BPR BRIEFS

Burns

This BPR Brief is an abridged version of the **Best Practice Recommendations for the Prevention and Management of Burns**. In alignment with a global health-care perspective, Wounds Canada is committed to provide support to patients to help them adapt to and self-manage their condition in the face of social, physical and emotional challenges. This document uses the Wound Prevention and Management Cycle (WPMC) (Figure 1) as the basis for clinical decision making. For clinicians, this document is meant as a cue for treatment; it provides non-inclusive examples listed below each recommendation. For policy makers, it highlights (in ***bold italics***) actions and policies that support best practice.

Wounds Canada follows a population health strategy for wound care that enables us to address the entire range of individual and collective factors that determine health, including:

- Better health: health of the general population improved; behavioral, social, economic and environmental determinants addressed; preventative care rewarded
- Better health care: patient-centred, reliable, safe, evidence-based treatment; care managers co-ordinate total health-care delivery; evidence-based treatment with outcome tracking
- Better value: costs and cost improvements monitored; readmissions to hospital reduced; early interventions to reduce per patient cosst implemented; unnecessary or duplicate procedures eliminated; information management technologies utilized

For more information on content, levels of evidence or tools related to a particular recommendation, click on the links provided.

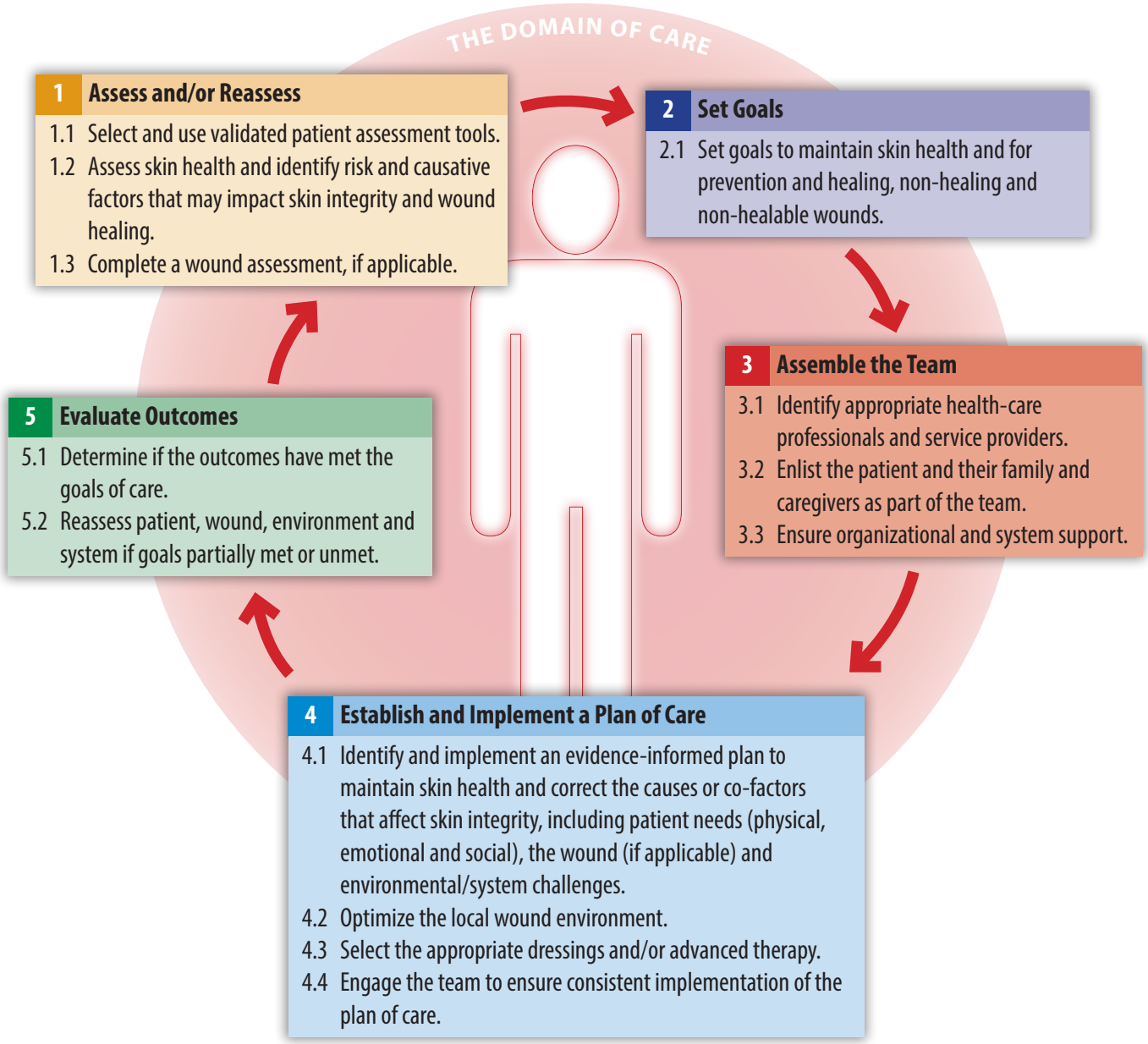
We strongly recommend that before using this BPR Brief the user read the full best practice recommendation (BPR) document. To obtain a copy of the full document, go to: www.woundscanada.ca/docman/public/health-care-professional/bpr-workshop/1308-bpr-for-the-prevention-and-management-of-burns/file.

