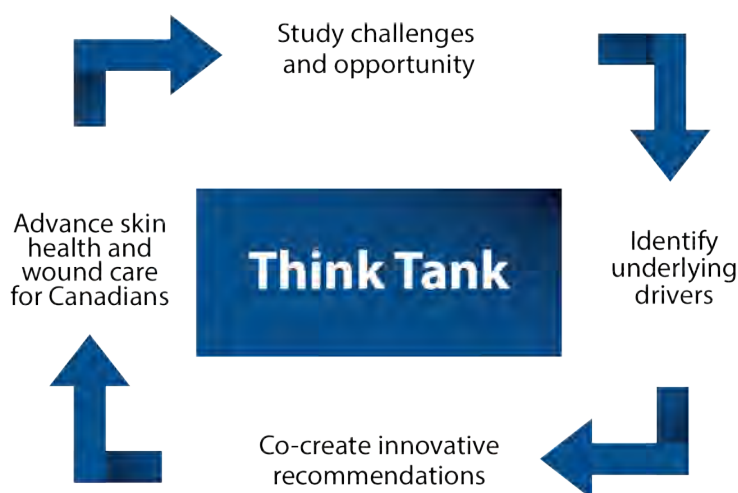
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Introduction

With an aim toward leveraging and mobilizing the knowledge and experience of a diverse and representative group from across Canada's skin health and wound care community, a National Wound Community Think Tank was launched in February 2023 as an action and solutions-oriented working group of Wounds Canada.

Cultivating 'Outside-the-Box' Thinking

This Think Tank brings together clinicians, patients, patient-advocates, educators, researchers, industry partners and other stakeholders from coast to coast. Through facilitated dialogue and co-creation processes, Think Tank members study areas of challenge and opportunity surrounding skin health and wound care within Canada's health-care system, identifying underlying drivers and





co-creating potential innovative recommendations and paths forward. The shared goal among Think Tank members is the advancement of skin and wound care for all Canadians within the complexities of our health-care system and our current and anticipated post pandemic realities.

Reflecting Canada's Diverse Wound Care Community

The National Wound Community Think Tank aims to represent the interdisciplinary, interprofessional and multicultural nature of Canada's wound care community and is working towards gathering representatives from health regions across Canada. Current membership includes more than 25 leading wound care experts from across academia, hospitals, community clinics, health-care associations and industry, alongside patients, patient-advocates and patient-partners. The diversity of its membership ensures that a range

of perspectives, lived experiences and worldviews are considered and listened to, so that we may learn from one another.

Developing Recommendations That Consider Multiple Perspectives

The National Wound Community Think Tank aims to consider skin health and wound care in Canada through multiple lenses, including (but not limited to): patient experience, provider experience, population health, value-driven care and equity.¹ These perspectives guide Think Tank members in their co-creation of strategic recommendations to advance Wounds Canada's pillars of research, education, awareness and advocacy.

Following Think Tank gatherings, recommendations are shared with, and considered by, the Wounds Canada team and Board of Directors to inform planning and activities.



2023 Activities

In early 2023, Think Tank members reflected on Wounds Canada's priorities and national activities, and together, identified awareness of skin health and wound care among Canadians as an important initial challenge and opportunity for the think tank.

Think Tank gatherings were held in spring and fall 2023 and began to explore this area of focus through the perspectives of those delivering care (i.e., health-care practitioners); those receiving care (i.e., patients, family members, caregivers); those funding care (i.e., government policy makers) and through the lenses of educators and researchers across various fields of study associated with skin health and wound care.

Through facilitated dialogue, Think Tank members acknowledged the difficulties both patients and clinicians are experiencing. Members further highlighted the importance of all Canadians realizing how many people are affected by wounds. A key opportunity was identified to blend quantitative and qualitative data to highlight the full extent of the socio-economic impact and burden of wound care in Canada as part of a national awareness campaign. Think Tank members are now actively engaged in co-creating prototypes surrounding potential campaign possibilities to inform Wounds Canada's 2024 awareness strategy and initiatives.

Cultivating Community And Creativity

Although in its early stages, the Think Tank aims to build a sense of community, unity and social support among members while simultaneously cultivating the collaborative creativity necessary to incubate new ideas. Members have begun to draw on one another's experiences and expertise to question current thinking and practice, explore a range of divergent ideas and possibilities and find unity through diversity to converge on paths forward. Impacts and outcomes of the Think Tank and its activities will be formally evaluated over the course of 2024.

Next Steps

In the months ahead, the National Wound Community Think Tank will continue to hold space for members to co-create awareness-focused recommendations, while expanding its focus to other areas of priority surrounding skin health and wound care in Canada.

At the same time, the Think Tank will be seeking to expand membership to ensure broad representation from across Canada. In doing so, it aims to mobilize the knowledge, experience, and expertise of Canada's skin health and wound care community to improve outcomes for all Canadians.

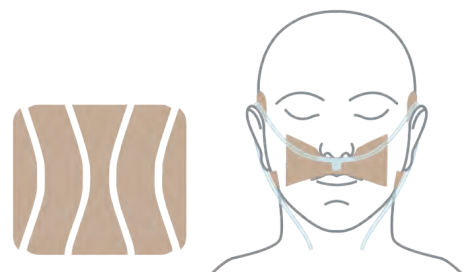
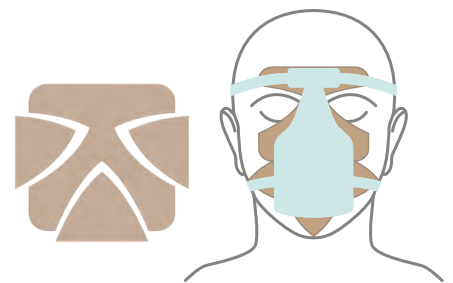
To learn more about the National Wound Community Think Tank, as well as other initiatives underway through Wounds Canada, please visit <https://www.woundscanada.ca/about/committees-and-partnerships>. 📄

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The Prevalence Of Diabetes In Canada And The Burden Of Diabetic Foot Ulcers

In 2022, approximately 30% of the population in Canada suffered from diabetes mellitus (DM) or pre-diabetes.¹ Patients with DM are at a higher rate of hospitalization compared to those from the general population. They are three-times, and twelve-times more likely to be hospitalized due to cardiovascular disease and end-stage renal disease, respectively.¹ DM also impacts those who are of a lower socioeconomic status more severely. Additionally, incidences of DM and pre-diabetes is six-times higher among the Indigenous populations in Canada.² The amputation rate in these populations is thirty-eight-times higher than non-Indigenous populations.²

Approximately 15-25% of patients with DM will suffer a diabetic foot ulcer (DFU) in their lifetime.¹ Compared to the general population, patients with DM are twenty-times more likely to suffer a non-traumatic lower limb amputation (LLA), which usually results from a pre-existing DFU (~85%).¹ The five-year survival rate for a patient with a DFU is 50%.³ This is lower than that of prostate cancer, breast cancer, and Hodgkin's lymphoma. DFUs are costly to the health-care system financially. They also impact the patients and their families physically and psychologically.

The Pathophysiology Of Diabetic Foot Ulcers

Various risk factors predispose patients with DM to DFUs (see Table 1). The main cause of DFU can be attributed to large-fibre, distal symmetrical sensory

neuropathy. Patients with sensory neuropathy often develop calluses on their feet as a result of abnormal shear, friction, and pressure. Due to the lack of protective sensation, the skin continues to be traumatized and eventually breaks down beneath the calluses, leading to the formation of DFUs.

Total Contact Casting – The Gold Standard Treatment Of DFUs

Pressure offloading is a key element to the management of DFUs. It can be accomplished by a number of modalities, including total contact casting (TCC). TCC helps to redistribute plantar foot forces and aids with wound healing. TCCs have been found to have the highest healing rates and are considered the gold standard treatment for DFU according to the literature. If TCC is a mainstay treatment for DFUs, why is it not done more often? Barriers to implementing TCCs include, but are not limited to, the knowledge and skills required for application, and funding.

Factors that Impact Skin Integrity and Wound Healing

- | | |
|-------------------|-----------------------------|
| • Glycemic levels | • Bony deformity |
| • Activity | • Peripheral artery disease |
| • Smoking | • History of wounds |
| • Trauma | • Amputation |
| • Footwear | • Age |
| • Neuropathy | |

Cutimed® Total Contact Cast Kit And Hydrofera Blue® Dressings

Essity offers a simple solution to the application of TCCs – the Cutimed® Total Contact Cast Kit. The Kit contains all of the necessary materials to apply a fibre-glass TCC. There is a step-by-step application guide in each kit. Experienced practitioners may be able to apply a fiberglass TCC using the Cutimed® Total Contact Cast Kit within 15 minutes. You can watch speaker Rosemary Hill apply it in this presentation video link: https://drive.google.com/file/d/16L0rW5jk9unvSKYkC-Sz8imDa_y3Buvb/view?usp=share_link



Hydrofera Blue has a very versatile portfolio of Non-cytotoxic antibacterial dressings that can be used through the continuum of care. See cases presented by Rosemary Hill in above video link. **The Hydrofera Blue READY-Transfer is ideal to use with TCC.**

The dressing is made of polyurethane foam which facilitates a high rate of moisture transfer through the dressing and away from the wound bed. As the bacteria laden exudate passes through the dressing, the bacteria is effectively killed in the dressing. The dressing is soft, conformable and can be cut.



The BC PharmaCare Program For Offloading Devices: An Important Milestone

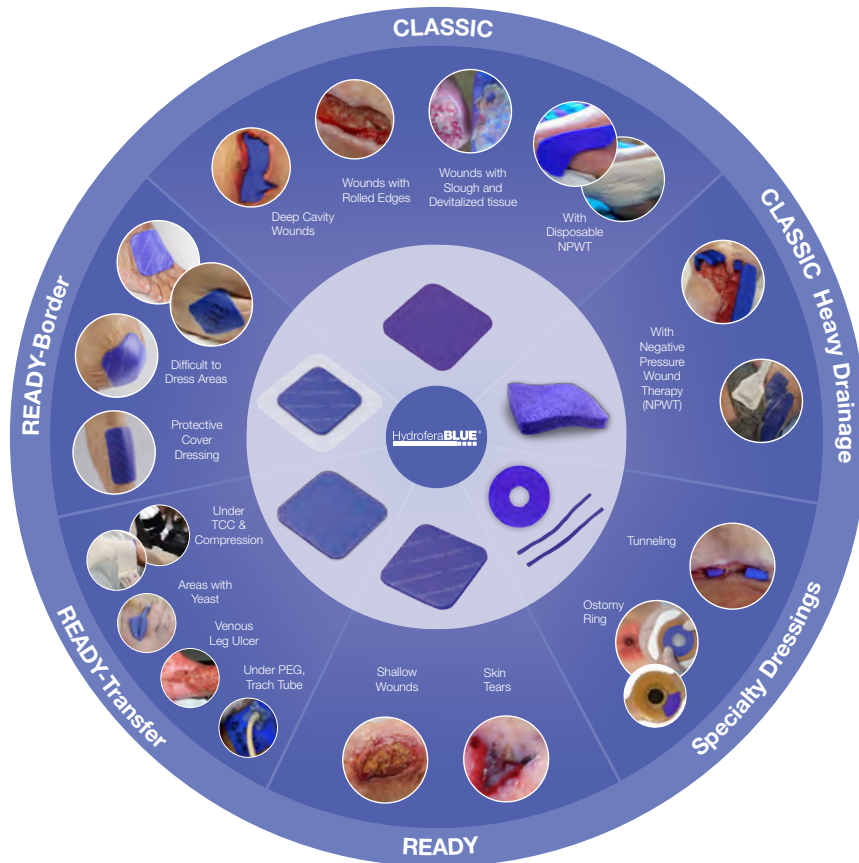
As of January 1, 2023, all five British Columbia (BC) Health Authorities can provide TCCs as a treatment for DFUs.⁴ The BC PharmaCare program also provides coverage for foot orthoses and adaptive shoes for patients who:

- Have been diagnosed with a DFU
- Have been wearing a TCC to treat a DFU
- Are almost ready to transition from TCC to an offloading device.⁵

This is an important milestone in the efforts to lower non-traumatic LLA related to DFUs. As mentioned before, TCC is the widely accepted gold standard treatment for DFUs. Lack of funding is often one of the biggest barriers to implementing TCCs as part of the treatment plan. Equally as important, and not to be neglected, patients who have healed DFUs need to be transitioned into appropriate footwear and orthoses to prevent future recurrence of their ulcerations. Lack of funding for orthopedic footwear and offloading devices (i.e., orthotics) contributes to the development and recurrence of ulcerations. Hopefully, this offloading program in BC is the first of many initiatives provincially and federally to fund preventative foot care, footwear, and offloading devices to prevent and treat DFUs and LLAs.

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An Exploration Of How Individuals Living With Diabetes Mellitus Access And Apply Foot Health Education To Prevent Diabetic Foot Complications: A Qualitative Descriptive Study

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Introduction

Education focused on foot health remains a priority for health-care teams as diabetes-related foot ulceration rates increase worldwide.¹ Persons with diabetes mellitus (DM) who develop loss of protective sensation, foot deformity and peripheral artery disease (PAD) are at greatest risk for complications including amputation.¹⁻⁴ In Canada, three million persons have DM and up to 20% will develop foot ulcers that may lead to amputation if not addressed.^{5,6} Armstrong and colleagues (2017) report the lifetime incidence rate of DM foot ulceration is, “19% to 34%, with a yearly incidence rate of 2%” (P2*).⁷ Of concern are foot ulcer recurrence rates. Researchers report that 40% recur in 12 months and 65% in three years.⁵

In Canada, foot screening and patient education is recommended by leading organizations including Diabetes Canada,^{6,8,9} Wounds Canada,¹⁰ the Canadian Podiatric Medical Association¹¹ and the Registered Nurses’ Association of Ontario.¹² Though recommended, there is no predictable path for persons with DM to obtain foot health information and education. Specifically, Diabetes Canada (2018) discussed the roles of physician, podiatrist, chiropodist and foot-care nurses when a person develops a complication such as in-grown toenails, callous, corns, or warts.⁸ The foot risk assessment (including footwear) is foundational to prevention and early identification of complications. Patel and colleagues (2022) sought to understand DM foot screening practices amongst clinicians. In a scoping review (n=21) they reported that in 12 months, only 53% of persons with diabetes received a foot examination by a health-care provider.¹³

Patient foot health education focuses on knowledge, behaviour and daily engagement in prevention activities, yet many lack knowledge and awareness of foot health.¹⁴ Researchers continue to identify the need for robust research to understand effectiveness of education (outcome measures).^{8,15} To understand the effectiveness of patient-centred foot health education, Manickum and colleagues (2021) completed a scoping review (n=58). They stated that though patients may have acquired varied knowledge about dia-

betic foot care, fewer practiced proper foot care such as conducting a daily foot care assessment, foot hygiene (washing and hydrating skin) and assessment for any foot skin injury (cuts, bruises, ulcers) or changes.¹⁶ As well, the ability for persons to manage foot care may be influenced by their health status, access to health-care services, access and ability to pay for foot care services and access to formal and informal support persons. Researchers (2022) furthered this work in a randomized control study (n=120) focused on foot care education. Results showed that face-to-face education improved patient foot care knowledge for those living with DM.¹⁷ Furthermore, in foot care education it is known that there are no improvements when the person is only given information without a focus on foot care skills,¹⁸ appropriate footwear and awareness of when to seek care.^{19,20}

Therefore, the aim of this qualitative study was to explore how individuals living with DM access and apply foot health education to protect their feet from DM related foot complications.

Framework Guiding This Study

This study was informed by the Expanded Chronic Care Model (CCM) organizational framework.⁶ The Expanded CCM framework includes a focus on population health and prevention efforts, social determinants of health, persons with chronic diseases learning self-management strategies (knowledge, skills, behaviour), delivery systems, decision support and clinical information.²¹ This was important as we wanted to understand how participants described receiving diabetes-related foot care education and explore what they applied to their foot health practice.

Methods

Participants: Participants included 14 adults (18+) living with type 1 and type 2 DM, from 16 months to 27 years. Participants were invited to describe their personal journey of caring for their feet and footwear and how foot health education played a role in their care decisions.^{22,23} We met participants in a place of their choice (home,

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library, coffee shop).²⁴ As data collection took place between September 2022 and April 2023, participants described their foot care practices before and during the pandemic. We adhered to provincial coronavirus guidance.

Procedures: Participants were recruited through posters in libraries, community bulletin boards, and social media posts. ‘Snowball’ recruitment was also employed as one adult invited another who they thought might wish to participate. Participants read or were given a research *Letter of Information and Informed Consent* (verbal, written) explaining the study purpose and that they would be asked about education received in relation to diabetic foot care, footwear, care practices, and how each participant interpreted and applied this information. As well, as part of the interview and discussion, participants were read and asked questions about peer-reviewed foot health information from Diabetes Canada’s *Foot Care*²⁵ and Wounds Canada’s *Diabetes, Healthy Feet and You* education pamphlets.²⁶ Data was transcribed verbatim and images of feet and footwear were taken. Research Ethics Board approval for this study was obtained. Qualitative semi structured interviews were conducted using web-based platforms, phone calls and face-to-face interviews (30-45 minutes).

Data Analysis

The researchers had no preconceptions of the emerging themes. The interview results were typed verbatim, read and re-read by the researchers in typed documents. Each was checked for accuracy. As DM is a life-long, complex disease, we analyzed the interview data across the continuum of time. The researchers kept field notes before and after interviews and used email and face-to-face meetings to discuss the study progress. Participants’ data was rich in detail and description of their personal experiences, care practices and their future vision for DM foot care and footwear in their community.

