



Preventing Medical Treatment Related Skin and Tissue Injuries in Adults and Children

EVIDENCE INFORMED PRACTICE TOOLS

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Winnipeg Regional
Health Authority
Caring for Health

Office régional de la
santé de Winnipeg
À l'écoute de notre santé

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PURPOSE AND INTENT

To provide healthcare teams with guidance, information and a consistent approach to prevent medical treatment related skin and tissue injuries in adults and children within the sites of the Winnipeg Regional Health Authority (WRHA) and Shared Health.

1. Practice Outcomes

This guideline will:

1. Identify the risks for skin and tissue injuries specific to medical treatment including those from medical devices, casts and backslabs, medical adhesives and extravasation.
2. Provide a list of medical devices and treatments with greater potential to cause injuries.
3. Outline strategies to prevent medical treatment related injuries.
4. Guide clinicians to report to complete occurrence report (RL6 or equivalent) for ALL stages of pressure injury and other injuries caused by medical devices or treatments.

2. Medical Devices

The term Medical Devices, as defined in the Food and Drugs Act,¹ covers a wide range of health or medical instruments used in the treatment, mitigation, diagnosis or prevention of a disease or abnormal physical condition. They are classified into four categories based on the risk posed.

Class I: Low risk devices include items with intermittent use such as wound care products, nasal cannulae, pulse oximeter, wheelchair, bed pan.

Class II: Low-to-medium risk devices such as intravenous systems, needles, central lines, non-invasive surgical devices, casts, walking boot, urinary catheter, and compression systems.

Class III: Medium-to-high risk devices such as hip implants, ultrasound diagnostic imaging equipment, and surgically invasive devices.

Class IV: High risk devices such as pacemakers and surgically invasive devices that diagnose, control, or correct a defect in the central cardiovascular system.

Providers of medical devices can include the following Health Care Professionals (HCP):

Audiologists, Nurses, Occupational Therapists, Orthopedic Technologists, Orthotists, Physiotherapists, Prosthetists, Physicians, and their delegates, Respiratory Therapists, Speech Language Pathologists, Surgeons and their delegates.

Medical devices are also classified by Canadian Medical Device Regulations ² as:

- Custom-made Medical Devices
A custom-made device is one which is: (a) manufactured in accordance with a HCP's written direction giving its design characteristics or made by the HCP; (b) differs from

medical devices generally available for sale and (c) is for the sole use of a particular patient. Custom-made medical devices include casts, back slabs, braces and splints.

- Pre-fabricated Medical Device

A Pre-fabricated Medical Device is generally available for sale and is mass-produced. Examples of pre-fabricated medical devices are walking boots, urinary catheters, compression stockings and cervical collars.

3. Background

Etiology of Skin and Tissue Injury from Medical Treatments

3.1 Medical Devices

Medical device related skin and tissue injuries occur as devices are often made of rigid materials such as plastic, plaster, fibreglass, rubber or silicone which can cause rubbing or create pressure on the soft tissues.³ The tape or securement devices may cause skin damage particularly where there are fluid shifts and edema develops.⁴ Products such as elasticized or non-elasticized tubular bandages, tensor bandages, compression systems and anti-embolism stockings can be the sources of skin injury.

3.2 Thermal Injuries from Casts and Backslabs

Casts and backslabs are also considered medical devices and pose challenges due to the fact that often they cannot be removed. They can also cause thermal injury from the exothermic reaction of plaster.

3.3 Medical Adhesive Related Skin Injury

Medical adhesives can cause traumatic skin damage when the skin-to-adhesive attachment is stronger than the attachment of the epidermis to the dermis. This can cause separation of the epidermal layers or the entire epidermis separating from the dermis. Repeated application and removal of adhesive products causes mechanical trauma and can range from skin stripping to a tension injury or blister or to a skin tear. Irritant or allergic dermatitis may develop under the product, and maceration from trapped moisture or folliculitis can also occur.⁵

3.4 Extravasation Injury

Extravasation injury to skin and tissue occurs when there is efflux of solutions from a vessel into surrounding tissue spaces during intravenous infusion.⁶