Introduction

Burns are injuries to the skin that occur when the skin or other tissues are damaged by contact with heat (scalds from liquids, grease or steam; contact burns; fire, flash or flame), electricity, radiation or chemicals. Burn injuries can be devastating and, without appropriate treatment, can result in slow healing, infection, scar formation and disfigurement, contractures, joint dysfunction, pain, as well as poorer mental health, well being and quality of life (QoL).

Burn victims may have to have multiple surgeries, undergo grafting, wear compression garments for several years and live with physical disability, body image disturbance, disfigurement and emotional and employment (schooling, training) challenges. Infants and children are increasingly vulnerable as they are growing, and the burn scarring and skin contracture lead to long-term care needs.

Figure 1: Wound Prevention and Management Cycle (WPMC)



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1 Assess and/or Reassess

1.1 Select and use validated patient assessment tools.
1.2 Assess skin health and identify risk and causative factors that may impact skin integrity and wound healing.
1.3 Complete a wound assessment, if applicable.

Assessment must take place to determine the causes and factors that may impact skin integrity and wound healing. Patient assessment includes history and current health status, skin status, baseline skin tone (and wound status), if applicable, environmental factors and system factors. If, after the WPMC has been completed, the goals of care have not been fully met, reassessment must take place, followed by the rest of the recommendations in the WPMC steps. ***Assessment tools need to be available and in use in all care settings, supported by staff education and policy.***

1.1 Select and use validated patient assessment tools

The use of validated and standardized patient and risk assessment tools is essential for identifying factors that may impede healing and quality of life and for providing direction for preventative care or management.

- **Burn size:** The Lund and Browder chart, and Wallace's 'rule of nines' both estimate the total body surface area (TBSA) of a burn injury.
- **Burn severity:** The Hand Burn Severity (HABS) score was devised and validatded to assess burn severity.
- **Wound assessment tools:** Currently there are no burn-specific wound assessment tools.
- **Mortality risk assessment:** The FLAMES score is a validated tool that can predict burn injury related mortality. Frailty is also a predictor of adverse outcomes for patients with burns.
- **Scar assessment:** Examples of validated scar assessment scales include the Matching Assessment of Scars and Photographs, Patient and Observer Scar Assessment Scale, Satisfaction with Appearance Scale and Vancouver Burn Scar Assessment Scale.
- **Pain assessment:** Currently there are no burn-injury-specific pain assessment tools. Examples of validated pain assessment tools that could be used to assess for burn injury pain include the visual analogue scale, numeric rating scale, verbal rating scale, the Brief Pain Inventory and the McGill pain questionnaire, among others.
- **Anxiety assessment:** The Burn Specific Pain Anxiety Scale is a valid and reliable tool that provides a standardized approach for identifying burn patients with feelings of anxiety and worry who require further assessment and intervention. Researchers also discuss the role of massage therapy in pain and anxiety reduction.
- **Nutrition screening:** Examples of validated nutritional screening tools that could be considered for use with burn injury patients include the Subjective Global Assessment, the Malnutrition Screening Tool, the Nutrition Risk Screening-2002, the Malnutrition Universal Screening Tool, the Subjective Nutrition Assessment Questionnaire and the Canadian Nutrition Screening Tool.
- **Quality-of-life (QoL) assessment:** Examples of validated tools to assess burn-injury-related QoL include the Burn Specific Health Scale-Abbreviated, Burn Specific Health Scale-Revised, and Burn Specific Health Scale-Brief.
- **Coping assessment:** The Coping with Burns Questionnaire was developed to measure coping after discharge and is based on the theory of coping as a process.

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- **Empowerment:** Empowerment is an important aspect of emotional care. Patients may benefit from activities that support skill building in stress management, adaptability to coping, social reintegration, emotion regulation, and problem-solving.

1.2 Set goals to maintain skin health and for prevention and healing, non-healing and non-healable wounds

According to the Canadian Hospitals Injury Reporting and Prevention Program (CHIRRP) database, in 2013 the five most common causes of burn injuries are:

Table 1: Highest Risk for Burn Type by Age and Sex

Burns Cause	Most at Risk (by Age and Sex)
Scalds: Includes contact with hot water, steam, food, oil, grease, liquid glue or liquid wax	Children under 1 year
Fire, flame, smoke (highest proportion)	Males aged 50–64 Females aged 20–29
Fire, flame, smoke (highest count)	Males aged 15–19
Sunburns (highest proportions)	Males/females aged 20–29
Electrical (highest proportion)	Males under 1 year Males 20–29 years
Electrical (highest count)	Males aged 2–4 years

Athough children and the elderly are most vulnerable to burn injury, those who cannot recognize or react to a dangerous burn-risk situation are at increased risk for burn injury, including persons with cognitive or mental impairment, impaired mobility and/or sensation, musculoskeletal or nervous system disorders, and/or mental illness. Recent rises in substance use have increased risks of burn complications, length of hospital stay and use of critical care services.