Data were then analyzed using ATLAS.ti²³®. Using thematic analysis, key messages emerged from the data.^{27,28,29} To increase trustworthiness

of the data, audit trails of our work were kept and findings were discussed by phone with five participants who wanted to know about the outcomes. We present the findings in a thematic story format identifying salient quotes from participants.

Results

Participants in this study included 14 adults (13 female, 1 male) ranging in age from 25 to 87 years. Participants described living with type 1 and type 2 DM, from 16 months to 27 years. Five lived with type 1 DM (two were newly diagnosed during the pandemic) and nine lived with type 2 DM (See Table 1). Participants were given peer-reviewed foot care information, a foot mirror and foot cream as a gift for participating in the full interview.

Results from the data analysis reveal a noticeable lack of consistency in how, when, where and by whom individuals living with diabetes receive foot health education. This inconsistency leaves many individuals at greater risk of developing diabetic foot complications. Findings were organized under four main themes:

- 1) Inconsistent acquisition of sound diabetic foot health education,
- 2) Footwear and foot care choices: Education takes a backseat to other factors,
- 3) Stress and fear: Always in the background and
- 4) Supports systems and family are important.

Theme 1: Inconsistent Acquisition Of Sound Diabetic Foot Health Education

Participants’ sources of knowledge of the importance of diabetes-related foot self-care varied widely and there were no consistent sources of foot care information (see Table 1). Several stated foot assessments were not done before the pandemic and it did not change after the pandemic (P5*, P7). Most described gaining knowledge about daily foot checks and foot care, “over time” and/or, “after some years being diagnosed”. Others described learning as, “eventually I learned” or “I learned after a

Table 1: Participants Characteristics

I.D. #	Gender	Age	DM Type 1	DM Type 2	Time with dx	Professional who told them about foot care/ footwear	Nail care provider	Footwear	Family History
1	F	53	x		27 years	Endocrinologist Family physician	Self-care	No special foot-wear	No
2	F	25	x		2 years	Diabetes Centre	Self-care Family-parent	Still learning, uses shoe inserts	X – with complications
3	F	46		x	20 years	Family physician Wound care nurses Orthopedic doctor	Self-care	No special foot-wear, learned after a foot ulcer	No
4	F	87		x	14 years	Family physician Nurse practitioner	Self-care Family-daughter Esthetician Circulation device Dr. Ho.	Wears Dr. Scholls shoes	X - with amputations
5	F	58		x	20 years	None	Self-care	Running shoes with liners	No
6	F	62		x	25 years	None	Self-care Esthetician	Wears inserts for flat feet & likes sandals	No
7	F	60		x	5 years	None	Self-care Esthetician	Sandals, sneakers & slippers	X – with amputations
8	F	66		x	2 years	None	Self-care Esthetician Daughter-nurse practitioner	New running shoes every 6 months	X - with complications
9	F	75		x	23 years	None	Self-care Family-daughters	Running shoes – “basic”	No
10	F	62	x		16 mos.	Podiatrist Diabetes Centre Orthotist	Self-care	Running shoes	X - with complications
11	F	50		x	14 years	Family physician	Self-care	Running shoes	No
12	M	70	x		5 years	Family physician	Self-care and wife	Walking shoes	No
13	F	45	x		18 years	Endocrinologist Podiatrist	Self-care Esthetician	Running shoes	X – with complications
14	F	82		x	18 years	Family physician	Self-care	Walking shoes	X – with complications

foot ulcer developed” from nurses at diabetes clinics, family members who had experienced an amputation, physicians, nurse practitioners, registered dietitians, neighbours, friends and

endocrinologists. The timing of footwear education was significant. Some participants received foot health education when they were first diagnosed with diabetes, one participant

stated, it was 12 years later (P1). Others did not remember receiving any foot care education. One participant new to their diagnosis stated, "I am still learning about foot and nail care, no one has really taught me anything yet" (P2). A few participants described not learning about foot care until, "someone else told me" or, "after there was a problem, an ulcer, a wound or bleeding". Some participants questioned why no one taught them about foot care and footwear until it was too late. They asked, "why is this not part of my diabetes care, how come a researcher had to tell me?" Many participants accessed diabetic foot information from the internet (home, library services). This form of searching increased during the pandemic. When asked, participants indicated that there were no specific health focused websites they preferred. Participants without internet access relied on family members to guide them.

Approximately half of the participants indicated that they had received some information about the importance of daily foot checks and nail care. They stated, "I know how to care for my toenails, I keep my nails trimmed and cleaned" (P4, P6, P11) or, "I do it all on my own". Other comments included, "I pay attention to the bottom of my feet for calluses or cuts"; "I use a mirror, some cream and have had some education using mirrors, creams, and education to aid in diabetic foot health (P5, P13, P14); "I also make sure, when my feet are dry, to moisturize and check them regularly with the mirror"; "I make sure that there's no calluses or cuts or bruising or discolouration" (P2-5, P9). Three participants with backgrounds in health-care professional education were knowledgeable about the risks and complications of DM and the importance of good foot care. Both acknowledged never receiving any formal teaching about foot care and footwear. They both felt they should have had foot care education and it should not have been presumed that they knew about risks because of their backgrounds. They both stated they were hesitant to ask questions as they were "trained" in health-care.

Even with some education, many participants remained uncertain regarding certain foot care practices. Contrary to recommended DM foot

care practices, eight participants (8/14) described soaking their feet in a basin of water and one described soaking their feet occasionally. Two participants described soaking their feet using a foot-soaker (commercial brand) and two added Epsom salts (magnesium sulfate) to the foot soak. One person described learning about foot and nail care and not soaking their feet, "after they experienced a foot ulcer and wore an offloading boot" (P3). Participants were further misinformed when individuals they considered professionals used non-recommended soaking practices. No participants were supported by Foot Care Nurses, and five participants received pedicures and nail care from estheticians (licensed and unlicensed). Of these, four had their feet soaked and cuticles 'pushed' off the nail bed as part of their nail care with the esthetician. One stated, "I told the esthetician that I have now been diagnosed with diabetes, and the foot soaks continued". The participant went on to say, "well I really did not know - not to soak my feet either, so it kept going on, so we were both wrong" (P7). During the pandemic, a few participants continued to visit their esthetician intermittently depending on availability of money and in line with the then existing pandemic guidelines for social distancing. Others who obtained nail care before the pandemic halted their foot care services, fearful of "their immune systems" (P13, P14).

Theme 2: Footwear And Foot Care Choices: Education Takes A Backseat To Other Factors

Education related to the proper footwear for individuals living with diabetes was only one factor among many that participants considered when choosing their footwear. Some participants stated there was no footwear education before the pandemic and it is presently the same. Some participants' footwear choices were based on preference, finances, seasonal weather demands, employment, social and sports activities. Some participants who were knowledgeable about proper footwear choices, lacing their shoes or using the Velcro closures, were committed to purchasing footwear that would, "keep my feet

healthy" (P10). They were aware of the risks of improper footwear. "I'm very careful about what I wear" (P3). "I know to wear proper footwear and if I see anything different, I go to the doctor" (P10). For some of the participants, running shoes or sneakers were their preference. "Yes, I wear a lot of sneakers." (P1, P5, P11, P12). "I wear my sneakers 90% of the time, I am very careful" (P5, P7, P14).

For other participants, there was a resistance to forgoing their preferred footwear choice and being confined to having to purchase *certain* running shoes to protect their feet. This focused footwear purchase was described as an obstacle and annoyance to seasonal weather and sports activities (P9-14). Seven participants preferred wearing a wide range of slippers, soft non-protective shoes, designer shoes, sandals and Crocs-style shoes. One described herself as a, "gambler with her foot health" taking chances that a foot complication would not occur, though she knew her footwear choices were not recommended. Others described wearing, "nothing, I like bare feet, or my slippers" to protect their feet (P1-3). In the heat of the summer, four participants described wearing sandals knowing they might cause harm (P6, P11-13). One participant noted, "knowledge can be

accepted and integrated, or ignored and sometimes I ignore things and a lot of the time I do go bare feet even though I know I am not supposed to" (P11).

For many participants, cost was a major obstacle to following foot care and footwear advice. The costs of going to a foot care specialist and accessing and affording footwear that would protect their feet was a tension-filled discussion for many. Persons living on a fixed income describing themselves as, "retired, seniors and living on a disability pension" expressed that foot care and diabetic shoes should be funded properly. They suggested provincial or federal funding. "It is just too much; \$45.00 for nail care and then shoes. It is just too much, so I wear what I can afford" (P5).

Another participant noted, "Foot care nurses are expensive and we only have a few here, around here. You know where I don't have to drive too far, fuel is expensive and the nurses are about \$45.00-55.00 CDN so I go to the esthetician as they are cheaper at \$22.00-35.00 approximately" (P7).

Two participants with extended health insurance were able to afford diabetic socks, a podiatrist foot care fee and diabetes-related footwear. "I have some extended health benefits, so I go



to a podiatrist. It costs me about \$8.00 after my benefits kick in. So, it's quite generous. I think we have \$800.00 a year of coverage a year" (P13). Some participants thought provincial and federal disability benefits, "should also cover diabetes foot care and shoes" (P7). Another reported that they knew they needed help, yet, "I had to pay for it. I've been on unemployment benefits for most of this year, so I've got no help at all with my nail care" (P4). Two persons stated, "I'm on social assistance, so you don't have any coverage for that" (P4, P13). Two participants noted, "so, the shoes might not be expensive, but the insoles are" (P7) and "the insoles alone were \$400.00" (P3).

Theme 3: Stress And Fear: Always In The Background

Independent of the quality and quantity of diabetic foot health education received, participants appeared aware of the potential for serious foot complications. A dominant theme described by the participants was fear - fear of neuropathy, ulcers and fear of amputation. For some participants, this was a motivator to follow prescribed foot care and footwear advice. For others who were restricted by finances or other factors, these fears still prevailed. Many participants described in detail a family member (immediate or remote) who lived with diabetes and foot complications. Some described how they thought there were genetic links between family members and the disease. One participant stated, "I don't want to end up in a wheelchair...I'm not losing my feet...I have to live and care for my children" (P7). "I could still lose my foot if the ulcer doesn't heal and things don't go right, but there's still a chance of amputation down the road, I know that..." (P3). "...I know Granny lost her leg...that could happen to me" (P6). For some participants, fear of the unknown was motivating to conduct foot care: "I am always worried they're going to be cut and I'm not going to know. So that's why I check them, my feet, so often" (P2, P4, P6, P12, P14). Regarding neuropathy, "I have a sister who has neuropathy and has cut her feet and been unaware of it, so that is why I look at my feet" (P2). Participants described an underlying fear of the unknown and

that, "one small unnoticed abrasion, could turn into amputation" (P14). One described, "I am a bit concerned right now because I feel I might have a bit of neuropathy" (P12). Others feared walking on the sand and beaches and that "we could walk on a huge rock and I wouldn't feel it, then there would be problems" (P2, P3, P12).

For some, fear was slightly magnified during the pandemic when face-to-face visits with their health-care provider were limited. All participants stressed that face-to-face visits were preferable to discuss their diabetes care, "not online". During the pandemic, most visited with a health-care provider using a web-based platform. Some were independent in linking to the call, others relied on the library services, or had a neighbour, family member or friend come to their home and set up the call with the provider. They also related that foot care checks, when done, "should be face-to-face". Two participants (P2, P14) described having regular foot screening conducted by their health-care professional before the pandemic. None of the participants described having their feet checked while using a web-based platform.

Theme 4: Supports Systems And Family Are Important

Many participants spoke about the importance of having a social support system as a necessity to help them follow-up on recommended diabetic self-care practices including foot care and footwear. Social support came in the form of partners, family, friends, neighbours and social and spiritual groups, as these were people they could rely on for support. Support persons helped with essentials such as obtaining food, maintaining their housing situation, running errands, removing snow, driving to medical appointments and cleaning their home. Some social support persons purchased new footwear for participants as they could not afford new shoes. Some family members helped with personal care.

One participant described, "I have what you call it? Thickened nails? I never had that before in my life and the nails started getting really thick with 'the diabetes'. When my daughter comes up from another province, she cleans them and tells my

other daughter who helps me, how to care for them, it is a team effort" (P9).

Another participant stated, "I moved in with one of my daughters during the pandemic...for help, you know, it was easier" (P4). Family support was particularly important during the pandemic when most people were unable to visit care providers. Participants attempted to manage on their own, conducting, "nail trimming and filing at home... well you know, to the best of my ability" and, "my daughters were in my safe zone, so they helped me" (P4, P5). Many described lack of access to footcare specialists, but in reality, they knew they would not go to the specialist as they already knew they could not afford the shoes or liners that would be recommended (P3, P5-7).

Finally, social support included accessing the internet and computers offered through the local library, depending on the pandemic guidelines. This was important as some participants could not access or afford internet services or computers (tablet) in their home setting. Some relied on family members to search for health information and/or to set up the medical/nurse appointment through a web-based platform. Participants reported that no specific sites were accessed for foot health and footwear guidance.

Discussion

Persons living with diabetes report wide-ranging sources of foot health and footwear information. None were consistent and not all credible or current. Some foot health information came from formal health-care providers such as nurses at diabetes centres, physicians, podiatrists and foot care specialists and some came from informal sources such as friends, family stories and experiences, estheticians and internet searches. Despite some having knowledge of diabetes risk factors and being able to thoroughly describe family and friends' issues of amputation, hospitalization, infection and death, not all participants engaged in preventative foot health practices or made proper footwear choices. Similar to our previous research, some were distanced from the responsibility of daily checking their feet and being fitted for protective footwear.³⁰ As well, few could



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describe receiving or taking part in regular foot health screening, being referred for therapeutic footwear, or an activity program as part of their health care provision.^{1,2} Most stated foot assessments were not a priority for their health-care provider before the pandemic and this did not change during the pandemic.

Some participants described diabetes risk factors, signs and symptoms and the natural history of developing wounds or ulcers, when their foot care and footwear choices were not ideal. When reviewing best practices foot health care information^{25,26} most described not knowing about not soaking their feet and they wondered why foot health information was not presented to them by their health-care providers in a timely and regular manner.³¹ Some believed in and engaged in preventative foot and nail care,³² and some relied on family members to check their feet and provide foot care. Participants described varied foot self-care practices from engaging in no foot care, checking weekly or monthly to daily foot checks. One participant had a mirror to view their feet. When travel for foot care services outside of their home community was recommended, many were not able to attend this referral. However, we also learned that some participants knew of the risks and of what to do to prevent foot complications and preferred to gamble with care decisions – consciously taking the risk.

Participants also reported on a variety of sources of footwear. Most purchased footwear based on availability of shoes in the community in which they lived and based on price (\$20.00 approximately).³³ Some relied on family members to check their feet and to purchase new footwear, mostly without a fitting or measurement of the feet. Some footwear was mailed to participants and the fit was not checked, just the size. Generally, few were focused on footwear being professionally fitted as they knew this service was not readily available in the community. As well, without being able to access this service, the participants miss out on the important education that occurs with footwear specialists.³⁴ Also, when travel was necessary, taxi costs or costs including access to a vehicle, fuel and an accompanying

support person were a barrier for participants, some of who would most often not attend the out-of-town consultation.³⁵ Several wore the same running shoes or Crocs-style throughout all seasons and did not wear seasonal (winter) footwear to protect their feet. Most discussed comfort, preference and the heat of closed-toed footwear.^{36,37} Some participants wore what they wanted to wear and did not heed proper footwear choices though they could describe the consequences.

Persons living with diabetes have a responsibility to engage in care, learn about their condition, seek health information and act upon the recommendations.³⁸ Yet, fear may interfere with learning about complications.³⁸ Fear is defined as, “the bad feeling that you have when you are in danger, when something bad might happen, or when a particular thing frightens you”.³⁹ Fear of foot trauma, infection, amputation, hospitalization and death were well-described by most participants.^{40,41} Fear of a lower leg amputation was common, often in relation to a family member or a community member.⁴² This is important as women are more likely to be anxious about diabetes complications.⁴³ Yet understanding and addressing why most participants, though fearful, do not fully engage in preventative foot care practices and choose proper footwear is essential.⁴³ Shifting the culture of giving patients education alongside supporting their mental health and well-being is critical.^{44,45} Identifying and screening for fear early in the diagnosis phase may help health-care providers intervene more effectively.⁴⁶ More research is needed to understand the complex social, motivational and economic issues surrounding this issue.⁸


Strengths And Limitations

The findings of this study were drawn from a relatively homogeneous group of participants residing in Eastern Canada and therefore may not be generalizable to the experiences of all individuals living and working with DM. Similar studies with larger groups of participants living with diabetes would help to establish a broader view and greater understanding of how individuals access and

apply foot health education to prevent diabetic foot complications.

Conclusion

This small qualitative study captured participants' descriptions of their accurate working knowledge of the progression of diabetes-related foot complications that could occur. Despite richly describing the potential risks and severity of complications, the reticence to fully engage in preventative foot care practice and footwear choices was evident. Therefore, persons with DM search for and obtain foot care and footwear care and information from a wide variety of sources, not all credible. Health-care providers were not a consistent or accurate source of information, nor was all education timely or relevant.