4. Skin and Tissue Injuries

4.1. Medical Device Related Pressure Injuries

Medical devices are used in all healthcare settings and the National Pressure Injury Advisory Panel (NPIAP) defines the etiology of a medical device related pressure injury as follows:

“Medical device-related pressure injuries result from the use of devices designed and applied for diagnostic or therapeutic purposes”. The resultant pressure injury generally conforms to the pattern or shape of the device. The injury should be staged using the Pressure Injury staging system.⁷ Medical devices can cause mucosal membrane pressure injuries, but due to the anatomy of the mucosal membrane tissue these injuries cannot be staged as unlike skin, mucosa does not have an epithelium, and the base of mucous membrane-covered tissue does not include muscle, tendon, ligaments and bone.^{8, 9, 10}

The cause of pressure injuries from medical devices is iatrogenic, that is it is caused inadvertently by medical or surgical treatments or diagnostic procedures. It has been found that medical device-related pressure injuries account for almost one third of serious (Stage 3, 4 and Unstageable) pressure injuries and that half of these are unstageable.¹¹ Preventing device related pressure injuries is often much more complex than preventing pressure injuries on bony prominences because the device causing the damage is required as part of the patient’s treatment. Medical co-morbidities, level of consciousness and extremes of age such being very young or very old may predispose patients to be unable to sense the tissue damage being caused by the device ¹².

4.2 Thermal Injuries from Casts and Backslabs

Plaster has a much higher setting temperature than fiberglass and therefore poses a higher risk for thermal injury (burn) when a cast is applied. Plaster and water react to produce heat through a process known as an exothermic reaction. There are a number of factors during the casting process and the post casting care which are associated with thermal injuries ¹³:

- Temperature of dip water for wetting plaster >50°C
- Inadequate volume of dip water, as water assists in releasing heat
- Removal of water by aggressive squeezing of plaster
- Increased room temperature
- Cast material >24 ply, considered too thick
- Reinforcing a curing plaster cast with fiberglass as the synthetic overlap prevents heat from effectively dissipating
- Covering the curing cast with blankets
- Supporting the freshly applied cast on a pillow with a plastic cover

4.3 Medical Adhesive Related Skin Injury

Medical Adhesive Related Skin Injury (MARSII) is a traumatic skin injury caused by the removal of adhesives from skin. It is defined as a medical-related skin injury in which erythema and/or other manifestation of skin trauma or reaction including formation of vesicles, bulla, skin erosion, and epidermal tears, persist longer than 30 minutes after removal of the adhesive tape. Other injuries include contact dermatitis and tension injuries from allergy, or tape applied

too tightly or stretched over the skin.¹⁴ Examples of products with medical adhesives include tape, dressings, ostomy pouches and electrodes. The elderly and neonates are at high risk for MARSI.⁷

The types of skin injuries caused by medical adhesives include:

- Mechanical trauma
 - Epidermal stripping: Removal of one or more layers of the epidermis following removal of adhesive
 - Tension injury or blister: Injury caused by shear force as a result of distension of skin under an unyielding adhesive tape or dressing
 - Skin tear: Wound caused by shear, friction, and/or blunt force resulting in separation of skin layers; can be partial- or full-thickness wound
- Dermatitis
 - Irritant contact dermatitis: Non-allergic contact dermatitis occurring as a result of a chemical irritant; a well-defined affected area correlates with the area of exposure
 - Allergic dermatitis: Cell-mediated immunologic response to a component of tape adhesive or backing; typically appears as an area of erythematous vesicular, pruritic dermatitis corresponding to the area of exposure and/or beyond
- Other
 - Maceration from trapped moisture: Changes in the skin resulting from moisture being trapped against the skin for a prolonged period; skin appears wrinkled and white/grey in colour
 - Folliculitis: Inflammatory reaction in hair follicle caused by entrapment of bacteria; appears as small inflamed elevations of skin surrounding the hair follicle