1.2.1 Physical

Primary Survey: evaluate all people with burn injuries requiring or receiving assessment by a health-care professional first using the ABCDEF mnemonic, listed in the order of priority, to identify any life-threatening injuries:

- **Airway:** Assess for airway obstruction and for injuries that are physically restricting breathing.
- **Breathing:** Evaluate breathing and ventilation. Watch for chest movement, auscultate and percuss to detect any conditions impeding ventilation.
- **Circulation:** Assess for signs of bleeding, hypovolemia and burn shock.
- **Disability:** Complete a neurological assessment to establish the patient's level of consciousness, pupil size/symmetry/reaction and evidence of spinal cord injury or compartment syndrome.
- **Exposure:** Expose the patient's skin to more accurately determine the area of burn injury.
- **Fluid resuscitation:** Assess the need for fluid resuscitation to combat the profound loss of intravascular fluid into the interstitial space.
- **Upper Gastrointestinal Burns:** Ingestion of caustic materials may cause chemical burns to the oropharynx, tongue, esophagus, stomach and duodenum. Laryngeal edema may occur, producing upper airway obstructions.

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Secondary survey begins once the primary survey has been completed and resuscitation is successfully underway. It includes:

- A head-to-toe examination to rule out secondary injuries
- Completion of a systematic and detailed history of the patient's general health
- The identification of specific issues related to the burn injury
- A wound (burn injury) assessment
- Quality-of-life (QoL) assessment: Burn injuries may have profound physical/aesthetic, psychological, social and vocational consequences. Individuals with burn injuries may have to cope with itching, tightness to skin and changes to functional ability. To optimize the rehabilitation of a patient with a burn, it is important to assess the predictors of health-related quality of life (HRQL).

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

Assess income, employment and working conditions, food security, environment and housing, early childhood development, education and literacy, social support and connectedness, health behaviours and access to health care. It is critical to provide a culturally sensitive environment for care.

1.2.3 Systems: Health-care support and communication

A systems assessment takes into consideration the patient's access to emergency services, funding, availability of support services and wound-related products, devices, diagnostic services, service delivery personnel and co-ordination of care, all of which vary widely from province/ territory and from one interprovincial/ interterritorial region to another.

Health-care support and communication can even vary from one service delivery site to another. When setting patient goals and developing a plan of care, early communication with the care partner and/or family, clinicians must take into consideration the patient's access to health-care supports, as an organized, interprofessional and collaborative approach to care is critical to improving burn-injury-related outcomes.

1.3 Complete a wound assessment, if applicable

Burn injury assessment: When assessing a burn injury, it is important to determine the underlying cause or mechanism of the injury—this is key as the cause influences the pathophysiology of the injury and its management—burn depth and size, and severity of the burn injury. Assessment of the burn can help the team to determine the ability of the person to heal their burn injury, plan treatment, facilitate communication, monitor treatment and predict and verify outcomes.

Locally, a burn may be divided into three zones:

1. Zone of Coagulation

- Centre of the wound – the area that had the most contact with the burn source
- Irreversible full-thickness tissue damage with no tissue perfusion
- Tissue appears white or charred and will not recover.

2. Zone of Stasis

- Surrounds the zone of coagulation
- Deep partial-thickness injury with decreased tissue perfusion
- Tissue appears red initially and later turns white and may blanche with pressure. Petechial hemorrhages may be present
- With good management, tissue will likely recover.

3. Zone of Hyperemia

- At the periphery of the wound
- Superficial partial-thickness injury with good tissue perfusion
- Tissue appears red, blanches with pressure and will likely recover.

Note: SUPERFICIAL (FIRST DEGREE) BURNS ARE NOT INCLUDED IN THE CALCULATION OF BURN SIZE (SURFACE AREA).

Mechanism of Injury

- Heat-related burn injuries vary in depth and size and are caused by scalds from liquids spilled or liquid immersion, grease or steam; contact burns and fire, flash or flame. The severity of the injury is related to the rate at which the heat is transferred from the heating agent to the skin, which depends on the heat capacity and temperature of the agent, duration of contact with the agent, transfer coefficient, and heat and conductivity of the local tissue.
- Scalds tend to be superficial partial-thickness tissue damage and may involve a large area of skin.
- Immersion scalds can result in more severe burn injuries because of the increased duration of contact between the heat agent and the skin. Such burns can cover a large skin area.
- Contact burns tend to cause deep partial-thickness or full-thickness tissue damage and involve less skin area than other types of burns.
- Flame injuries are of various depths (superficial partial-thickness to full-thickness) and cover varied amounts of skin.
- Cold-related burns may occur through exposure to extreme cold. Across the spectrum of tissue damage patients may experience a freezing injury (FI) from frostnip, to superficial injury, to deep tissue freezing caused by crystallization of water in the cells, which may cause ischemia, leading to skin necrosis and damage to the deeper tissues. The Hennepin Score may be used to quantify injury and tissue loss of frost-bite injury, similar to TBSA calculators in burn patients.
- Electrical burns outwardly may not reflect the true extent of the injury, as internal tissue and organ damage may have ensued. The extent of electrical burns is related to the voltage of the current. With low-voltage electrical burns, small, deep burns are seen at the contact points. Assessing the contact points help to determine the probable path of the electrical current and thus the potential areas of injury is required. High-voltage burns (> 1,000 volts) may cause extensive deep tissue damage, limb loss and death.
- Radiation burns are injuries to the skin or tissue caused by exposure to ultraviolet rays (sunburn), radiation therapy for cancer treatment and, in rarer instances, nuclear emissions or explosions
- The extent and depth of a chemical burn is directly proportional to the amount, type and strength of the agent, its concentration, extent of penetration, mechanism of action and length of contact time with the skin/tissue. Chemicals will continue to destroy tissue until inactivated by reaction with tissues, neutralized, brushed off (powders), or diluted with the appropriate neutralizing agent (it is important to note that, in some cases, water may favour skin disruption*)
- At the periphery of the wound
- Superficial partial-thickness injury with good tissue perfusion
- Tissue appears red, blanches with pressure and will likely recover

Burns can also be characterized by depth of injury (see Table 2).