The need to proactively conduct foot risk screening and to stratify risk results in discussion with the person and their family or care providers is essential. Clinicians need support and training on diabetes foot screening and how to communicate this across the trajectory of health care. For example, if a person is screening in a community physicians' clinic, how is that communicated to the person and family and/or diabetes centre and how and where are the best and most accessible financially affordable services? 

*NB: P designates participant (see Table 1).

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Best Practice Recommendation Updates 2024: Methodology For Developing Foundations Of Best Practice For Skin and Wound Management

By Janet L. Kuhnke RN BA BScN MSc NSWOC Dr Psychology, Cathy Burrows RN BScN MScCH, Robyn Evans BSc MD CCFP, Mariam Botros DCh DE IIWCC MEd, Jasmine Hoover BSc MLIS and Ian Corks

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The *Best Practice Recommendations* are the most popular resource developed by Wounds Canada and are used by frontline clinicians, students and policy makers to inform their practice.

These recommendations have been developed by leading Canadian experts on each individual topic and are based on the latest available research evidence. They are presented using the 'Wound Prevention and Management Cycle,' a process intended to illustrate an easy-to-understand pathway that can be used by care teams in all settings, for all types of patients with wounds or at risk for developing wounds, regardless of the environment and health-care system in which the teams live and work.

The objective is to provide practical practice enablers that help guide frontline clinicians and health-care decision makers through a step-by-step process that addresses the assessments and interventions of various factors that may interfere with skin integrity or affect wound healing and to provide a recognized standard for the delivery of wound care across Canada based on the most current evidence and clinical experience.

The *Best Practice Recommendation Updates 2024* build on the work of previous authors and editorial teams and incorporate expert opinion, clinical experience and the latest available research. It didn't take a village - it took a country - to create and regularly update Wounds Canada's

Skin Health and Wound Management Best Practice Recommendations 2024

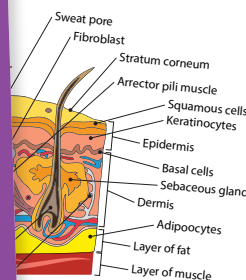
CHAPTER 1

Skin: Anatomy, Physiology and Wound Healing

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feet.
The squamous cells are in transition to becoming the stratum corneum and machinery, including the nuclei.
contains the Langerhans cells, which are derived from bone marrow and immune defence.
ns keratinocytes, melanocytes and Merkel cells. Skin cells are constantly. The keratinocytes, from the lowest layer of the epidermis, are continuously the production of new cells beneath them. These cells fill with keratin of the epidermis. Keratin gives skin protective qualities and makes it each the top layer of the skin they are essentially dead flat sacs filled with d cells are shed daily, resulting in an entirely new epidermis every 35 – wedged between the basal cells and produce melanin, which protects Merkel cells are thought to be sensory cells.
dermis by the basement membrane, a very thin membrane that attaches the the dermis.
rmis and above the subcutaneous tissue. The dermis is 0.3 to 4.0 mm thick and r layers.¹² The junction between the epidermis and the dermis has a series of at project up from the dermis. Similar structures project down from the epider- of contact between the two layers and help to prevent the epidermis from be- ges they get smaller and flatter.
ix (ECM) made of collagen and elastic fibres that provide structure to the skin dermis also contains a capillary bed that is fed by the arterioles and drained y bed are the lymph capillaries. The hair follicles, sweat glands and seba- e that leads to the skin's surface and supports the regeneration of the skin s) helps to regulate body temperature, and sebum (from the sebaceous out.



Blood circulates within the capillaries of the dermis to supply nutrients and metabolites to the tissues and to collect waste products produced by the tissues. Without this nourishment and waste removal, tissue health cannot be sustained, and tissue healing cannot occur. This exchange of constituents between the blood and tissues takes place via interstitial fluid (ISF), or tissue fluid.

Blood is mostly water (90% by volume). It contains dissolved proteins, glucose, mineral ions, hormones, carbon dioxide, platelets and blood cells. Blood cells make up 55% of blood plasma and include red blood cells (erythrocytes), white blood cells (leukocytes);

Drawing licensed from RF123. Adapted.

(formerly, the Canadian Association of Wound Care) *Best Practice Recommendations (BPRs)*. This initiative began in 2000, led by the efforts of Dr. David Keast, Heather Orsted and Sue Rosenthal. Seventeen years later, a total of 71 expert authors and various research, editorial and production teams have been involved in the development and updating of these seminal documents.

The authors of the latest updates approached the content and process with new eyes - eyes that see the patient, not the wound, as the centre of the care process. This vital shift ensures that clinicians acknowledge and act on the full range of risks and risk-specific interventions required to support positive patient outcomes. A stronger focus on self-management and sustainability

acknowledges the role the patient plays in the prevention, healing and/or palliation process when not under direct care.

*"The authors of the Best Practice Recommendation Updates 2024 approached the content and process with new eyes - eyes that see the **patient**, not the **wound**, as the centre of the care process."*

Methodology

Best practice recommendations typically rely on

a combination of high-quality evidence, expert consensus, clinical experience and expertise. Following feedback received from previous editions of the *Best Practice Recommendations*, the Expert Panel and editors decided to integrate the GRADE (Grading of Recommendations, Assessment, Development and Evaluation)¹ approach into the 2024 Updates. The GRADE approach is utilized to grade the quality of evidence and strength of recommendations in guidelines.² In this new edition, we present best practice recommendations that draw upon high-level evidence and application. They constitute a synthesis of relevant guidelines that utilize the agreed upon method with a strong clinical application process. While we do not strictly adhere to the GRADE methodology in the development of our recommendations, we adopt guidelines that have incorporated GRADE principles into their development processes. This approach ensures that our best practice recommendations provide valuable guidance for health-care professionals and organizations seeking to optimize their clinical practices. By leveraging evidence-based guidelines and principles, we aim to promote effective and informed decision-making in health-care settings.

This methodology outlines a systematic process for developing clinical best practices, ensuring that they are grounded in clinical expertise and robust evidence. These recommendations have been developed by carefully selected experts with direct experience in each specific topic and are based on the latest research. Updates will occur on a regular schedule or when it is determined that significant changes are needed due to new research or treatment approaches.

The methodology used aimed to:

1. Identify the Clinical Topic: Select a specific clinical topic for which there is a need to establish best practices. For the *Best Practice Recommendation Updates 2024*, the topics are presented in 12 chapters: Skin Anatomy, Prevention and Management of Wounds, Prevention and Management of Pressure Injuries, Prevention and Management of Skin

Tears, Prevention and Management of Surgical Wounds, Prevention and Management of Diabetic Foot Ulcers, Prevention and Management of Burns, Prevention and Management of Venous Leg Ulcers, Prevention and Management of Peripheral Arterial Ulcers, Prevention and Management of Moisture-associated Skin Damage, Prevention and Management of Wounds in Patients with Lymphedema and Nutrition and Wound Healing. The Nutrition and Wound Healing chapter is a new addition to the line-up in 2024.

2. Review the Literature: Conduct a review of national and international guidelines that adopt GRADE methodology literature on the chosen clinical topic. Gather and evaluate relevant research studies, systematic reviews, meta-analyses and clinical practice guidelines, knowledge, evidence gaps and areas where best practices are warranted.

3. Utilize an Expert Panel: Assemble a national multidisciplinary expert panel consisting of health-care professionals with expertise and experience related to the clinical topic. Highlight the diversity of the wound care provider in terms of clinical settings, geographical locations and professional backgrounds to capture a broad perspective.

4. Highlight Consensus Building: Facilitate discussions and deliberations among the expert panel members to reach a consensus on the best practices. Incorporate their clinical expertise, perspectives and judgment into the decision-making process. Encourage open dialogue, critical appraisal of the evidence and the consideration of potential benefits, harms and resource implications. Gain consensus on the changes using a modified Delphi method.³

5. Define Key Questions: Collaboratively develop a set of key clinical questions that the best practices will address. These questions should be focused, specific and relevant to the clinical topic under consideration. They will serve as a guide for the subsequent application steps of the methodology, with the goal of integrating the recommendations into the new five-step format of the 'Wound Prevention and Management Cycle'.

6. Evaluate the Evidence: Conduct a thorough search of published research studies, systematic reviews and meta-analyses related to wound prevention and management. Evaluate the quality of the guidelines evidence and identify knowledge gaps using a validated grading system.

7. Develop Best Practice ‘Statements’: Based on the evidence evaluation and consensus reached, draft clear and actionable best practice statements for each key question. Each statement should be practical, feasible and based on the highest quality evidence available. Consider using a standardized format, such as PICO (Population, Intervention, Comparison, Outcome), to structure the statements. Base statements on the ‘Wound Prevention and Management Cycle’.


8. Implement External Review: Seek external peer review from additional experts, patients and care partners (e.g., caregivers in the field) to validate the recommendations and ensure their accuracy, clarity and applicability. Incorporate feedback to refine and improve the recommendations. Revise the best practice statements based on the external review feedback. Finalize the document, ensuring clarity, coherence and consistency. More than 60 reviewers were involved in this thorough process.

9. Facilitate Dissemination and

Implementation: Disseminate the finalized clinical best practices through a comprehensive strategy that makes them easily accessible to health-care professionals, patients and caregivers through online platforms, educational resources and supporting partner societies. Develop supporting materials, such as algorithms, decision aids and educational resources, to facilitate the implementation of the best practices into individual practices and institutions.

10. Periodically Review and Update: Recognize that clinical best practices are dynamic and subject to evolving evidence. Establish a process for regular review based on a 3-5 year cycle and update specific recommendations if and when significant changes are needed due to new research, approaches, etc., to ensure their continued relevance and alignment with the latest

research findings. Regularly monitor emerging evidence, feedback from users and changes in clinical practice to inform future revisions of the best practices.

The *Best Practice Recommendation Updates 2024* will be launched online in the first quarter of 2024. They will be available on the Wounds Canada website at www.woundscanada.ca. 

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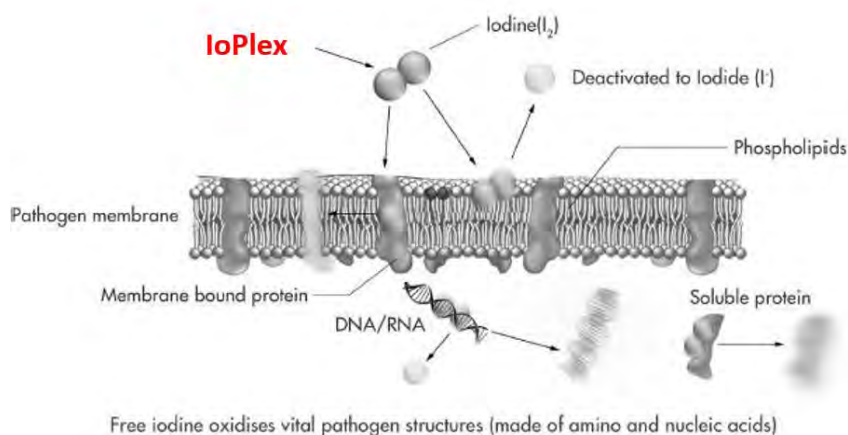
Presenter: Dr. Gregory Schultz PhD*

The Burden Of Biofilm In Chronic Wounds

Biofilm is the preferred form of bacterial life. Biofilms have a complex physical architecture consisting of proteins, extracellular DNA, polysaccharides, and lipopolysaccharides. When the wound bioburden is high, the aggregate of planktonic (free-floating) bacteria goes through a process known as *quorum sensing* to change the bacteria phenotype and develop into a biofilm. These colonies of bacteria will subsequently secrete extrapolymeric substances (EPS) that serve as a protective barrier. This barrier renders the biofilm resistant to antimicrobials and inflammatory cells. Biofilms are prevalent in chronic, hard-to-heal wounds. In a study by Malone et al., biofilm was identified in >80% of chronic wound biopsies.¹ Biofilms delay wound healing and can cause infections. It has also been found that biofilm can penetrate deeper into the tissue under the wound bed. This allows biofilm to further evade the effects of topical antimicrobials. Proper wound hygiene is crucial to the management of biofilm. This includes proper wound cleansing, adequate wound debridement (appropriate for the patient), and the use of an antimicrobial that can disrupt biofilm and target planktonic bacteria.

The History Of Iodine As An Antimicrobial Agent

Iodine has long been used as an antimicrobial agent. It is an oxidizing agent (i.e., takes electrons away from other molecules) that can oxidize/iodinate multiple bacterial components, including genetic material (RNA and DNA), soluble proteins, and phospholipids. It can also



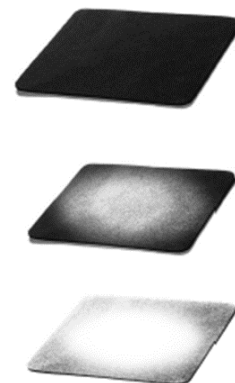
Bigliardi, P. L., Alsagoff, S. A. L., El-Kafrawi, H. Y., Pyon, J. K., Wa, C. T. C., & Villa, M. A. (2017). Povidone iodine in wound healing: A review of current concepts and practices. *International Journal of Surgery* (London, England), 44: 260–268.

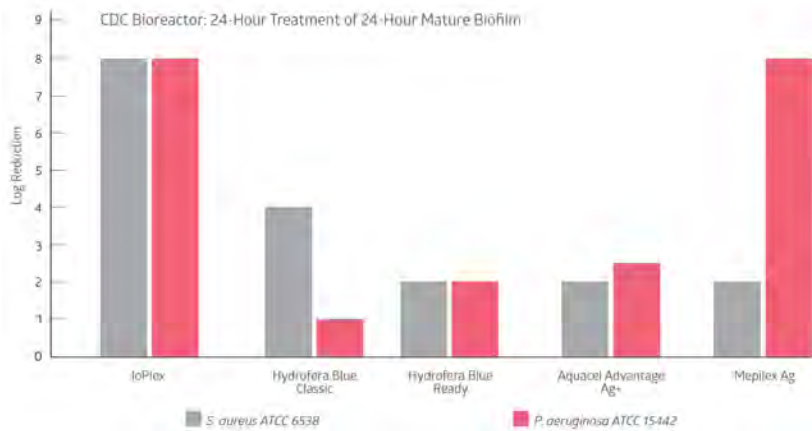
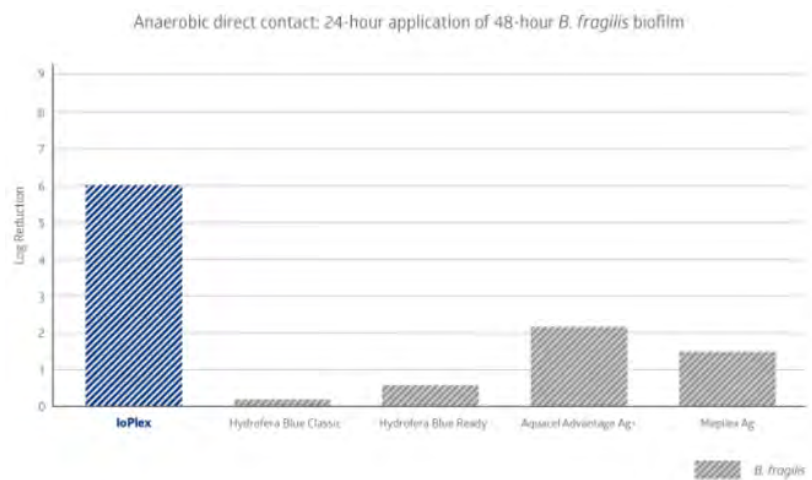
disrupt biofilm scaffolding. The multiple mechanisms of antimicrobial action makes it near impossible for bacteria to adapt and develop resistance against iodine. Caution must be taken when using aqueous iodine, as iodine at high concentrations is cytotoxic and can cause further damage to the wound bed.

The Next Generation Of Anti-Biofilm Strategy: The IoPlex® Iodophor Foam Dressing

The IoPlex® Iodophor Foam (IoPlex) dressing provides a controlled release of iodine into the wound bed. Unlike aqueous iodine, the release of iodine by the IoPlex dressing does not exceed the cytotoxicity index. IoPlex is made of polyvinyl alcohol (PVA) foam.