4.4 Extravasation Injury

Extravasation occurs when a drug is inadvertently administered outside of the vein. Depending on the substance involved, this may lead to tissue necrosis with significant long-term morbidity. Neonates especially premature infants are particularly susceptible to extravasation with up to 70% of children in neonatal intensive care unit having some form of extravasation injury¹⁵. This high prevalence is attributable to the immature vasculature of premature infants, which makes the course of blood vessels less predictable and more vulnerable to damage compared with the blood vessels of adults.¹⁵ During and after cannulation, the site does not remain fixed, which makes neonates vulnerable to extravasation. If treatment is delayed, surgical debridement, skin grafting, and even amputation may be the unfortunate consequences of such an injury.¹⁶

5. Prevention and Management of Skin Injury under Medical Devices

5.1 Prevention of skin injury under medical devices requires continuity of care, skin surveillance and documentation.

5.2 The Health Care Provider is responsible for:

a. Supply of the medical device and documentation of the following:

- Name and type of medical device
- Diagnosis necessitating medical device
- Indications for wear, including whether device is removable or not
- Communication with patient and family of skin injury risk posed by device
- Provider name and telephone number/alternate contact

NOTE: See Section 11 on page 13 for information on Medical Device Prescription & Education sheets

b. Communication of information regarding the medical device with receiving facility (including Home Care) if patient is transferred or discharged. This should include providing the medical device prescription sheet (if available) to patient /family and receiving facility (including Home Care)

5.3 Skin Surveillance under Removable Medical Devices

Assess patients at risk for skin breakdown using a risk assessment such as the Braden Scale for Predicting Pressure Ulcer Risk ¹⁷, The Braden Q Scale ¹⁸ or interRAI Pressure Ulcer Risk Scale (PURS).¹⁵

Prevention of skin breakdown under medical devices is device removal with inspection of the skin under adequate light. Unless otherwise indicated, device should be removed and skin surveillance completed once a shift (at least every 8 hours) for hospitalized patients and personal care home residents.²⁰ Skin inspection under medical devices should always be noted on rounds, patient handovers and transfers. Daily documentation is required for skin and pressure injury risk from device and presence of skin or pressure injury.

Early skin breakdown is heralded by non-blanchable erythema, which is a Stage I pressure injury. Stage 1 pressure injuries can be difficult to detect in dark skinned persons, and should be augmented with palpation for warmth and induration (firmness).

- Check the fit of devices, by ensuring that device conforms to the patient's anatomy comfortably and only the areas of the device that are intended to have contact with skin do so.
- Lift or move the medical device to examine the skin underneath and other areas vulnerable to pressure ulcers from medical devices (e.g., openings of the nose, inside

the mouth). If the patient has a larger body habitus, examine between any skin folds to ensure the medical device is not hidden from view.²¹

- Apply dressings, as needed, to redistribute pressure and absorb moisture from body areas in contact with a medical device or tubing. Remove and reapply the dressings during skin assessments to check the skin.²¹
- Reposition the medical device at routine intervals.²²
- Check the tension of any tape or straps holding a medical device or tube in place to ensure it does not create more pressure from the device against the skin.²²
- Examine the patient for any swelling that could aggravate skin breakdown from a medical device. Tape and straps holding a medical device in place could tighten against the device and skin with swelling.²¹
- Evaluate the patient's need to continue with a medical device to eliminate unnecessary use of the device.

5.4. Skin Surveillance under Non-Removable Medical Devices

Signs and symptoms of problems under a non-removable device include:

- Pain beyond what would be considered normal (burning, stinging)
- Foul odour
- Complaint of pressure point, rubbing
- Moisture in device (i.e. wet cast)
- Intense pressure from swelling i.e. fracture blisters
- Body fluid leaking through device

If the device is non-removable and there is risk of a pressure injury developing or a pressure injury or thermal injury is suspected, contact the prescribing physician and/or the department that applied the device.