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

Table 2: Characteristics of Burn Types According to Depth

Classification	Depth of Injury	Appearance	Sensation	Most Common Cause of Injury
Superficial (first degree)	▪ Epidermis	▪ Intact skin (red, shiny) ▪ Blanchable erythema and mild edema ▪ Brisk capillary refill ▪ No blisters ▪ May scar	▪ Tactile and pain sensation intact ▪ Pain ranging from itching to sharp	▪ Scalds from spilled liquids (low viscosity) ▪ Electrical flash ▪ Sunburn
Superficial partial thickness (second degree)	▪ Epidermis with partial-thickness loss of dermis ▪ Dermal appendages intact	▪ Blanchable erythema ▪ Brisk capillary refill ▪ Intact or ruptured thin-walled serum-filled blisters (blisters may increase in size) ▪ If blisters ruptured, tissue is pink or red and moist ▪ Mild to moderate edema	▪ Sharp pain. Potential residual sensitivity to sun, cold, friction, months after healing. Possible residual pruritus[67]	▪ Scalds from spilled liquids (low viscosity) or steam ▪ Electrical flash ▪ Brief exposure to flame ▪ Brief contact with hot object ▪ Sunburn
Deep partial thickness (deep second degree)	▪ Epidermis with deep partial-thickness, loss of dermis ▪ Underlying structures are not exposed. ▪ Some dermal appendages intact	▪ Non-blanchable erythema ▪ Sluggish capillary refill ▪ Intact or ruptured thick-walled serum-filled blisters (blisters may increase in size) ▪ If blisters ruptured, tissue is blotchy/mottled, cherry red/blanched white and dry (plaque like) ▪ Will scar and may require surgery	▪ Deep pressure ▪ sensation intact ▪ Pinprick sensation ▪ absent ▪ Variable pain sensation	▪ Scalds from spilled liquids (low and high viscosity) or steam ▪ Exposure to flame ▪ Contact with hot object
Full-thickness (fourth degree)	▪ Full- thickness skin/tissue loss ▪ Exposed or directly palpable underlying structures (muscles, fat, bones, tendons) ▪ Dermal appendages destroyed	▪ Non-blanchable ▪ Tissue leathery, pale, mottled, red/ brown/ white in colour and dry ▪ Eschar may be present ▪ Thrombosed vessels visible (dry, carbonization, no blisters) ▪ Involves deeper tissues, and frequently leads to loss of the burned part	▪ Insensitive to pain and pressure; pain may be present at the periphery, and absent at the level of the burn	▪ Prolonged liquid immersion scald ▪ Prolonged contact with hot flame, hot objects, or chemicals ▪ Electricity

Adapted from the Ross Tilley Burn Centre

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

2 Set Goals

2.1 Set goals to maintain skin health and for prevention and healing, non-healing and non-healable wounds.

Goals of care need to revolve around the patient. Achieving goals will depend on the interplay of the patients' health status and lifestyle, the availability of resources and the knowledge and ability of care partners to provide optimal interventions. If these factors are not taken into consideration the goals of care may be unrealistic and unrealizable. The team should aim to set goals according to the SMART principle: **S**pecific, **M**easureable, **A**ttainable, **R**elevant and **T**imely.

2.1 Set goals to maintain skin health and for prevention and healing, non-healing and non-healable wounds

Burn injury prevention should be considered a primary safety goal for all people and in all employment, home and social settings.

2.1.1 Identify goals based on prevention or healability of wounds

Where burn injury already exists, the most common goals must relate to the overall healing ability. Timeframes to accomplish goals are dependent on the depth and severity of the burn and may include:

- Prevent further progression of burn depth using cool water for for 20 minutes, once the causal agent has been identified,
- Wound closure, stabilization or prevention of deterioration,
- Reduction in the amount of necrotic tissue,
- Reduced bacterial burden or prevention of increased bacterial burden,
- Establishment or maintenance of an appropriate amount of wound moisture,
- Decreased number of dressing changes,
- Prevention of scarring or improved scar quality,
- Limb preservation,
- Improved nutrition and hydration and
- Mental health and well-being, and spiritual care

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

A comprehensive patient, wound, environment and systems assessment will also allow for the development of goals related to the impact of the burn injury on the patient's daily life. Such goals may include:

- Pain reduction and management,
- Reduction and management of wound-related itch,
- Maintaining or improving joint range of motion and function of the burn-injured area,
- Contracture reduction,
- Restoration of independence,
- Return to work, home, school or leisure activities,
- Reduced anxiety and/or psychological stress and
- Improved coping mechanisms and supported spirituality

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3 Assemble the Team

3.1 Identify appropriate health-care professionals and service providers.
3.2 Enlist the patient and their family and caregivers as part of the team.
3.3 Ensure organizational and system support.

Prevention, assessment and management of burn injuries require the collaboration of an integrated team to optimize the patient's overall health and well-being. The team must work closely and collaboratively to address the complex physical, emotional and social impacts of surviving a burn injury, and create and implement a sustainable plan of care based on the identified goals.