It has a high absorption capacity and can manage a large amount of



CDC Bioreactor: 24-Hour Treatment of 24-Hour Mature Biofilm²Anaerobic Direct Contact: 24-Hour Application of 48-Hour *B. fragilis* Biofilm²

wound exudate. It can also wick moisture away from the wound. Moisture management is an important component to anti-biofilm strategy. The iodine is complexed with polymers in the PVA foam. This ensures a controlled release of iodine to prevent it from exceeding cytotoxic concentrations. Clinically, IoPlex® (which is black) will turn white (the colour of the native PVA foam) when all the iodine has been released. This is a useful visual tool to signal a dressing change is needed. IoPlex has been found to be superior in log reduction of in vitro biofilm,



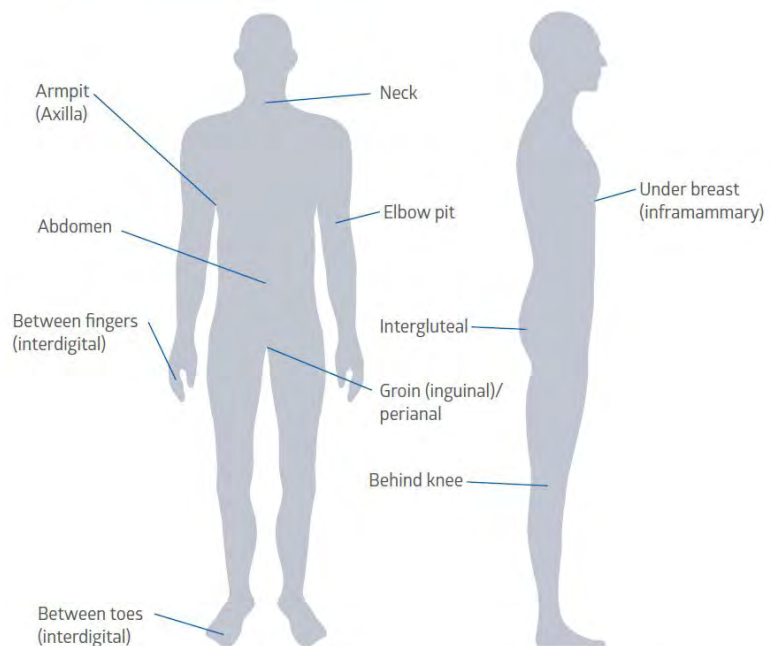
including anaerobic bacterial biofilms.¹

DriGo-HP™ Hydrogen Peroxide (H₂O₂): A Natural Antimicrobial Agent

Hydrogen peroxide (H₂O₂) is a major reactive oxygen species (ROS) that the body produces to combat bacteria. White blood cells, namely neutrophils and macrophages, produce H₂O₂ to inactivate and kill bacteria by oxidizing bacterial proteins (i.e., amino acid side chains) and cell membranes (i.e., phospholipids). The human body prevents tissue damage by H₂O₂ by producing endogenous enzymes (i.e., catalase) and reducing agents (i.e., glutathione) to neutralize it.

Medline offers a soft, smooth fabric with hydrogen peroxide (H₂O₂) for the management of moisture in skin folds prone to maceration, odor and skin breakdown. The DriGo-HP™ Antibacterial Wicking Sheet contains 0.3% of H₂O₂, a naturally occurring antimicrobial agent in the human body, that is sequestered in the fabric. It has excellent moisture wicking rate, absorption capacity, and evaporation rate. It is non-cytotoxic, and non-irritating and non-sensitizing to intact skin. DriGo-HP™ can be used to reduce the risk of moisture-related intertriginous dermatitis (ITD) in areas such as under the armpits, under the breasts, groins and buttocks and between the toes.

Intertriginous Dermatitis



***Dr. Gregory Schultz PhD** is Professor Emeritus of Obstetrics and Gynecology at the University of Florida where he served as the Director of the Institute for Wound Research for 32 years. A major focus of Dr. Schultz's more recent research is on understanding the role that bacterial biofilms play in stimulating chronic inflammation that leads to highly elevated levels of proteases in wounds that impair healing in chronic wounds by destroying proteins including growth factors, receptors, and extracellular matrix proteins that are essential for healing.

2. Roman M. Management of Biofilm: The efficacy of controlled release iodine. White paper, Medline Industries. Data on file. 2019.



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Benefits And Challenges Of Using A Commercially Available Infrared Thermometer For Foot Self-Management For Patients With Diabetes: Findings Of A Mixed Methods Study

By Kathleen Stevens RN PhD, Donna Moralejo RN PhD, Steven Ersser RN PhD and Cathy MacLean MD

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Daily foot assessment, with appropriate action, is recommended for patients with diabetes to prevent diabetic foot ulceration (DFU). A daily foot assessment includes looking between the toes and at the bottoms of the feet and assessing for any changes since the last self-assessment. Symptoms such as inflammation (e.g., redness, pain, swelling, loss of function and temperature increase), broken, peeling and/or dry skin and callusing should be noted. If the person identifies any areas of concern or unexplained pain, they

should make an appointment to see their health-care provider (HCP).¹

However, many patients do not assess their feet daily. Authors of a recent scoping review analyzed 44 studies on foot inspection and reported that 0–91% of participants regularly assessed their feet (median 41%; IQR 33–56%).² For those that do regularly assess their feet, detecting the signs and symptoms of skin inflammation may be challenging. For patients with neuropathy, identifying foot inflammation is especially difficult as they



may not experience pain or loss of function associated with inflammation.³ Additional tools are needed to support foot assessment and provide patients with the information to prevent complications such as DFU and amputation.

Self-monitoring skin temperature using an infrared thermometer is a promising tool for supporting daily assessment, detecting early inflammation and preventing skin breakdown on the plantar aspects of the feet. One of the earliest signs of DFU is inflammation; a temperature increase associated with inflammation can be subtle and is difficult for individuals to detect by palpation.⁴ Patients who cannot rely on cues such as pain need to change their understanding that signs of inflammation may constitute symptoms of DFU or potential DFU.⁵ Self-management tools that identify early signs of inflammation may help

effectively prevent skin breakdown by giving patients the information they need to address the identified concern.

In three randomized controlled trials (RCTs),^{3, 6, 7} and a pilot RCT,⁸ patients assessed their foot temperature daily for inflammation. Inflammation was determined by a difference of greater than (>) 4 degrees F (> 2.2 degrees C) between the two feet. If inflammation was detected patients were directed to rest that day. If the temperature was still elevated in 48 hours, patients were directed to see their health-care professional.^{3, 6, 7, 8} The researchers found that using temperature monitoring with a \$700 *medical-grade* infrared thermometer was an effective way to predict and thus prevent DFUs. A 2015 study compared a low-cost, *commercially available* infrared thermometer (CAIT) to medical-grade thermometers

and found them to be a reliable measure of skin temperature. However, they did not use the CAIT as part of foot self-management for patients with diabetes.⁹

None of the studies that tested the use of the thermometer captured the patients' perspective. What needs to be discovered is the patients' opinion and their viewpoint on incorporating this tool into their daily foot self-management. Understanding the benefits will strengthen the evidence and rationale for using a thermometer for foot self-management. Understanding the challenges and usability is also essential so HCPs can provide education and support to patients that address challenges. This study evaluated the impact on assessment and the patient perspective of using a \$30 CAIT. This research is part of a more extensive study that assessed the effectiveness of a foot self-management intervention that utilized a CAIT. This paper focuses on the patients' experience of using the CAIT.

Research Design And Methodology

This paper focuses on the explanatory sequence (Phases 2 and 3) of a more complex Mixed Methods Model research design (see Figure 1). In Phase 2, a 6-month pilot randomized controlled trial (RCT) was conducted to test the effectiveness of a thermometer and education intervention developed for the study and informed by the

Phase 1 qualitative data (N=24). The Phase 1 and Phase 2 (i.e., intervention) results are reported elsewhere.^{10,11,12} In the RCT, participants were randomized to the thermometer and education group (n = 34) and education-only group (n = 26). In Phase 3, interviews were conducted with participants regarding their experiences with the intervention (n = 9) (i.e., explanatory sequence). Integration of all phases occurred at the end of the explanatory sequence. The study was registered at clinicaltrials.gov, NCT0306776.

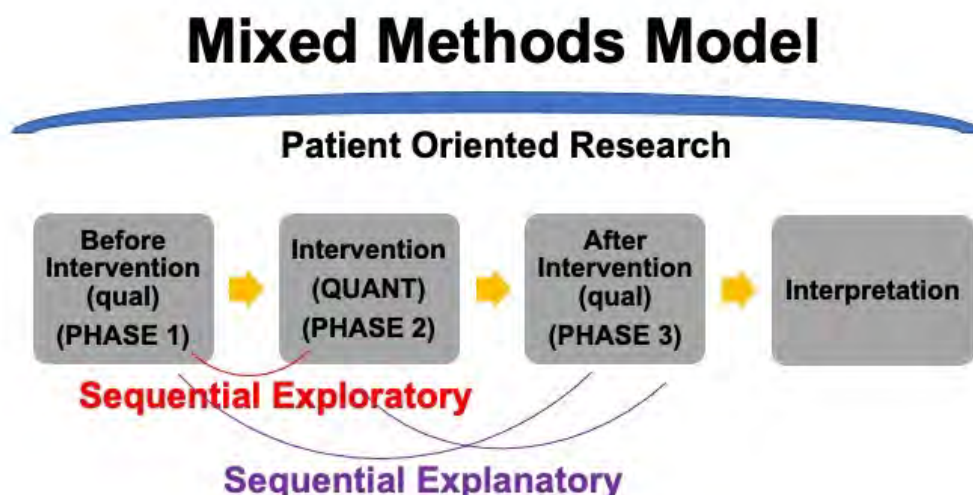
Research questions:

1. What are the benefits and challenges of using a CAIT as part of foot self-management?
2. Would participants continue to use the CAIT, and why?

Setting And Sample

Participants were recruited from health clinics and communities in Newfoundland and Labrador's Eastern Health Authority zone. Recruitment for Phase 2 occurred from August 2017 until October 2018, with data collection ending in August 2019. Key inclusion criteria were 18 years of age or older and foot assessment fit with International Diabetic Foot Risk Classification category 2 or 3. A key exclusion criterion was peripheral arterial disease with an ankle brachial index (ABI) less than (<) 0.8. As recruitment was slow, this exclusion criterion was adjusted to an ABI <0.7. Phase

Figure 1. Mixed Methods Model



3 was conducted in October 2019. All participants provided informed consent and ethical approval was obtained from the Health Research Ethics Authority.

Data Collection Methods

The data collection methods for this study are described in detail elsewhere.^{10,11,12} The methods relevant to this paper are the following Phase 2 measures: the foot assessment, self-report logbook data, quality of life (QoL) measure and an exit interview. The foot assessment was completed by an advanced foot care nurse at baseline, three and six months using the validated Simplified 60-Second Foot Screen.¹³ For the logbooks, all participants daily recorded their visual foot inspection and recorded their number of steps using a pedometer. The participants in the thermometer-education group also recorded their daily temperature. The return demonstration data, logbook data and exit interview results were used to determine the usability of the CAIT. To measure QoL, the Quality of Life Enjoyment and Satisfaction Short Form (Q-LES-SF) was administered at baseline, three and six months.¹⁴ After the intervention, an exit interview that included a return demonstration was completed with the Phase 2 participants.

Statistical Analysis

Descriptive statistics, t-test and Chi-square were used to summarize participants' characteristics and evaluate differences between variables. Any assessment was determined by calculating how many days a participant measured and recorded in the logbooks, either a visual inspection, temperature monitoring, or both, out of the 180 days. To determine the variables that contributed to foot assessment, logistic regression was utilized. Intent to treat approach was used for all analysis, which was conducted using Stata 14.2.

Phase 3 Methods

Phase 3 recruitment began after analyzing the Phases 1 and 2 findings. Phase 2 participants

who indicated they would be interested in a follow-up interview were contacted to participate. The decision regarding who to contact was made considering who could best answer the questions related to the Phase 2 findings that needed further explanation. For example, to gain more understanding regarding how the thermometer helped direct action, participants who took action were contacted for an interview. Nine participants completed a 30-60 minute semi-structured interview. Notes were taken during the interviews, with transcriptions of the audiotaped interviews supplementing the notes. Interpretive Description was used to analyze the data. Interpretive Description aims to address real-world clinical practice issues.¹⁵ A joint display was used to analyze the data and support data integration.

Results

Patient Characteristics: There were slightly more males than females in both groups. The average age of the participants in both groups was similar: for the thermometer and education group, the average age was 66.2 years and for the education-only group, it was 65.7 years. There was a wide age range of 38-86 across both groups. The average number of years with diabetes was similar: the mean for the thermometer and education group was 13.9 years and the education-only group was 17.9 years. There was also a wide range for the duration of diabetes, <1-54 years across both groups. There was no statistically significant difference between the groups, except for the use of insulin; 65.4% of participants in the education-only group used insulin compared to 29.4% in the thermometer and education group ($p = 0.009$). Other characteristics, such as co-morbidities, foot-risk classification and previous DFU, were comparable between the two groups (see Table 1).

Benefits of Using the CAIT: Analysis of the data showed that there were benefits to using the CAIT. One of the primary benefits was foot assessment, which was defined as either a temperature check, visual check, or both. The intervention group had more days where an assess-

Table 1. Patient Characteristics

Characteristic	Thermometer and Education % (n)*	Education-only % (n)*
Gender	Male 52.84 (18) Female 47.06 (16)	Male 57.69 (15) Female 42.31 (11)
Age in years (mean)	66.2 (range 38-80)	65.69 (range 49-86)
Marital Status	Single 8.82 (3) Married 67.65 (23) Widowed 11.76 (4) Divorced 11.76 (4)	Single 15.38 (4) Married 80.77 (21) Widowed 3.85 (1) Divorced 0
Income		
< \$20000	9.68 (3)	20 (5)
\$20,000-100,000	80.65 (25)	60 (15)
>\$100,000	9.68 (3)	20 (5)
Education (highest level completed)		
Elementary	2.94 (1)	0
High School	35.29 (12)	11.54 (3)
Post-Secondary	35.29 (12)	50 (13)
Some University	2.94 (1)	0
Degree	23.53 (8)	38.46 (10)
Comorbidities	No 11.76 (4) Yes 88.24 (30)	No 0 Yes 100 (28)
Type of Diabetes	Type 1 5.88 (2) Type 2 94.12 (32)	Type 1 15.38 (4) Type 2 84.62 (22)
Had Previous Foot Ulcer	5.88 (2)	11.54 (3)
Neuropathy	38.24 (13)	46.15 (12)
Foot Risk Classification**		
Very low	61.76 (21)	53.85 (14)
Low	2.94 (1)	11.54 (3)
Moderate	29.41 (10)	26.92 (7)
High	5.88 (2)	7.69 (2)

* % (n) is the proportion and number of participants in the thermometer and education group (n = 34) and the education-only group (n =26) who had the identified characteristics.

** Foot risk classification was based on International Diabetic Foot Risk Classification System

ment was completed (150.98 vs 119.84, $p = .02$). As shown in Figure 2, 67.7% (23) of participants in the thermometer and education group completed an assessment > 80% of the days compared to 50% (13) in the education-only group. When years with diabetes were controlled for, those in the intervention group were significantly more likely to have completed an exam >80% of the time, compared to the control group (OR: 3.54; 95% CI: 1.11 – 11.29; $p = 0.032$) $R^2 = 0.0989$. A

benefit that could be related to the increased frequency of assessment is that the CAIT prompted participants to check their feet. In Phase 3 interviews, participants shared that taking their temperature prompted a thorough visual check, raised awareness of their feet and made them feel more involved in their foot assessment. One participant discussed how recording the temperature increased the structure of her assessment. Another participant stated that it gave her more

of an acute awareness of the surface of her foot.

The Phase 2 logbook data showed that both groups took action to address foot concerns such as applying cream, wearing appropriate footwear, choosing appropriate activities, re-assessment and seeing an HCP. In the exit interviews, participants were asked whether they changed what they planned to do based on their temperature assessment. Six (22.22%) participants indicated that they rested, rechecked later in the day, went to bed earlier and decreased walking. These results were explored further in Phase 3 to understand the CAIT readings' interpretation better and how the temperature readings guided action.

Participants in Phase 3 shared that a temperature reading of < 4 degrees F provided reassurance that their feet were fine. One participant said that when the reading was < 4 degrees F, she felt she was, "good to go" and to do whatever activity she had planned, such as dancing. In contrast, a temperature of > 4 degrees F heightened concern and prompted action such as: resting, further investigating, rechecking, looking and going to see a health-care professional. For example, one

participant said that if it was > 4 degrees F, he would cancel going for a walk that day.

Another benefit was decreased callusing, which was measured by presence or absence of callusing using the Simplified 60-Second Foot Screen.¹³ The data showed that participants in both groups had reduced callusing when comparing baseline and three months. At baseline, 17.6% of the intervention group had no calluses on their left foot; this increased to 43.8% at three months, a difference of 26.2 percentage points. In the control group, the difference was 21 percentage points (from 15.4% to 36.4%). These differences were not statistically significant but were clinically meaningful (See Figure 3). The improvement was not sustained, but more participants had no calluses at six months compared to baseline.

Another benefit is that the CAIT facilitated discussion about foot health with health-care professionals. Participants were given a letter to provide to their primary health-care professional explaining the intervention and use of the CAIT. In the exit interview, 67.86% of the participants indicated that they gave their health-care profes-

Figure 2.