3.1 Identify appropriate health-care professionals and service providers

Team members may include first responders, anesthesiologists, nurse practitioners, burn nurse, burn surgeons, critical care specialists and post-critical care physicians, physiatrists, physician assistants, emergency room clinician, occupational therapist and assistant, pharmacist, physiotherapist and assistant, respiratory therapist, counsellor, social worker, psychologist, psychiatrist, speech language pathologist, spiritual care, and vocational/educational specialists.

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

The success of a plan of care for the prevention and management of burn injuries hinges on the collaboration of the person with the burn injury (or at risk), their support system and communication among the integrated, collaborative team involved in the development of the plan of care.

For pediatric patients, parents or legal guardians need to be part of the care-planning team and for those with cognitive impairment, the assignee of their Power of Attorney for Personal Care.

3.3 Ensure organizational and system support

Wounds Canada's resources and education align with a population health management model. This model encourages the proactive management of a total population at risk for adverse outcomes through a variety of individual, organizational and cultural interventions to improve patient, clinical and financial outcomes. The interventions are based on a risk-stratified needs assessment of the population, supported by a comprehensive governance infrastructure.

Successful burn injury programs are designed and evaluated in collaboration with clinical practice leaders, educators, policy makers and administrators at a local, regional, provincial/territorial and national level. To support this model and secure successful outcomes, decision makers must:

- ***Use globally recognized risk classifications to identify risk, support prevention and develop management strategies by allocating appropriate resources such as resources, patient education and clinical visits.***
- ***Develop and implement policies (federal, provincial/territorial, regional and institutional) based on current evidence that acknowledge and designate human, material and financial resources to support the team in the development of a burn prevention and management program.***
- ***Work with community and other partners to develop a process to facilitate patient referral and access to local health professionals with specialized knowledge in burn management.***

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

- ***Work with community and other partners to advocate for strategies and funding for all aspects of burn prevention.***
- ***Audit all aspects of the service to ensure that local practice meets accepted national and international standards of care.***

4 Establish and Implement a Plan of Care

4.1 Identify and implement an evidence-informed plan to maintain skin health and correct the causes or co-factors that affect skin integrity, including patient needs (physical, emotional and social), the wound (if applicable) and environmental/system challenges.
4.2 Optimize the local wound environment.
4.3 Select the appropriate dressings and/or advanced therapy.
4.4 Engage the team to ensure consistent implementation of the plan of care.

The development and implementation of a sustainable plan of care must be based on the identified goals and be collaboratively created with the patient, their family and care partners, and relevant health-care team members.

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

Burn Prevention
Identify risk factors, provide education and heighten awareness of individual risk. Encourage people to practice strategies to decrease their level of burn injury risk at home, employment, social, educational or play.

Management – Primary Survey
After ensuring personal safety, the top priority of care for patients who have experienced a burn injury is to stop the burning process by:

- removing the heat source for patients who have experienced a thermal injury
- turning off the electricity supply for those with electrical burns
- brushing off dry chemicals or diluting liquid chemicals with water for those who have experienced chemical burns
- removing the patient from the source of radiation for those with radiation burns

In conjunction with the treatment of life-threatening injuries, most burn injuries need to be cooled. Thermal burns should be cooled with clean, tepid running water or wet towels and compresses to stop the burning process, limit tissue damage, minimize swelling, cleanse the wound and aid in pain control. Very cold water

and ice should not be used to cool burn injuries, as these can cause local vasoconstriction, which can increase tissue damage and may contribute to hypothermia.

For freezing injuries, moist rewarming, possible thrombolysis and watchful waiting are recommended. Organizations should have frostbite protocols in place for providers and regular education should be available.

- Once the initial treatment phase has passed in severely affected or symptomatic individuals or those at risk for re-injury, consider an assessment of quantitative peripheral sensory testing, using a tool such as Semmes-Weinstein monofilament.
- Freezing injuries, like other cold injuries, should be treated as an acute traumatic injury.
- Rewarm actively and rapidly in a water bath (40–42°C).
- Passive rewarming is only acceptable when the first option is unavailable.
- Have the patient avoid nicotine or other vasoconstrictors during the period of rewarming.
- Provide thrombolytic therapy to identified candidate patients but only in an appropriate medical setting.
- Debride necrotic tissue, if necessary, at a later stage and only after completion of the rewarming cycle.
- Provide supportive care of post-injury nerve and skin damage.
- Educate patients to prevent repeat injury.

Chemical burns require copious irrigation with tepid water or an appropriate antidote to remove the corrosive agent and stop the burning process. This irrigation process may be lengthy, e.g., 15–120 minutes, and should continue until the patient stops complaining of discomfort and the tissue pH normalizes. Electrical burns should not be irrigated.

All people with burn injuries who require care by a health professional, should then be provided care using the **ABCDEF mnemonic,** listed in the order of priority, to treat any life-threatening injuries:

- **Airway:** If the patient has an airway obstruction or an injury that is physically restricting breathing, attain and maintain an airway.
- **Breathing:** If the patient is not breathing, immediately initiate cardiopulmonary resuscitation (CPR). In addition, treat any conditions impeding ventilation.
- **Circulation:** If the patient is bleeding or has hypovolemia or burn shock, treat accordingly.
- **Disability:** If the patient presents with an altered level of consciousness, it is imperative to treat the underlying cause, e.g., hypoxia secondary to carboxyhaemoglobin level or hypovolemia. In addition, a fasciotomy may be required to treat compartment syndrome affecting a limb.
- **Fluid resuscitation:** For patients with major (complex) burns, e.g., TBSA > 10–15%, fluid resuscitation is key to combating the profound loss of intravascular fluid into the interstitial space, which can lead to organ dysfunction and death, and should be initiated as soon as possible after injury (ideally pre-hospitalization).

To access the updated American Burn Association (2022) Burn Patient Referral criteria for transfer of a patient to a burn unit, visit https://ameriburn.org/aba-releases-new-guidelines-for-burn-patient-referral/.

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

Management – Secondary Survey

The secondary survey should commence to diagnose any other injuries from head to toe, including the depth and extent of burn injuries. Once this thorough survey has been performed, appropriate and targeted treatment and management can begin. This includes correcting any modifiable comorbidities assessed during the detailed patient history that may negatively impact wound healing and general burn injury recovery.

Management – Burn Pain

The type and intensity of pain must be taken into consideration.

Table 3: Criteria for Transfer to a Burn Unit

	Immediate Consultation with Consideration for Transfer	Consultation Recommendation
Thermal burns	▪ Full-thickness burns ▪ Partial thickness ≥ 10% TBSA ▪ Any deep partial- or full-thickness burns involving the face, hands, genitalia, feet, perineum or over any joints ▪ Patients with burns and other comorbidities ▪ Patients with concomitant traumatic injuries ▪ Poorly controlled pain	▪ Partial-thickness burns < 10% TBSA ▪ All potentially deep burns of any size
Inhalation injury	▪ All patient with suspected inhalation injury	▪ Patient with signs of potential inhalation such as facial flash burns, singed facial hairs or smoke exposure
Pediatrics (less than or equal to 14 years or < 30 kg)	▪ All pediatric burns may benefit from burn centre referral due to pain, dressing change needs, rehabilitation, patient/caregiver needs or non-accidental trauma	
Chemical injuries	▪ All chemical injuries	
Electrical injuries	▪ All high-voltage (≥ 1,000 volts) electrical injuries ▪ Lightning injury	▪ Low-voltage (< 1,000 volts) electrical injuries should receive consultation and consideration for follow-up in a burn centre to screen for delayed symptom onset and vision problems

Consider non-pharmalogical interventions that may also be of assistance with pain management.

Quality-of-life (QoL): Once psychosocial issues such as anxiety, depression and post-traumatic stress disorder are identified, appropriate interventions, referrals and education need to occur. Treatment and intervention options may include coping self-efficacy, cognitive behavioural therapy, medications to treat anxiety and depression, and peer support groups.

Nutrition: Metabolic and nutritional management plays a vital role in the management of burn injuries. Proportionate to the severity of the injury, patients with major burn injuries often experience oxidative stress, intense inflammatory response and a long hypermetabolic and catabolic response. Such patients require the initiation of nutritional therapy, preferably by the enteral route, within 12 hours of the burn injury.

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Physical therapy: Therapeutic exercise with the burn survivor should be goal oriented and directed at reducing the effects of immobilization, maintaining or improving function and strength and elongating scar tissue. Then, rehabilitative exercise should include stretching, strengthening, cardiovascular training and functional activities. Positioning and splinting of the burn patient become increasingly important as the TBSA increases. Larger TBSA burns will require specialized sleep surfaces along with positioning devices within the patient's bed environment. Minor burn injuries may simply require a supportive splint for the affected area. Rehabilitation may include:

- Strengthening exercises, resistance training
- Cardiopulmonary rehabilitation
- Return to work activities
- Positioning and splinting
- Orthoses
- Scar prevention and management (e.g., laser therapy, compression therapy, scar managment, pressure garment therapy, injection of fat).

4.2 Optimize the local wound environment: Cleansing, debriding, managing bacterial balance and managing moisture balance.

Local wound management strategies should be part of the plan of care and fit within the context of the overall healability of the burn injury. To optimize the local wound environment, clinicians must consider wound cleansing and debridement, management of bacterial burden and moisture control.

4.2.1 Cleansing

Cleansing solutions commonly used in wound management include sterile normal saline, sterile water, potable tap water, commercial wound cleansers and liquid antiseptics. Such cleansing solutions may be appropriate in the management of burn injuries depending on the goals of care.

Expert opinion recommends that sterile solutions be used for acute burn injury management and in situations where underlying structures are exposed, to cleanse tunnels or sinuses, where the patient is immune-compromised or is suffering from a current wound infection (or has a history of recurrent wound infections), or in situations where potable tap water is inaccessible or the environment in which the wound is being cleansed is less than hygienic. (See Wounds Canada's Product Pickers, below.)

4.2.2 Debriding

Debridement serves to remove microbes, foreign bodies, debris and non-viable tissue from a wound to promote wound closure. Like with wound cleansing, the appropriate method of debridement needs to be determined based on the needs of the patient and the wound, the environment, available resources and the scope of practice of the person completing the debridement.

Biological, mechanical, hydrosurgical, chemical, autolytic and enzymatic debridement methods have all been reported in the literature as effective debridement options for burn injuries to various degrees, although most research focuses on surgical debridement of major burn injuries to facilitate wound coverage (either using xenografts, allografts, autografts or skin substitutes) and reconstruction. (See Wounds Canada's Product Pickers, below.)