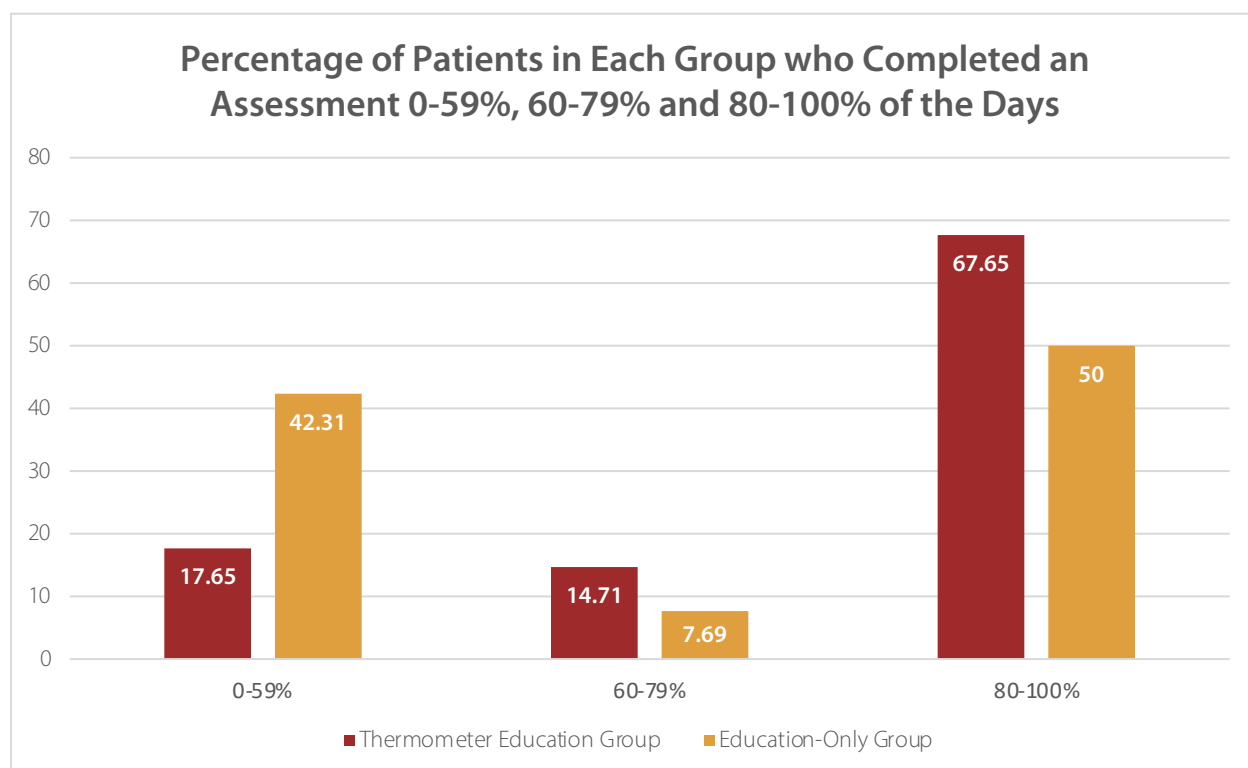
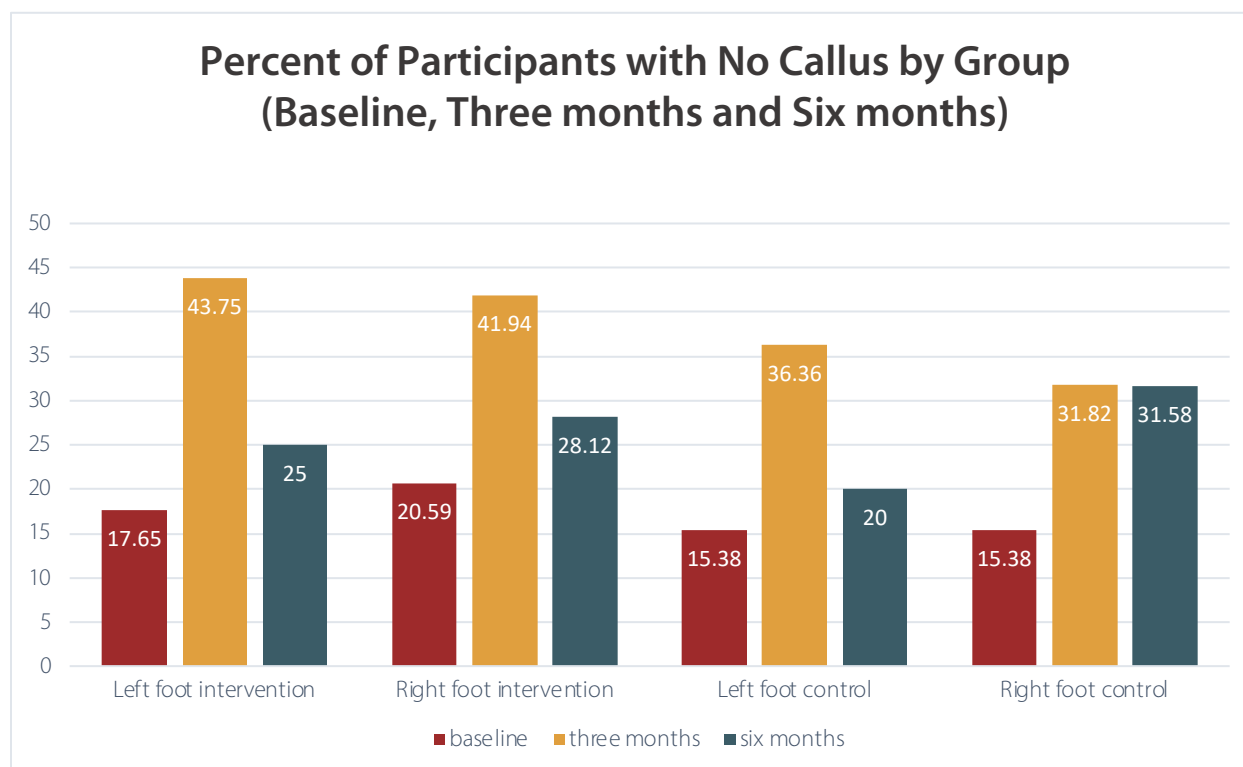


Figure 3.



sional the letter, with two stating that they did not provide the letter but told their health-care professional about the study. During the study, six participants visited their physician about their feet for various reasons (e.g., assessment, activity level, issue found during self-assessment). One of the participants shared that they went to the doctor because they were having redness and swelling, but the temperature readings were consistent (e.g., no difference in temperature).

Challenges of Using the CAIT: There were also challenges identified with using the CAIT. During Phase 2, challenges with using the CAIT were identified by the researcher and participants related to: lack of clarity regarding the purpose of the thermometer; misunderstanding of what to consider a concern and when to take action; interpreting the findings and taking action based on the assessment and the logistics of using the CAIT. Based on these findings, participants' understanding was further explored in Phase 3. When asked what information the CAIT provided, some participants in Phase 3 were clear that the CAIT helped identify inflammation or infection.

However, other answers were more vague, with one participant stating that a temperature difference would tell him he needed to rest his feet. One participant who never identified a temperature difference noted that the CAIT provided no information.

There were also issues identified in Phase 2 with participants understanding the temperature readings and taking appropriate action. Why participants did not change their activity level when measuring a temperature difference > 4 degrees F was explored in Phase 3. One participant stated that when he got a temperature difference, he would look for other reasons why his temperature would be increased, such as the room temperature. Another participant considered that he might have done something wrong when checking the temperature, resulting in an inaccurate reading. Another reason was that the foot issue was a concern but insufficient to take action: they would 'watch it'. The issue of not taking action was also related to a lack of clarity regarding what should be considered a foot concern that needed to be addressed. From all three phases

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of the study, it was found that participants were only sometimes clear on what would be a foot concern and when they should take action to see their health-care professional.

During the Phase 2 teaching sessions and the return demonstrations, the researcher noted issues related to the logistics of using the CAIT. Some participants had difficulty completing the temperature reading because of physical challenges such as flexibility, arthritis and vision loss. Using the CAIT and obtaining an accurate temperature reading required participants to complete several steps. A return demonstration during the Phase 2 exit interview showed that half the participants were using the thermometer correctly, and the remaining participants were completing only aspects of the assessment correctly (e.g., having the thermometer too far or close to the foot; incorrect settings; incorrect recording and not scanning the whole foot).

A Phase 3 participant highlighted the complexity of completing a CAIT reading when he stated:

"There were four or five things that I had to do to make sure I was taking it right. It had to be a certain distance from the foot, it had to stay on the foot. They might have been one little step that I didn't do correctly so this might be the reason it might not be giving me the correct temperature reading."
(Participant)

It was observed that several participants in the thermometer group had help from their linked support person in completing the temperature checks. This assistance may have minimized issues related to logistics and physical challenges. Participants in the intervention group with multiple sources of support did complete more days of assessment (M: 165 days) vs. spousal support alone (M:146) or family support (M:102). Similar trends were seen in the control group for multiple sources of support (M:134.2) vs. other sources (M: 89.2-121). However, no conclusion regarding causality can be drawn between the support provided and the use of the thermometer.

One potential challenge was the time

commitment to using the CAIT, as identified by one participant in Phase 3. However, she saw the CAIT as favourable and adjusted her schedule. Because we wondered if adding the thermometer to foot self-management would negatively impact QoL, we utilized the Q-LES-SF to measure QoL. There were no differences between the two groups or within groups for the QoL scores. This finding indicated that additional self-management activities did not impact the QoL of participants and thus would not be expected to discourage the use of the thermometer.

Continued Use of the Thermometer: The Phase 2 exit interview results showed that everyone in the intervention group found the CAIT easy to use. The vast majority (96.8%) indicated they would continue to use the CAIT, but 37.9% indicated that they would only use it sometimes or rarely. Furthermore, 93.1% said they would recommend the CAIT to a person with diabetes (See Table 2). Participants in Phase 2 stated they would use the thermometer to: see if there was inflammation; keep a record and have a baseline assessment; help monitor for hot spots; identify any issues and find out the difference. They also indicated they would use it because it was practical and part of their regime. Those who said they would use it sometimes indicated that they would do it to, "keep an eye on things," to see if anything was wrong, such as an infection, or if they noticed any redness or pain.

These findings were explored further in Phase

Table 2. Exit Interview Results for Thermometer Group

Question	Result % (n)*
Was it easy to use the thermometer?	Yes 100 (25)
Will you continue to use the thermometer?	No 3.45 (1) Yes 58.62 (17) Sometimes 31.03 (9) Rarely 6.90 (2)
Would you recommend a thermometer to another person who had diabetes?	No 6.90 (2) Yes 93.10 (27)

* % (n) is the proportion and number of participants in the thermometer and education group (n = 29)

- Findings suggest that the use of a CAIT is an available low-cost tool that could support foot self-management for people with diabetes.
- Using a CAIT may offer several benefits, such as promoting foot assessment and direction for action.
- Understanding possible challenges with using the CAIT and involving, as appropriate, support persons with foot self-assessment can help health-care providers strengthen patient education and foot self-management.
- Future research is needed to determine the optimal schedule and technique for CAIT assessment and to better understand decision making related to foot self-management (e.g., why patients take action or do not take action).



3 to clarify whether the CAIT was a helpful technology for participants. Five of the six participants from the thermometer and education group interviewed in Phase 3 used the CAIT since completing Phase 2. The reasons provided by participants for using the CAIT were curiosity, habit, another step in the inspection process and concern after completing the visual foot assessment. One participant said it gave her confidence in determining whether the issue she identified was serious. Two participants shared that they had a schedule for using the thermometer; one used it weekly, and another stored it with his blood pressure kit and checked it every couple of weeks. Other participants used it more sporadically, such as when they identified a concern with visual inspection.

Conclusions: It is clear from the findings that the intervention that combined education and using a CAIT supported foot self-management and offered several benefits to patients without being a burden concerning time. Participants shared that they felt more involved in their assessment and felt reassured about their foot health feet when the temperature difference was < 4 degrees F between their feet. Participants that used the thermometer were more likely to have a regular daily approach to their assessment that did not include only measuring their foot temperature but also a visual inspection of their feet; they checked their feet more frequently and identified more concerns compared to those in the control group. Considering most patients with diabetes do not regularly assess their feet,² providing a tool that supports assessment is very useful.

For a person with diabetes at risk for foot complications, taking appropriate action based on foot assessment findings is crucial. Another important benefit of using the CAIT is that it may provide information to help a person with diabetes make the best decisions for their foot health. Completing an assessment for inflammation with the thermometer and a regular visual inspection of their feet would allow patients to identify any changes that may have occurred and may prompt them to action. Although both groups took action, participants in the therm-

ometer group had more information to guide action in relation to resting. Reduced callusing was seen in both groups, suggesting that education is an important element for promoting foot self-management. There was a greater improvement in the thermometer and education group, however, which may reflect an additive benefit of using the thermometer. Lavery et al. (2004) concluded that the use of the thermometer provided patients with, "actionable information".³ (p.2646) It was suggested by Lavery et al. (2007) that using an infrared thermometer would allow patients to decide their safe activity level, similar to how a glucometer reading enables a patient to determine the correct insulin dose.⁷

Another noteworthy benefit is that the thermometer facilitated discussion with health-care professionals. Participants gave the letter about the research to their health-care professional, and some participants indicated that they saw their practitioner about their feet based on their self-assessment. Research supports that foot self-management is complex in interactions with health-care professionals. The communication between patients and the professional was identified in two studies to be an enabler and barrier. Clear communication had a positive impact on foot health practices. However, if patients had a negative experience with an health-care professional, they were more likely not to participate in positive foot health behaviours.¹⁶ It was noted that health-care professionals often did not provide information on foot care which contributed to the lack of knowledge and the perception that foot care was not critical.¹⁷ Therefore, the use of a tool like the CAIT may be an enabler and support discussions about foot health between patients and health-care professionals.

Although it was clear that the CAIT potentially offered benefits, there were several issues related to using the CAIT, such as: a lack of clarity regarding the purpose of the CAIT; the findings; not taking action based on the assessment and the logistics of CAIT use. Some participants needed clarification regarding the thermometer purpose and that a temperature difference > 4 degrees F identified inflammation that could lead to skin

breakdown. Sometimes, when participants had a temperature difference, rather than considering that there could be an issue with their feet, they looked for other reasons for the temperature increase. This reasoning may be linked to a need for more clarity regarding the purpose of the assessment.

There were also several challenges identified with the process of taking action to address the foot assessment findings. First, interpreting the visual inspection was an issue. It was apparent that some participants needed clarification about what assessment findings would be considered a concern. Most participants identified that a break in the skin was a concern that required attention. However, some participants did not view findings such as bruising and pain as a concern requiring attention and were comfortable waiting to see if these settled back to normal and whether the symptoms were transient or persistent. The decision to wait and see if a concern settled back to normal and not take action may be related to the challenge of getting a health-care professional appointment. Participants in Phase 3 highlighted this challenge. It could take a week or more for a patient to see their health-care professional. This limited access would make it difficult for patients to follow what they were directed to do: get their feet checked immediately if there was a concern. It also may be related to risk perception, a highly variable concept. The variability of the answers may reflect that people perceive risk concerning their foot health differently. Decision-making related to taking action should be explored in future research, considering behaviour modification. Furthermore, structural equation modeling should be used in future research to determine the contribution of multiple components to taking action.

The logistics of using the CAIT also presented challenges. Participants had a lot to remember when completing the temperature assessment. There were several steps to complete: having the foot up, waiting five minutes after removing the socks, having the thermometer the correct distance from the foot, ensuring the laser stays on the foot and using the correct settings. Taking the

temperature reading was more difficult for participants with physical issues such as a sore shoulder or knee. Some participants had a support person who would take their foot temperature, enabling the completion of the assessment. Participants received two return demonstrations at baseline and one-week post-enrollment in the study. However, even with this teaching, only half of the participants completed the temperature check correctly at the end of the study. These findings have implications for health-care professionals; understanding the possible challenges with using the thermometer is essential for providing effective patient education, involving support persons and regular follow-up to ensure patients complete the temperature assessment correctly.

These findings also have implications for patient education and policy. Health-care professionals should reinforce with patients what assessment findings would be a foot concern and what would be the appropriate action, whether it be waiting and watching their feet closely or seeing the relevant practitioner. Health-care professionals should stress to patients with neuropathy who cannot rely on cues such as pain that signs of inflammation may be symptoms of DFU or potential DFU.⁵ As well, the concept of teach-back should also be considered to help identify a knowledge gap. Teach-back is a technique that can be utilized to see if the health-care provider was clear in their explanation and if patients have understood all the concepts that were conveyed. This strategy has been shown to be effective in chronic disease management.¹⁸ Incorporated into this approach could be two key messages: what are foot concerns and when should a patient see their health-care professional. Concerning the thermometer, if patients use the CAIT as an assessment tool, their process of completing the measurement should be evaluated regularly by a health-care professional to ensure it is being performed correctly and to explore options for addressing any challenges.

The CAIT may be a tool that could be used on a long-term basis for foot self-management as participants reported that it was easy to use, they would recommend the thermometer to

other patients with diabetes and they would continue to use the thermometer. Although many participants said they would continue using the CAIT, it would not be daily. Although patients would not use it daily, they still benefited from using the CAIT as it supported completing a visual assessment. More research is needed on the optimal schedule for a foot assessment, including temperature monitoring and the role of the support persons in supporting use of this tool as part of self-management. Until this gap is filled, health-care professionals should continue recommending and supporting daily foot assessments.

A strength of this MMR research is that it is the first study to assess using a CAIT from the patients' perspective concerning usability, challenges and benefits. Another strength relates to intervention integrity. All Phase 2 participants had their feet assessed by an advanced foot care nurse and one researcher provided the education. Using sophisticated data analysis was also a strength, as logistic regression allowed for the control of confounding variables. A limitation of this study relates to using a six-month intervention. The long-term impacts of the intervention may have been better understood with a 12- or 18-month intervention. As well, the daily logbook data was a limitation as some participants did not always fill in the information. Another limitation was the small sample size in the RCT. Although, differences were not statistically significant they may be clinically meaningful.