Debriding Blisters: If blisters are greater than 1 cm2, are filled with cloudy serous fluid or blood, are in an area where they are prone to break with routine activities or are impeding joint function they should be deroofed. All blisters secondary to chemical burns should be deroofed. Areas that are difficult to debride include the interweb spaces of the feet and hands, thin areas on the face and dorsum of the hands and areas that are edematous secondary to fluid resuscitation.

4.2.3 Managing Bacterial Balance

Acute burn injury infections are one of the most serious complications. Infections contribute significantly to burn morbidity and mortality. Infections are the result of the interruption in the skin's barrier, immune dysfunction and from invasive procedures. Management must focus on optimizing the host response, reducing the number or virulence of microorganisms in the wound and optimizing the wound environment. Jeschke et al. discuss the importance of topical antimicrobials as the mainstay of non-surgical burn treatment; no one dressing or agent is superior, and antimicrobial choice is often determined by the burn unit product/dressing availability, the preference of the staff and historical experience. Strategies to manage bacterial burden at the surface of the burn wound include prophylactic and therapeutic use of topical antiseptics and antimicrobials. (Table 4).

Table 4: Common Topical Antimicrobials Used in Burn Management

Agent	Description
Silver dressings*	▪ Silver-containing calcium alginates, foams, gels, gelling fibres and non-adherent synthetic contact layers ▪ Some formulations kill bacteria within the dressing, others release silver into the wound bed itself ▪ Broad-spectrum coverage ▪ May be toxic in high concentrations to fibroblasts and keratinocytes or if not delivered in a sustained release manner ▪ Most require less frequent dressing changes (except for the silver gel)
Honey (medical grade)	▪ Leptospermum honey-containing calcium alginates, gels and pastes ▪ Biocidal effect is multifactorial ▪ Broad-spectrum coverage ▪ Low toxicity ▪ Most require less frequent applications (except for the gel and paste) ▪ Promotes autolytic debridement
PMHB (Polyhexamethylene biguanide)	▪ Polyhexamethylene biguanide (PHMB)-containing ribbon gauze, gauze squares, transfer foam, foam, gel and non-adherent synthetic contact layer ▪ Bacteria kill occurs largely in/on the dressing ▪ Broad-spectrum coverage ▪ Low toxicity ▪ Most require less frequent dressing changes (except for the PMHB gel)
Gentian Violet/ Methylene Blue	▪ Gentian violet- and methylene blue-containing polyvinyl alcohol or polyurethane foam ▪ Biocidal effect is multifactorial ▪ Broad spectrum coverage ▪ Non-cytotoxic ▪ Require less frequent dressing changes
Hypochlorous acid (NaOCL/ HOCL)[170]	▪ Broad spectrum coverage ▪ Used for multi-drug resistant organisms (MDRO) ▪ Penetrates biofilm rapidly, killing formations from within; does not promote resistant bacteria strains

cont'd...

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

OCT (Octenidine Dihydro-chloride)[165]	▪ Broad spectrum coverage ▪ Eradicates bacterial biofilm for up to 72 hours ▪ Gel, irrigation and surfactant preparations ▪ Does not promote bacterial resistance ▪ Good tissue tolerability, not shown to disrupt healing ▪ Anaphylaxis and allergic response rarely observed
PVP-I (Iodophors (Poly-vinyl alcohol)	▪ Knitted viscose fabric impregnated with polyethylene glycol containing 1% povidone iodine ▪ Biocidal ▪ Broad spectrum coverage ▪ Require less frequent dressing changes ▪ Used specifically for prevention of infection in minor burns
Silver sulfadiazine (SSD) cream	▪ Topical, water-soluble cream containing 1% silver sulfadiazine ▪ Bacteriostatic ▪ Broad-spectrum, but lacks fungal and vancomycin-resistant enterococci activity ▪ Has cytotoxic effects on fibroblasts and keratinocytes and may delay healing of superficial burns71 ▪ May create a pseudo eschar ▪ Once-daily dressing change versus twice daily171 ▪ Avoid in patients with sulfonamide allergies (sulfa) ▪ Avoid applying to the face as in rare cases localized argyria may develop172-174
***A Note on Silver Dressings** The 2018 International Society for Burn Injuries (ISBI) Practice Guidelines for Burn Care made the following recommendations for the use of silver as a topical agent: "Silver-containing compounds and dressings are effective topical antimicrobial agents. However, silver also has cytotoxic effects which may delay wound healing. Silver-based topical agents are appropriate for deeper burns (essentially those awaiting surgery)". (ISBI 2018).	

Adapted from: International Wounds Infection Institute, 2022.

Common organisms in critically ill burn-injured patients with bacteremia include *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella*, *Escherichia coli*, *Enterococcus* and *Acinetobacter* species. Such infections typically require surgical debridement of the involved tissue in conjunction with systemic broad-spectrum antimicrobials. The International Wound Infection Institute has created several enablers for optimal infection management that can be useful tools for clinicians. Resources can be found at https://woundinfection-institute.com/wp-content/uploads/IWII-CD-2022-web-1.pdf.