To prevent foot complications, it is recommended that patients with diabetes complete a daily visual inspection of their feet to identify a concern and take action to address the issue. However, often patients do not complete this inspection regularly and due to nerve damage, many patients cannot identify the signs of inflammation. Findings from this study indicate that the CAIT is a promising low-cost tool that offers several benefits related to completing and prompting a regular assessment and direction for action, improving the condition of the skin and facilitating a discussion about foot health with health-care professionals. There were challenges identified with use of the CAIT, such as

lack of clarity regarding the purpose of the tool, taking appropriate action based on the temperature reading, logistics with using the CAIT and the time commitment. Even with the additional time commitment, we did not find there was an impact on the QoL of participants. Overall, our findings show that a CAIT is an available and affordable tool that supports foot self-management. Understanding the patient perspective in relation to benefits, challenges and usability has implications for patient education and follow-up by health-care professionals. 📄

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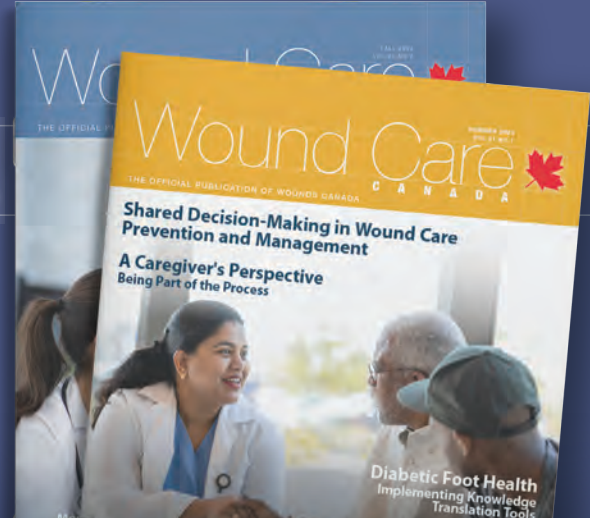
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**DEADLINE FOR SPRING 2024 ISSUE:
FEBRUARY, 2024**

Mölnlycke Sponsored Learning: Are Your Patients Dressed for Success?

Presenter: Rosemary Hill BSN CWO CN NSWOC WCCC(C)

"Ring the bells that still can ring. Forget your perfect offering. There is a crack, a crack in everything. That's how the light gets in."
Anthem, Leonard Cohen

The Physical And Psychological Burden Of Radiation Dermatitis

Patients who live with breast cancer often experience physical and emotional hardships. These hardships can often be iatrogenic (i.e., caused by medical procedures). Patients who suffer from breast cancer often requires radiation therapy (RT) as part of their treatment plan. Prolonged exposure to radiation, like the sun for example, can lead to adverse skin reactions (i.e., a sunburn). Patients who undergo RT can develop inflammatory changes in their skin known as radiation dermatitis (RD). RD can present with an array of signs and symptoms, including redness/erythema, pigmentation, and dry and moist desquamation. It has been found that 95% of women who require RT experiences some degree of RD.¹ Patients with large breasts and those with post-mastectomy undergoing RT are at a greater risk of RD. Additionally, other risk factors include age, skin type, history of smoking, and radiation delivery methods.

The possibility of RD adds to the emotional burden for patients who are living with breast cancer. It has been found that psychological stress can exacerbate RD in patients receiving RT.² Therefore, it is imperative to find a solution to prevent RD or reduce the severity of RD.

Early Research In Radiation Dermatitis

Herst et al. performed a study³ with 80 breast cancer patients receiving RT. They compared patients who used aqueous creams with those who used Mepitel® Film on and near the treatment area. The study demonstrated that the Mepitel® Film prevented moist desquamation and reduced skin reaction severity by 92% when used



prophylactically. This was a pivotal study – the use of a film dressing became a standard of care in New Zealand for breast cancer patients receiving RT. In 2022, Behroozian et al. performed a similar study⁴ with 376 breast cancer patients receiving RT and concluded that Mepitel® Film significantly reduced symptoms of RD (i.e., blistering/peeling, erythema, pigmentation, and edema).

The Light In The Crack: Mepitel® Film

Mepitel® Film is designed to protect and preserve fragile and sensitive skin to minimize skin breakdown. It can adapt to irregular body contours. It essentially acts as a 'second skin' layer. Mepitel® Film has a proprietary silicone contact layer, known as Safetac®. This silicone



DERMATITIS RADIATION

Adapted NCI CTCAE (Version 4.03)

GRADE 1 (Mild)	GRADE 2 (Moderate)	GRADE 3 (Severe)	Grade 4 (Life-threatening)	Grade 5
Faint erythema or dry desquamation	Moderate to brisk erythema; patchy moist desquamation, mostly confined to skin folds and creases; moderate edema	Moist desquamation in areas other than skin folds and creases; bleeding induced by minor trauma or abrasion	Life-threatening consequences; skin necrosis or ulceration of full thickness dermis; spontaneous bleeding from involved site; skin graft indicated	Death

BC Cancer Agency. (2023). Symptoms Management Guidelines: Radiation Dermatitis.
<http://www.bccancer.bc.ca/nursing-site/Documents/16.%20Radiation%20Dermatitis.pdf>

Application Tips and Precautions:

- Be sure to consult the radiation oncologist first
- Check and see if the patients have a silicone allergy
- Apply the Mepitel® Film dressing the day before starting RT
- Ensure the skin is clean and dry and free of deodorants, lotions, or creams prior to application
- Place the patient in the position of how they will be receiving RT
- Do not stretch the Mepitel® Film dressing; Gently lay it into place
- Minimize overlapping of the film dressing to 1cm or less
- Educate the patient that they can shower with the Mepitel® Film dressing
- Encourage the patient to avoid excessive/strenuous exercises
- Trim additional dressings and patch as needed (minimize overlap to 1cm or less)
- Remove the film dressing in the shower/bath
- Wash the area gently with a fragrance-free, pH-balanced soap

A video application guide created by Mölnlycke can be found by searching "**Mepitel® Film Application on Breast for Radiotherapy**" on YouTube.

A step-by-step application guide can be found at:
<https://www.molnlycke.ca/our-knowledge/mepitel-film---radiotherapy-breast-application/>

layer ensures the dressing can be removed easily without causing damage to the fragile and sensitive skin.

The Mepitel® Film has been found to prevent and reduce the severity of RD. It is a simple dressing to apply. It has been recommended by the Multinational Association of Supportive Care in Cancer (MASCC) as an intervention to prevent acute RD.⁵ Patients living with breast cancer often suffer physically, mentally, and emotionally. Perhaps the Mepitel® Film, a simple yet sophisticated dressing, can minimize or mitigate some of these sufferings. Like in Leonard Cohen's song *Anthem*, perhaps the Mepitel® Film, a simple yet sophisticated dressing, is the crack that lets the light of hope in.

Rosemary Hill BSN CWO CN NSWOC WOCC(C) has been a nurse for over 35 years and is the recipient of the Award of Excellence in Practice from the Association of Registered Nurses of British Columbia (ARNBC). She works at Lions Gate Hospital as a Nurse Specialized in Wound Ostomy and Continence (NSWOC). Her past volunteer activities include the role of President for Nurses Specialized in Wound Ostomy Continence Canada (2016-2018). As well, she participates as a member on the British Columbia provincial Skin and Wound committee, continues to Chair the Provincial Ostomy committee, and is an expert speaker at national and international events. Most recently volunteer activities have taken her to Argentina where she worked to provide wound education.

To access the full presentation click here: https://drive.google.com/file/d/15uPlz7zeBo_aJT7GeuUgc0vM-wC8H3KV/view?usp=share_link

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Wound Care Teams Are Stronger When They Embrace An Interprofessional Approach

By Joel S. Alleyne BSc (Computer Science) MSt

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Defining Interprofessional Education/Care (IPE/IPC)

We often speak of working “interprofessionally” in health care and in wound care. However, this term is used by different people to mean similar but different things. Accordingly, it is important to define the difference between interprofessional and other related terms (e.g., collaborative, interdisciplinary, trans-disciplinary, multidisciplinary, coordinated). This brings precision to our language and helps to create a shared understanding that underlines practice.

Terms used across the literature include: interprofessional, collaborative, interdisciplinary, trans-disciplinary, multidisciplinary, multi-professional, coordinated and trans-professional.

Inter- denotes ‘working together toward a goal’; i.e., interdisciplinary work, which is done jointly by professionals in different disciplines.

Multi- denotes ‘working independently toward a common goal’; i.e., multidisciplinary work – parallel or sequential (but still independent) work from professionals in different disciplines.

To clarify the narrative, we need to think also about group or individual decision-making.¹

Over the years, there have been a number of approaches aimed at getting the professions working together. These have been framed using the various terms above. But interprofessional care is different as it tries to be more precise in how practitioners engage with each other.

D'amour and Oandasan explain the difference



between interdisciplinary and interprofessional by intimating that the former term is concerned with knowledge and the latter with practice.² They note that 'interdisciplinary' approaches to teamwork recognize that complex fields of research draw on knowledge from many different disciplines. Equally, modern professionals are faced with professional challenges that require skills and knowledge from many different professions and through interprofessional efforts, are able to meet these challenges more effectively.

Retchin seems to apply interdisciplinary to professionals from different disciplines but of similar educational/professional backgrounds (e.g., medical doctors), whereas interprofessional applies to efforts that involve professionals of different educational backgrounds with varying types of certifications, including, for instance, health-care professionals such as massage therapists, physiotherapists, and chiropractors as well as medical doctors.¹

Oandasan and Reeves apply a similar definition to these terms, noting a general movement toward using the latter term over the former.³ They note that the profession of 'doctor' includes many different disciplines but excludes other health-care professionals, for instance, such as chiropractors or massage therapists and that by explicitly moving toward the language of interprofessionalism, it includes a wider range of professionals. Additionally, Oandasan and Reeves distinguish between the *inter-* and *multi-* prefixes for professional and disciplinary work, noting that the former connotes working together toward a goal and the latter working independently toward a common goal. This latter distinction is also made by Mitchell,⁴ in which she cites earlier work by Nowotny and Rosenfeld, to differentiate between multidisciplinary work – parallel or sequential (but still independent) work from researchers in different disciplines – and interdisciplinary work, which is done jointly

Table 1. Core Contrasts among the Baseball, Football, and Basketball Models

	Baseball	Football	Basketball
Organizational strategy			
Distinctive competence	Adding value through star performers	Reducing costs and/or complexity through global coordination	Innovating by combining resources in novel ways
Strategic orientation	Divergence	Convergence	Divergence and convergence
Organizational structure			
Interdependence	Pooled	Sequential	Reciprocal
Coordinating mechanism	Design of free-standing roles/units	Hierarchical planning and administration	Mutual adjustment
Decision system	Decentralized	Centralized	Shared
Information system	Locally controlled	Globally controlled	Distributed
Reward system	Individualistic	Hierarchic	Mutualistic
Effects of physical layout	Independent action	Programmed interaction	Voluntary interaction

Source: Keidel.⁶

by researchers in different disciplines. Although Mitchell references researchers, the application to professionals in health care and other areas remains clear.

Sheehan et al. consider 'multidisciplinary' and 'interprofessional' teamwork as steps on a scale that culminates in 'trans-professional', noting that with each step comes a reduction of formalities and role separation between the various professionals involved.⁵ They state that, "working in a 'multidisciplinary' team is based on recognizing professional expertise and dividing the labour accordingly, whereas working in an 'interprofessional' team requires greater sensitivity to social issues within the team and willingness to share roles to develop collaborative ways of working.

Based on these formulations of professional working styles, the advantage of interprofessional teamwork seems to be a closer integration between team members from less closely related professional backgrounds which provides greater opportunities for problem-solving and more streamlined communication between team members.

We need to move from uni-professional, past multi-professional, to interprofessional teams. Simply sharing clinical space is necessary but not sufficient for creating high-functioning interprofessional teams.

Team Work

Although we use the term 'teamwork' thinking we all mean the same thing, I am reminded that Keidel makes the distinction that sports teams use different strategies depending on the game being played.⁶ This is summarized in Keidel's chart (see Table 1).

Keidel points out that we need to understand the game we are playing and choose strategies that match carefully.⁶

I am also reminded of the interview where the candidate was asked, "Are you a team player?" And responded, "Yes sir, 'team captain'!". Understanding the need to play different roles in teams is important.

Retchin also points out that our care settings require different approaches. Interprofessionalism is different in emergency or surgical settings when compared to long-term care where we have the ability to deliberate during decision-making. Two key charts from Retchin summarize this concept clearly (see Figure 1 and Table 2).¹

Temporality, urgency and structural authority define our IPC environments.

Interprofessional care is important for several reasons.

Holistic Patient Care:

In health care, patients often have complex needs that require expertise from multiple disciplines. Interprofessional care ensures that patients receive holistic and well-rounded care, addressing not only their medical conditions but also considering psychological, social and environmental factors.

Improved Patient

Outcomes: Collaboration among health-care professionals can lead to better patient outcomes. When a team of experts works together, they can develop more effective treatment plans, reduce errors and enhance the overall quality of care. This can result in improved patient satisfaction and a higher likelihood of successful treatment.

Enhanced Communication: Interprofessional care promotes effective communication among health-care team members. This includes sharing information, discussing treatment options and coordinating care plans. Clear and open communication helps prevent misunderstandings,

The sense of urgency defines how teams function:

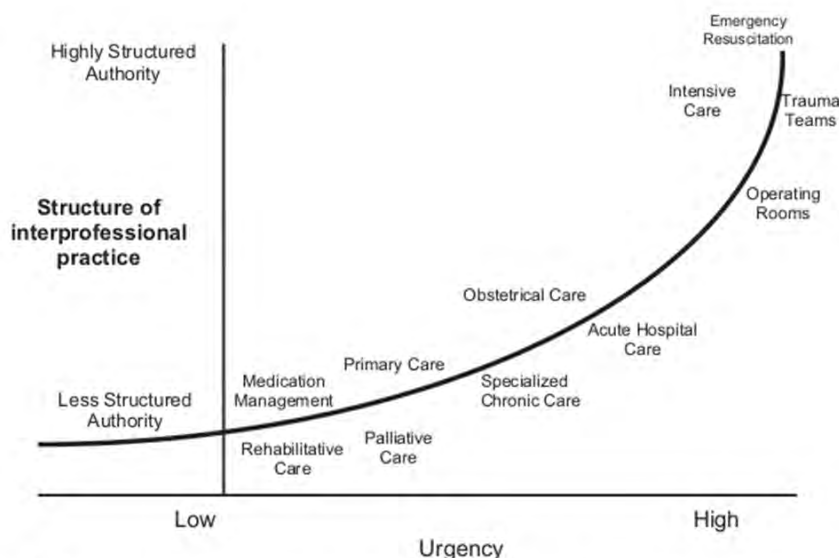


Figure 1 Degree of structured authority of interprofessional care according to urgency.

Source: *Academic Medicine*, Vol. 83, No. 10 / October 2008

reduces the risk of errors and ensures that everyone involved in a patient's care is on the same page.

Efficient Resource Utilization: Collaboration allows for the efficient use of resources. Different professionals bring unique skills and perspectives to the table, and by working together, they can optimize the use of available resources, minimizing redundancies and maximizing the effectiveness of interventions.

Patient-Centered Care: Interprofessional care emphasizes a patient-centered approach, consid-

Table 2. Definitions, Constructs, Resource Intensity, and Examples of Interprofessional Care Domains

	Temporality	Urgency	Structured authority
Definitions	Time frame, episode of care	Intensity of care, degree of necessity for rapid decision making	Delineation of leadership in multidisciplinary team, conventionally associated with final authority in decision making
Constructs	Concurrent \leftrightarrow sequential	Low \leftrightarrow high	Less structured \leftrightarrow highly structured
Resource intensity	Concurrent: Expensive because of standby capacity Sequential: Less expensive because it does not require real-time meetings or scheduling	Low urgency is likely to generate less resource intensity. However, low-urgency care (e.g., cancer care) can generate high-intensity resources over time	No relationship to resources, except that the need for structured authority is more likely to be concurrent and high intensity
Examples	Concurrent: Team meetings on rehabilitation unit for discharge planning Sequential: Coordination of care between acute and post-acute-care teams	Low urgency: Medication management strategies between pharmacists and primary care physicians for the anticoagulation management of patients with atrial fibrillation High urgency: Response to serious trauma event	Less structured: Group decision making during team conference

Source: Retchin¹

ering the preferences and values of the patient in the decision-making process. When professionals from various disciplines collaborate, they can tailor treatment plans to align with the individual needs and preferences of the patient.

Adaptation To Complexity: Health care is becoming increasingly complex, with advancements in medical technology, evolving treatment modalities and a growing understanding of the interconnected nature of health issues. 'Interprofessional' care allows health-care teams to adapt to this complexity by drawing on the diverse expertise of different professionals.

Education And Professional Development: Interprofessional collaboration provides opportunities for ongoing learning and professional development. Health-care professionals can learn from each other, share their knowledge and skills, and stay informed about advancements in their respective fields.

Efficient Workflow: When health-care professionals collaborate, they can streamline workflows, reducing delays and improving the efficiency of health-care delivery. This is particularly important in fast-paced and high-stakes health-care environments.

In summary, interprofessional care is crucial for delivering comprehensive, patient-centered, and high-quality health-care. It brings together the expertise of different professionals, promotes

Interprofessional Resources

Three key resources are useful for those who wish to take interprofessional teams to a higher level and give them requisite focus.

Oandasan, I, Closson, T, et al.

Interprofessional Care: A Blueprint for Action in Ontario, 2007: <https://www.cor-healthontario.ca/01-ipc-blueprint-july-2007-en.pdf>

WHO. Framework for action on interprofessional education & collaborative practice: <https://www.who.int/publications/i/item/framework-for-action-on-interprofessional-education-collaborative-practice>

Canadian Interprofessional Health Collaborative. A National Interprofessional Competency Framework: <https://phabc.org/wp-content/uploads/2015/07/CIHC-National-Interprofessional-Competency-Framework.pdf>

effective communication and contributes to improved patient outcomes. 🏥



Creating An Effective Interprofessional Team

Creating an effective interprofessional team requires careful planning, communication and a commitment to collaboration. Here are key elements that contribute to the effectiveness of interprofessional teams:

Clear Goals and Objectives

- Clearly define the goals and objectives of the interprofessional team. Establish a shared understanding of the team's purpose, mission and expected outcomes. This

clarity helps align the efforts of team members toward common objectives.

Role Clarity

- Clearly define the roles and responsibilities of each team member. This includes understanding the unique contributions that individuals from different professions bring to the team. Clearly defined roles help prevent duplication of efforts and promote efficient collaboration.

Effective Communication

- Establish open and transparent communication channels within the team. Encourage regular meetings, discussions and the exchange of information. Effective communication helps prevent misunderstandings, promotes a shared understanding of patient needs and fosters a collaborative culture.
- Shared charts are important.
- Shared purpose-built space strengthens the team.

Mutual Respect

- Foster a culture of mutual respect among team members. Recognize and value the expertise of individuals from different professions. A respectful environment encourages open dialogue and the sharing of diverse perspectives, contributing to better decision-making and problem-solving.
- Leave the professional egos behind and treat other professionals as contributing equally and significantly to the team.

Shared Decision-Making

- Promote shared decision-making processes within the team. Encourage input from all team members, considering their unique perspectives and expertise. Shared decision-making not only leads to better-informed choices but also fosters a sense of ownership and commitment among team members.

Interprofessional Education

- Provide opportunities for interprofessional education and training. This can include

workshops, seminars and simulations that allow team members to learn about each other's roles, responsibilities and perspectives. Increased understanding can lead to improved collaboration.

Effective Leadership

- Appoint or develop effective leaders who can guide the interprofessional team. Strong leadership is essential for setting a positive tone, facilitating collaboration and addressing challenges that may arise. Leaders should encourage a culture of collaboration and model effective communication.

Conflict Resolution Skills

- Equip team members with conflict resolution skills. In any collaborative setting, conflicts may arise due to differences in perspectives or approaches. Having strategies in place to address and resolve conflicts constructively is crucial for maintaining a positive team dynamic.

Continuous Evaluation and Improvement

- Establish mechanisms for continuous evaluation of team performance and outcomes. Regularly assess the team's effectiveness, identify areas for improvement and implement changes as needed. This ongoing evaluation contributes to the team's ability to adapt to evolving challenges and improve over time.

Supportive Organizational Culture

- Create an organizational culture that supports and values interprofessional collaboration. This includes policies, incentives and resources that facilitate teamwork. When the broader organizational culture aligns with the goals of the interprofessional team, it enhances the team's effectiveness.

By incorporating these elements, organizations can create an environment where interprofessional teams can thrive, resulting in improved patient outcomes and a more comprehensive approach to health-care delivery.

This framework summarizes key elements for success in an interprofessional environment.

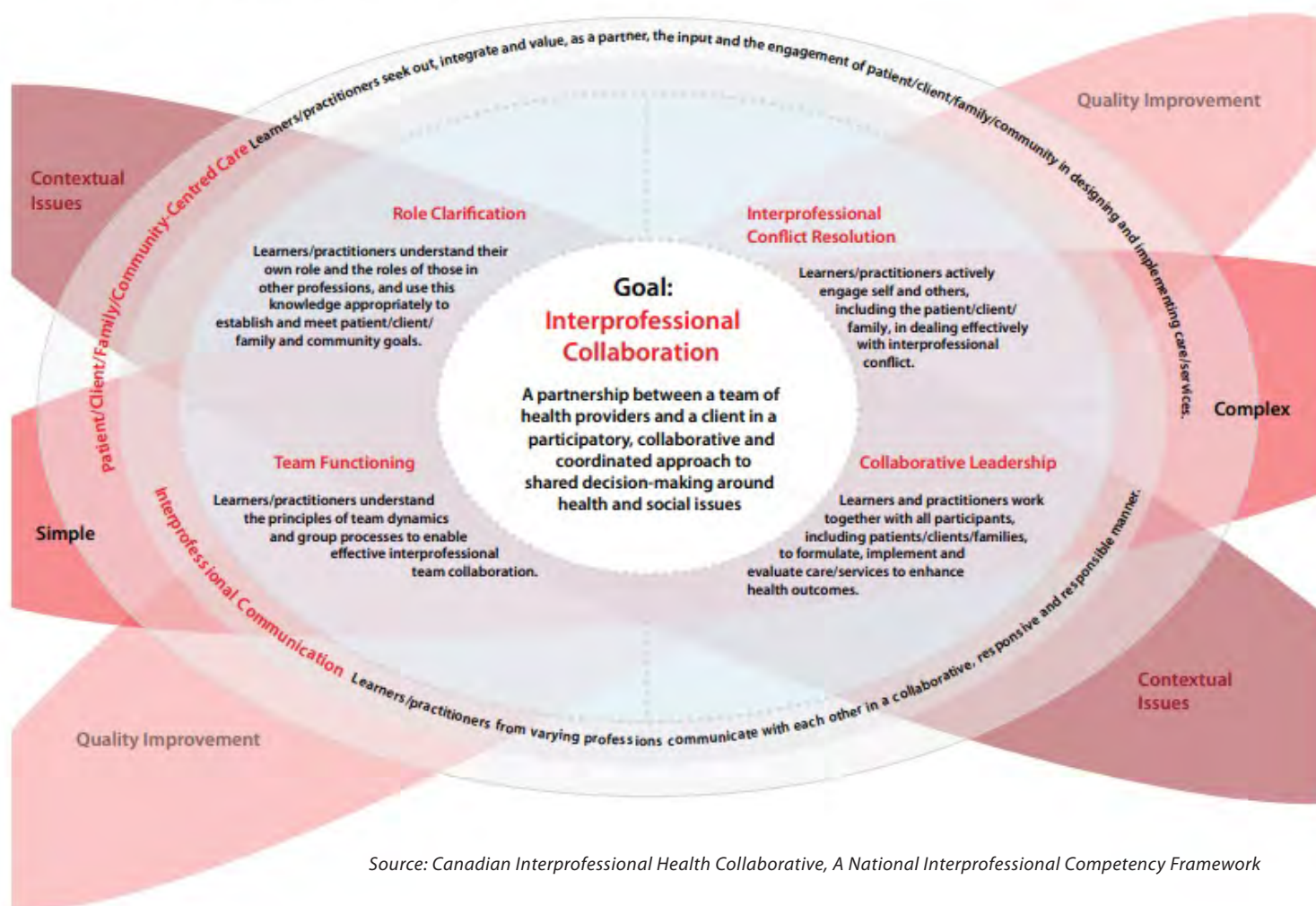


Figure 2. The National Competency Framework

Joel Alleyne BSc (Computer Science) MSt is Executive Director, Canadian Podiatric Medical Association and President, Alleyne Inc.

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Smith+Nephew Sponsored Learning:

Shaping What's Possible In Negative Pressure Wound Therapy

Presenter: Nicolo Conti* BBiotech and Chris Webb BSc**

Simplifying Negative Pressure Wound Therapy (NPWT) Through Innovation

Negative pressure wound therapy (NPWT) is commonly used as an adjunctive therapy in wound care. Since 2007, Smith+Nephew has been on a mission to simplify NPWT through innovation.

The RENASYS EDGE System

Smith+Nephew's latest innovation - the "RENASYS EDGE" - was recently launched at Wounds Canada. Prior to developing the product, S+N gathered feedback from various stakeholders including clinicians, biomedical engineers and repair technicians to ensure all stakeholder needs were captured. The team synthesized the feedback and discovered three overarching trends: patients wanted a pump that alleviated the burden of living with a wound, clinicians wanted a pump that alleviated the burden of caring for a wound and stakeholders in charge of operations needed a pump that streamlined maintenance for higher utilization. After collecting the data, the team of engineers spent another four years and 20,000 hours of both designing and testing the pump prior to launching this year.

The new RENASYS EDGE has been designed with simplicity at its core.

For the Clinician: The RENASYS EDGE pump is easy to use. It has step-by-step tutorials built into the pump. Patients, caregivers and/or clinicians can troubleshoot by following the on-screen tutorials. There is also a NFC sensor on top of the pump that acts similar to a QR code. Clinicians can scan the NFC sensor with their mobile device and be taken to the RENASYS EDGE website for further troubleshooting. There are audio and visual alerts when a potential problem is detected and audio and visual alarms when a problem is imminent.

For the Patient: The RENASYS EDGE pump is small, lightweight, portable and quiet - allowing patients to continue with their daily lives. A hidden 300ml canister is designed to be discreet while still allowing assessment of exudate. Both the filter and the o-ring have been moved from the pump to the canister to minimize maintenance, reduce odour (filters are changed with every



PRESENTATION DIGEST

canister change instead of once a year during annual maintenance), and prevent back flowing of exudate when inverted. Additionally, the soft port tubing on the dressings will help minimize device related skin injuries and reduce the need for clinicians to bridge.

For Operations: The features and design of the RENASYS EDGE allows for efficiency at every turn. The self-test functionality removes the need for annual servicing. The components within the pump are sturdy, reliable and durable to help minimize the number of device returns. The pump is easy to clean and takes less than five minutes to wipe down and reset settings in between patients.



***Nicolo Conti BBiotech** is Senior Global Marketing Manager, Smith+Nephew. He is a pharmaceutical biotechnologist with over 12 years experience in wound care and medical device industries. Since 2022, Nico has led the global launch of RENASYS EDGE as the Sr. Global Marketing Manager – RENASYS in Smith+Nephew

****Chris Webb BSc** is Product Design Lead, Smith+Nephew NPWT. Chris is a physicist with over 30 years industrial and manufacturing experience in vacuum-related applications, the last 18 years in the field of Medical Equipment. He has worked for Smith + Nephew since 2015 in operational and research roles and is currently involved in the design of Negative Pressure Wound Therapy (NPWT) devices.

To access the full presentation, click here: https://drive.google.com/file/d/1HYjPQhXBNVeJ_b8M_wVln0L_bSIL_Lq6/view?usp=share_link

Smith+Nephew

Presentation Digest is a production of Wounds Canada (www.woundscanada.ca).

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Wound Sleuth

By Sheri McPhee RN BScN MEd NSWOC WOCC (C)

To Swab Or Not To Swab? That Is The Question

How to cite: McPhee S. To swab or not to swab? That is the question. Wound Care Canada. 2023;21(2): 96-99. DOI: [10.56885/DNMK4627](https://doi.org/10.56885/DNMK4627).

M.L. is a 69-year-old male client receiving daily nursing visits for chronic wounds to the left lower leg. The client states he has been, “dealing with this lower leg wound for over four months”. Within the past few days, the visiting nurse has noted an increase in wound size and drainage and the client reports increased pain. Three days ago, a wound swab was obtained and the wound care clinician was consulted.

Medical history includes: hypertension, chronic obstructive pulmonary disease, peripheral arterial disease, substance abuse and a recent angioplasty to improve circulation to the left lower limb.

Medications include: ASA, hydrochlorothiazide, acetaminophen, magnesium sulphate and nicotine patch.

There are no known allergies.

Wound Care Clinician Assessment Findings

Dressings are saturated with foul-smelling drainage; the colour of exudate is green with a blue hue (see Figure 1). There are new areas of skin breakdown, increased wound measurements and erythema extending from ankle to the knee. The client states he is feeling very tired and has not been sleeping well due to increased wound pain. The client denies fever and states his appetite is fair.

The wound care clinician contacted the client’s physician to discuss the current clinical assessment findings noted above and to inquire regarding the status of the wound culture and sensitivity report. The physician states, “the swab is negative with no evidence of infection”.



Figure 1. Left lower leg wound exudate.

What Are Some Of The Key Considerations For The Clinician To Consider When Deciding How To Proceed?

1. Open communication with the physician and advocating for the client are priorities within this case.
2. Incorrect or delayed treatment of wound infections can lead to prolonged healing times, increased risk of com-

The Wound Prevention and Management Cycle

Assess/Reassess ► Set Goals ► Assemble Team ► Establish and Implement ► Evaluate

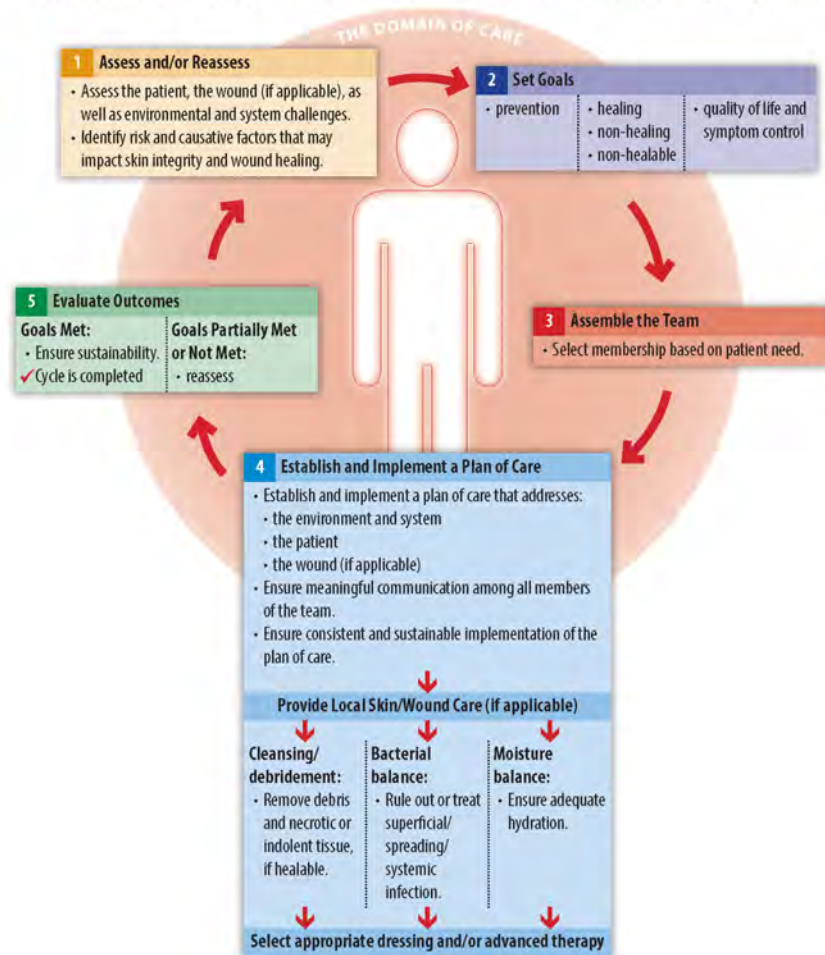


Figure 2. Wounds Canada: Wound Prevention and Management Cycle.²

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plications, increased health-care costs and can negatively impact the overall quality of life for persons with wounds and their caregivers.¹

3. The Wound Prevention and Management Cycle (see Figure 2) notes that addressing the bacterial balance within the wound is necessary to appropriately manage the wound.
4. Utilizing the NERDS and STONES criteria can assist the

clinician when differentiating between superficial bacterial burden and deep infection.³

5. It is vital to complete a pain assessment in conjunction with the wound assessment; although not a defining sign, increasing pain is a potential indicator of infection.⁴
6. There are several ways to obtain a wound specimen; wound swab, tissue biopsy, debrided viable tissue from

the wound bed and wound fluid aspirate. Each type of specimen collection requires a level of skill/competency and must be completed by a trained clinician.¹

What Are The Next Steps For The Clinician In This Case?

1. The client has clinical signs and symptoms suggesting the presence of deep infection.
2. When speaking with the physician, the wound clinician emphasized the patients' current signs/symptoms and requested an order to repeat the swab for culture and sensitivity.
3. The wound clinician is trained in sharp debridement and suggested obtaining a swab using the Levine technique post wound debridement. Research suggests the Levine technique of wound swabbing is superior to the Z tract method.⁴
4. The attending physician provided an order for debridement and wound swab for culture and sensitivity. No antibiotic treatment was initiated as the physician stated he would address this once the report of swab sample was available. Client refused additional pain medication due to history of substance abuse.
5. Three days after the repeat sample was sent for microbiology, the final report noted the following:
 - a. Heavy growth of *Pseudomonas aeruginosa*.

NERDS and STONES

Non-healing wounds

Exudative wounds

Red and bleeding wound surface granulation tissue

Debris (yellow or black necrotic tissue) on the wound surface

Smell or unpleasant odor from the wound

For deep infection, think of STONES:

Size is bigger

Temperature is increased

Os probe to or exposed to bone

New or satellite areas of breakdown

Exudate, erythema, edema

Smell

Source: Sibbald, Woo, Ayello.³

b. Heavy growth of *Staphylococcus aureus*.

c. Moderate growth of *Streptococcus Group C/G*.