4.2.4 Managing Moisture Balance

Moisture balance within the wound base can be achieved through appropriate dressing selection and dressing change frequency (see Wounds Canada's Product Pickers, below). Increased wound exudate can also be a sign of increased trauma or infection, so assess the wound closely prior to dressing selection.

Wounds Canada's Product Pickers

Skin and Wound Clean-up: helps users choose appropriate skin and wound cleansers as well as irrigating solutions

Wound Dressing Formulary: describes common wound dressings in generic categories and lists usage considerations

Wound Dressing Selection Guide: helps users choose appropriate primary and secondary dressings based on common clinical situations and wound care goals

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

4.3 Select the appropriate dressings and/or advanced therapy

A good burn-injury dressing has the following characteristics (where indicated):

- Promotes autolytic debridement of non-viable tissue
- Protects against infection and environmental contamination/trauma
- Maintains a moist wound environment while containing or wicking away excess moisture
- Reduces evaporative losses
- Is non-adherent to protect delicate skin
- Contours easily and conforms to the wound bed
- Aids with splinting or immobilization
- Is esthetically pleasing
- Is easy to apply and remove
- Is painless on application and with wear and removal
- Is cost-effective (inclusive of the cost of the product, frequency of dressing change and the cost of health-care professional time)

Common dressings used in burn management can be found here. For more information, see Wounds Canada's Product Picker for Dressing Selection.

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

To ensure the best experiences and outcomes for patients with burn injuries, it is imperative that health-care professionals involved in the care of people with burns keep abreast of current research and innovations in burn wound management.

5 Evaluate Outcomes

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

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

5.1 Determine if the outcomes have met the goals of care

Routine reassessment using validated tools helps clinicians determine if the goals of the prevention and/or the treatment plan have been met. In addition, at discharge, the plan of care needs to be revisited and revised as needed to ensure that appropriate self-management strategies are in place to support the patient to sustain outcomes.

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

When the goals of care have not been met in a timely manner it is imperative to go back to Step 1 of the Wound Prevention and Management Cycle: Assess and/or Reassess. Careful re-assessment of the patient, their wound and environment and systems factors will most often reveal modifiable factors that can be addressed. Reassessment needs to consider gaps in care or the person's ability to adapt to their condition and engage in self-management.

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

5.3 Ensure sustainability to support prevention and reduce risk of recurrence

At discharge, people with or at risk for burn injuries and their care partners require information regarding the cause and risk factors for burn injuries as well as their risk for re-injury. Both formal and information educational methods are beneficial, including the use of standardized patient-education materials as well as individualized demonstration and review of prevention and management techniques.

Specific teaching relevant to a newly closed burn injury includes:

- **Skin care:** For at least 12 months post closure, burn-injured skin requires daily (or more frequent) cleansing and moisturization (using an emollient). Products that are pH balanced, non-scented and non-sensitizing are preferred. Fragile tissue should be protected from the sun during this period as it is more prone to sunburn, and sun exposure may cause further pigmentation changes.
- **Burn itch:** Itchiness at the site of the burn injury is common post wound closure and can be worsened by heat, stress and physical activity. Keeping the tissue moisturized and the area cool, relaxation, distraction, and use of pressure garments are some non-pharmacological techniques for reducing itch. Topical and oral antihistamines may be required to manage itch.
- **Hypertrophic scarring:** Burn wounds heal with the formation of scar tissue. The amount of scar produced generally relates to the depth of the injury sustained. If not managed appropriately, the injured area may become hypertrophic. Scarring that crosses a joint can cause contracture and, as a result, decreased function of the area. The average length of time for a burn scar to mature can be two years or more. Treatment of hypertrophic burn scars involves a number of different modalities, including the application of pressure and silicone therapy and burn scar massage.

For more information on common expected burn outcomes by burn depth, see **(Hyperlink back to burns BPR table 14)**

Burn prevention is key to both people with burn injuries and those at risk for such injuries, and simple safety measures can reduce the risk of burn injury.

For additional Wounds Canada resources go to: www.woundscanada.ca/health-care-professional/resources-health-care-pros/boutique.

Care at Home Series:

- Burns: Preventing and Managing Skin Injuries
- Caring for Your Wound at Home: Changing a Dressing

For the complete version of Best Practice Recommendations for the Prevention and Management of Burns, visit here.

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Burns

Production:
Editor, Major Publications: Ian Corks
Editorial Assistant: Loukia Papadopoulos BA MSc
Communications & Administrative Coordinator: Zahra Haider
Research Assistant: Sandi D. Maxwell BA(Hon)
Librarian: Jasmine Hoover Bsc MLIS
Art Direction and Layout: Sydney Vajda, Willow Graphix
Medical Illustrator: Robert Ketchen BASc ACIDO

Authors:
David Wallace MD MSc FRCSC
Stephanie Chadwick RN NP-PHC MCISc-WH BScN NSWOC WOCC(c)
Jack Rasmussen MD FRCS(C)
Marc Jeschke MD PhD FACS FCCM FRCS(C)
Crystal McCallum RN MCISc
Matthew Godleski MD
Shahriar Shahrokhi MD FRCSC FACS
Louise Forest-Lalande RN MEd NSWOC
Mignon Radhakrishnan MEd RD
Janet L. Kuhnke RN BA BScN MS NSWOC DrPsychology

Wounds Canada
P.O. Box 35569, York Mills Plaza
North York, ON M2L 2Y4
416-485-2292
www.woundscanada.ca

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