Treatment Plan

A treatment plan was based on the specific bacteria and their susceptibility to antibiotic therapies. The physician prescribed IV ceftazidime twice daily for two weeks, 'vinegar soaks' twice daily for 10 days

were also ordered. Acetic acid 5% diluted with sterile water to achieve a 0.25% concentration was used to implement a 'vinegar soak'. The acetic acid solution was poured into a sterile dressing tray, several 4x4 gauze were placed into solution then placed onto the wound. The wound was rinsed with normal saline following the 10 minute soak and the wound dressed with an absorbent pad twice daily.⁶

Upon follow up 10 days later, the wound was showing signifi-

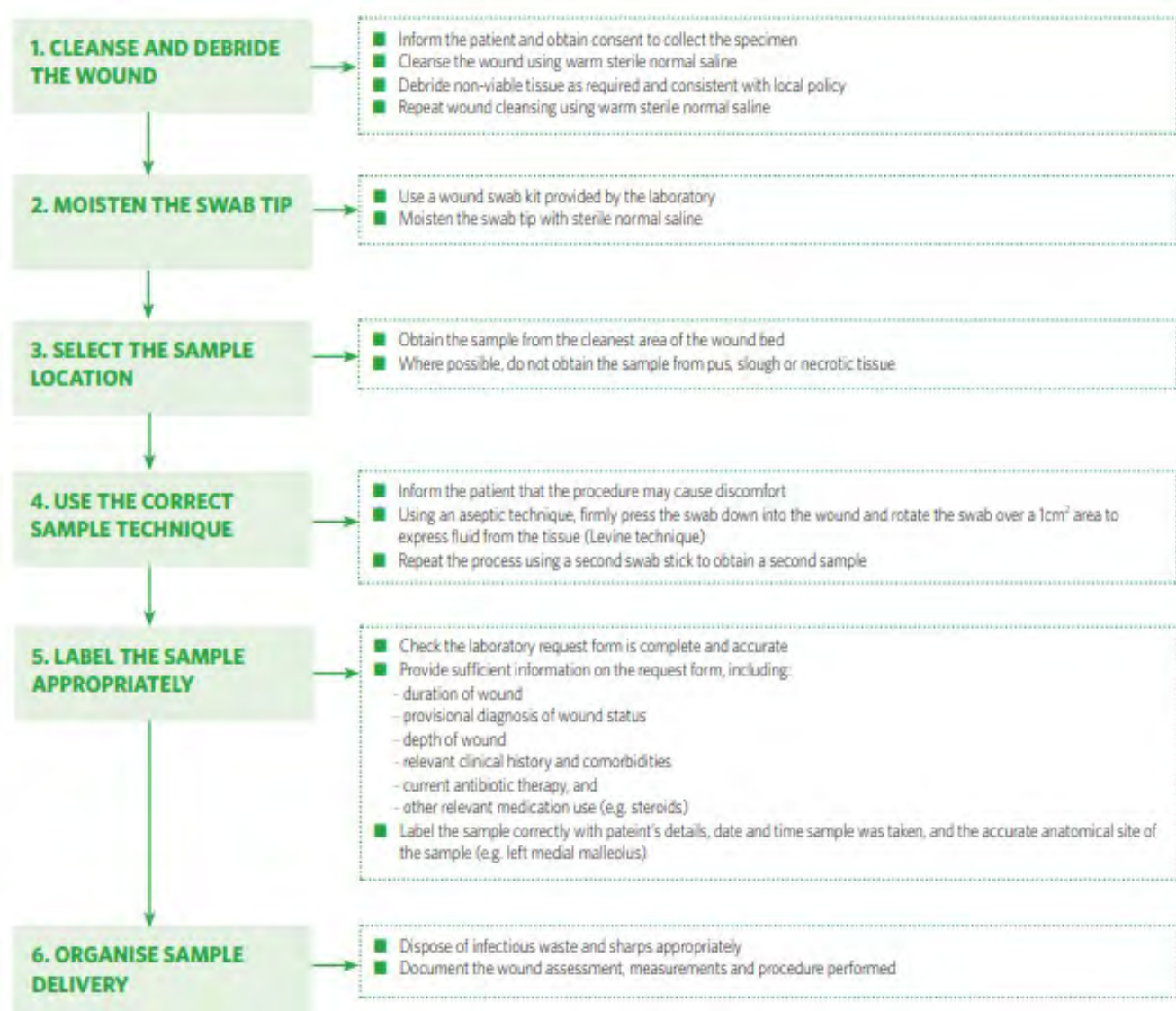


Figure 3. Taking a wound swab for culture. Source: IWII Update 2022 Pg.15



Figure 4. Left lower limb 10 days post antibiotics.

cant signs of improvement; no odour, scant exudate, decreased erythema and the client was reporting no pain (see Figure 4).

Summary

This case highlights the importance of clinical wound assessment skills using a holistic approach. Clinicians must remember the purpose of wound cultures is not to determine the presence of infection, but to determine the specific organisms present, thereby guiding selection of the most appropriate antimicrobial treatment. The International Wound Infection Institute (IWII) 2022 Guidelines note that tissue biopsy is the preferred method for sampling;¹ however this method is more costly and requires a trained professional to obtain the specimen, therefore is not always feasible. Although wound swabbing continues to be the most

frequent sampling method used, not every wound should be swabbed. The decision to culture a wound should be based on the presence of clinical signs and symptoms of wound infection. 🚫

**Sheri McPhee RN BScN
MEd NSWOC WOCC(C)** is a wound consultant with the Nova Scotia Provincial Wound Management Program.

**FIRST-TIME
AUTHOR**

Wound photos used with client's permission.

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Urgo Sponsored Learning:

The Use of Evidence Support Hypochlorous Acid-Based Cleanser: What Is The Science? What Is The Evidence? And What Are The Clinical Usage Pearls?

Presenter: Christine Murphy RN BSc(Hons) Tissue Viability MCISc(WH) PhD, WOCC(C)* and Kim Le Blanc PhD RN NSWOC WOCC(C) FCAN

Wound Cleansing: Where Does It Fit In?

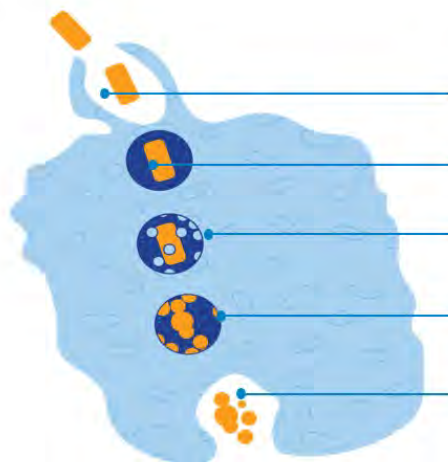
Wound cleansing is an important aspect in preparing the wound bed for healing. Appropriate wound cleansing can also lower the risk of wound infections. Wound cleansing is defined as “actively removing surface contaminants, loose debris, non-attached non-viable tissue, microorganisms and/or remnants of previous dressings from the wound surface and its surrounding skin.”¹ Adequate wound cleansing of chronic or hard-to-heal wounds can remove excessive exudate and debris from the wound and hydrate a desiccated wound bed.¹

Biofilm is the preferred form of bacterial life and is prevalent in chronic or hard-to-heal wounds. Biofilm can

delay wound healing and cause wound infections. Anti-biofilm management includes:

- Routine cleansing of the wound and peri-wound with an anti-biofilm solution
- Physical removal of the biofilm via regular cleansing with intent
- Retarding biofilm regrowth with advanced antimicrobial dressings
- Optimizing the health of the wound bed with debridement (including surgical)
- Promoting a wound healing environment with advanced dressings (e.g., protease modulators,

Oxidative Burst Pathway



- 1 Pathogen is targeted by chemotaxis
- 2 Neutrophil forms pseudopods to engulf pathogen
- 3 Neutrophil then forms a phagosome, which surrounds pathogen
- 4 **Hypochlorous acid is generated**
- 5 **The pathogen is killed by HOCl action**
- 6 Residual material is removed by exocytosis

extracellular matrices, negative pressure wound therapy)

How To Select An Appropriate Wound Cleaner

Traditionally, normal saline has been the wound-cleanser-of-choice. However, it is inadequate to address biofilm. According to the International Wound Infection Institute, practitioners should consider the following factors when selecting a wound cleanser:¹

- Assessment of the wound (e.g., etiology, location, and visible structures)
- Patient's risk of wound infection
- Signs and symptoms of local wound or spreading infection
- Colonization with multi-drug-resistant organisms
- Efficacy and organism sensitivities of solution
- Goals of care
- Local policies and procedures

Additionally, when choosing a wound cleanser, practitioners should consider the cytotoxicity of the solution, and how the solution may affect the pH of the wound. Traditional antiseptics, such as povidone-iodine and hydrogen peroxide, are cytotoxic to the tissue of the wound bed and are not recommended as wound cleansers.² Solutions that are cytotoxic can hinder the wound healing process by affecting cells such as fibroblasts, keratinocytes, and white blood cells.³ pH is another important factor to consider in wound healing. Bacteria generally prefer a slightly more basic environment (see table⁴). Lower pH has been found to correlate with wound healing. An ideal wound cleansing solution should mimic the natural acid mantle of the skin.

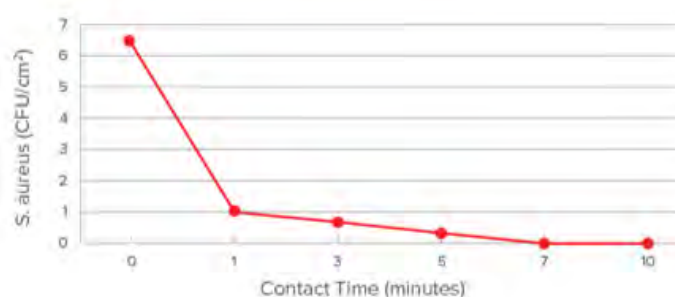
Wound-associated microorganisms	Optimum pH for growth
<i>Staphylococcus aureus</i>	7.0–7.5
<i>Enterococcus faecalis</i>	7.0–9.0
<i>Pseudomonas aeruginosa</i>	6.6–7.0
<i>Coagulase-negative staphylococci</i>	7.0–7.5
<i>Anaerobic bacteria</i>	6.0–7.0
<i>Escherichia coli</i>	6.0–7.0
<i>Klebsiella spp.</i>	5.5–7.0
<i>Candida spp.</i>	7.0–8.0

Hypochlorous Acid: An Ideal (and Natural) Wound Cleansing Solution

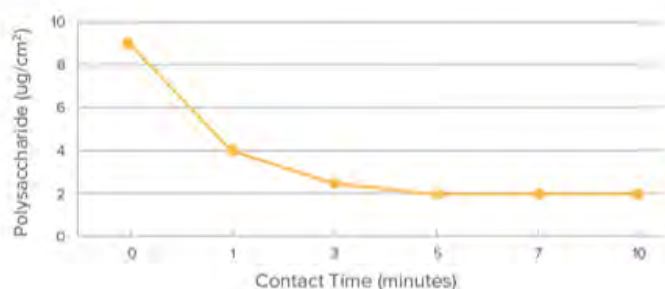
Hypochlorous acid (HOCl) is a naturally occurring antimicrobial substance in the human body. White blood cells, such as neutrophils, produce HOCl to combat pathogens.

HOCl has been found to be effective against multi-drug resistant bacteria, viruses, fungi, and spores. It exerts its effects rapidly (within seconds) and has been

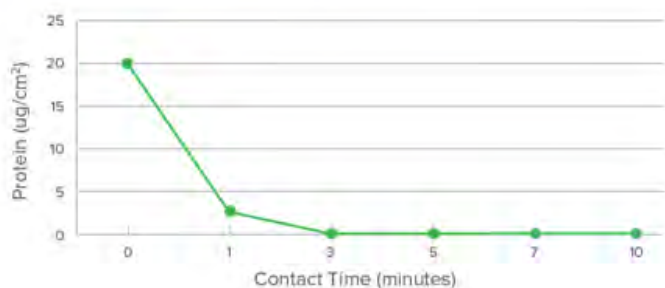
Effect of Hypochlorous Acid on adherent colonies of *S. aureus* Bacterial Numbers



Effect of Hypochlorous Acid on Polysaccharide Levels Within *S. aureus* slime



Effect of Hypochlorous Acid on Protein Levels within *S. aureus* slime



demonstrated to eradicate 99.999% of these pathogens in 15 seconds. It can also penetrate and disrupt the polysaccharide/protein matrix of bacterial biofilm, rendering it an effective anti-biofilm agent. Prolonged exposure of HOCl has been found to be more effective in mechanically penetrating and removing bacterial biofilm. Additionally, HOCl is non-cytotoxic and does not cause damage to the healing tissues in the wound. It has a higher therapeutic index than sodium hypochlorite and hydrogen peroxide.⁵

Biocompatibility and Toxicity Data for Vashe Wound Therapy

Animal Model	Results
Eye Irritation (Rabbit)	No ocular irritation
Skin Sensitization (Guinea Pig)	No skin sensitization, no delayed- contact hypersensitivity
Primary Dermal Irritation (Rabbit)	No dermal irritation, no erythema or edema
Acute Oral Toxicity (Rat)	No oral toxicity (LD50>5g/kg)
Cell-Based Assay	
Bacterial Mutagenicity	Non-mutagenic
Cytotoxicity	Biocompatible with fibroblasts and keratinocytes

Sampson CM, Sampson MN. Hypochlorous acid: A safe and efficacious new wound therapy. Poster presented at: World Union of Wound Healing Societies; 2008; Toronto, Ontario, Canada. 2. Data on file with Urgo Medical North America.

Comparative Cytotoxicity Testing of Hypochlorous Acid and Commonly Used Wound Irrigants Against Human Dermal Fibroblasts and Keratinocytes (n=5 per group, $p<0.01$)

Wound Irrigant	Results	Grade
Hypochlorous Acid (@ 4 times the normal % of Vashe Wound Solution)	Pass	0
Saline (0.9% NaCl, pH 5.0)	Pass	0
Dakin's Solution (0.25%)	Fail	3
Dakin's Solution (0.5%)	Fail	3
Chlorhexidine gluconate (4%)	Fail	3
Hydrogen peroxide (3%)	Fail	3
Povidone iodine (7.5%)	Fail	3
Povidone iodine (10%)	Fail	3

Block SS. Disinfection, sterilization, and preservation. Philadelphia: Lea & Febiger; 2000

Pearls From Consensus And Clinical Practice Guidelines

1. *All chronic wounds should be assumed to be contaminated or infected with bacteria.*

Most patients with chronic, hard-to-heal wounds have complex medical histories and are usually of advanced age. These factors can contribute to compromised immunity. All chronic wounds and hard-to-heal wound should be assumed to be contaminated or infected with bacteria (especially biofilm).

2. *Wound cleansers should be effective in disrupting biofilm.*

Presence of biofilm in chronic, hard-to-heal wounds delays wound healing and can cause wound infections. Addressing biofilm is an important factor in initiating and supporting wound healing. Saline or water flushes are inadequate to remove biofilms. The wound (and the peri-wound tissues) must be cleansed intently with an anti-biofilm cleanser to prepare the wound bed for healing.² The wound cleanser must be able to effectively kill biofilm and planktonic (free-floating) bacteria without causing damage to the tissue in and around the wound.⁵

3. *Minimize harm.*

As previously mentioned, traditional wound antiseptics such as hydrogen peroxide, sodium hypochlorite, povidone-iodine, and chlorhexidine, are cytotoxic and no longer recommended as wound cleansers. Contrarily, HOCl is non-cytotoxic and is an effective anti-biofilm agent.

4. *Patient-centered care: Wound care is not a transaction but an interaction.*

Wound care is not a transaction, but a patient interaction.² Health-care practitioners must take a holistic approach and always put the patient at the centre of their management plans. Comprehensive management, including odour management and pain control are important aspects of wound care practitioners must not forget. Promoting the patient's health, immunity and holistic wellbeing is crucial to wound care and patient care in general.¹



Why Choose Hypochlorous Acid (HOCl) As A Wound Cleanser? Think About The MICROBes

- **Minimal irritation**
 - HOCl is non-cytotoxic and non-irritating/gentle to the skin.
- **Infection prevention**
 - HOCl is a naturally occurring antimicrobial agent that the body produces. It is effective in eradicating bacteria, viruses, fungi, and spores. Wound cleansing with HOCl can reduce wound bioburden and aid wound healing.
- **Cellular healing**
 - HOCl is non-cytotoxic and does not cause damage to cells and tissues that are healing.
- **Reduce inflammation**
 - By reducing the wound bioburden, HOCl can reduce inflammation, leading to less pain, swelling, and discomfort or the patient.
- **Odour control**
 - HOCl can reduce and control unpleasant odour associated with infected wounds
- **Biofilm disruption**
 - HOCl can penetrate and disrupt bacterial biofilm.

***Christine Murphy RN BSc(Hons) Tissue Viability MCISc(WH) PhD WOCC(C)** is a nurse specialist in complex vascular wounds who has worked with her team to develop a multi-professional Limb Preservation Clinic at The Ottawa Hospital. Chris has been a nurse for over 30 years in acute care. She completed a degree in Tissue Viability, Master of Clinical Science in Wound Healing, and PhD investigating healing challenges in a vulnerable vascular population with wounds. Previously President of Nurses Specialized in Wound, Ostomy, Continence Canada, and co-chair of the RNAO ostomy guideline update, Chris is also an Assistant Professor in the Western University MCISc Advanced Health Practices, Wound Healing program.

****Kim Le Blanc PhD RN NSWOC WOCC(C) FCAN** is known globally as an innovative nurse leader. She is the current Academic Chair of the Association for Nurses Specialized in Wound Ostomy and Continence Care's (NSWOC) Wound Ostomy and

Continence Institute (WOC Institute) and an Advanced Practice and Certified Wound Ostomy Continence nurse working with KDS Professional Consulting. She holds a Doctor of Philosophy in Nursing from Queen's University. Kimberly is an Adjunct Professor with the University of Western Ontario Masters in Wound Care Program, an Affiliate Lecturer at McGill University, and an Honorary Senior Lecturer at Cardiff University. Kimberly is a past president and a founding member of the International

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