Refer to Medical Devices Protocol-Quick Reference Guide: <https://home.wrha.mb.ca/wp-content/uploads/Medical-Device-Protocol-Quick-Reference-Guide.pdf>

6. Prevention of Thermal Injuries when Casting

Prevention of thermal injuries requires that the plaster must be allowed to cure before setting the casted limb on a support or covering with a blanket or applying fiberglass reinforcement.²³

Suggested solutions:

- Plaster splints: Use room temperature water. "Avoid using water that is warmer than 24°C (75°F) or has already been used for plaster-making, because water activates the plaster's exothermic (heat-producing) agents. Excessively warm or previously used water makes the plaster harden too fast to shape and hot enough to risk burning the

patient.” Nursing Skills On-Line: https://point-of-care.elsevierperformancemanager.com/skills/243/quick-sheet?skillId=EN_127.ety

- Bottled water can be used as dip water as the ambient temperature is in the safe range to activate plaster (thermometer is not needed)
- Prop limb on pillows during the drying period to avoid pressure points
- Ensure that pillows do not have plastic covers

7. Prevention and Management of Medical Adhesive Related Skin Injury

Prevent Medical Adhesive Related Skin Injury ²⁵ by:

- Identifying patients at elevated risk and implementing interventions before skin injury occurs
- Applying skin preparation prior to application of tape or dressings (unless dressing has silicone based border)
- Using silicone dressings, silicone tape or tape which has less adhesion
- Using adhesive remover to remove heavy tape, tube securement devices, and ostomy pouches
- Keeping skin well moisturized
- Using protective devices such as skin sleeves to keep at-risk areas covered (also protects from skin tears)
- Changing devices that are adhered to the skin (ostomy pouches, tube securement devices) on a routine basis
- Removing tape and/or device in the direction that the hair is growing

8. Prevention and Management of Extravasation

Neonates: Refer to Management of Peripheral IV Access Devices and Extravasation Injuries in Neonates: (WRHA Website)

Health Sciences Centre – Cytotoxic Medication (Chemotherapy): Management of Extravasation of Antineoplastic Vesicant and Irritant Drugs
https://policies.sharedhealthmb.ca/wp-admin/admin-ajax.php?juwpfisadmin=false&action=wpfd&task=file.download&wpfd_category_id=60&wpfd_file_id=291&token=cfdb900c8d8fe796346a7bb788ffc592&preview=1

Health Sciences Centre: Infusion therapy: Standards of Practice.
<https://policies.sharedhealthmb.ca/document/64/management-of-patient-services-patient-care/370/350-140-124-cpg-hsc-infusion-therapy-central-peripheral-subcutaneous-intraosseous>.

Nursing Skills On-Line: Refer to Intravenous Therapy: Prevention and Management of Extravasations

Prevention: The patency of the catheter and vein should be assessed frequently so that extravasation can be prevented. Before administering each dose of medication, the nurse should visually inspect and palpate the site, checking for vein cording, edema, skin temperature, and tenderness or discomfort. Check for a positive blood return. ^{13, 15, 25, 26}

Suggested Extravasation Interventions ^{6, 15, 25, 26}

- **STOP** the infusion immediately. **Notify *Prescriber/ Primary Care Prescriber DO NOT flush if extravasation is suspected as this would inject additional fluid into the tissues.**
- **Consult Pharmacy immediately** for further treatment direction, including antidote information and application of heat or cold.
- Disconnect the IV tubing from the catheter hub and carefully aspirate any remaining vesicant using a 3-5 ml syringe with a gentle technique.
- **NOTE:** Do not remove Vascular Access Device (VAD) until antidote requirement is determined. Certain antidotes must be given through the existing VAD to ensure delivery into the affected tissue.
- When VAD can be removed, apply a dressing to achieve hemostasis and elevate the extremity. **NEVER apply pressure to a site where extravasation is suspected.**
- In collaboration with the Provider, consider facilitation of consultation with other specialists as needed (ex. PICC Services, Wound Care CNS, Vascular Surgeon, Plastic Surgeon, PT/OT, pain specialist).
- Mark the affected area with a skin marker, continue to monitor. This is due to increased risk of tissue necrosis and risk of loss of limb.
- **Document** ^{6, 25}
 - Date and time of occurrence
 - Site of administration, condition of the vein, and age of the IV site
 - Method of administration and equipment used with administration
 - Patient and family discussion including symptoms, pain
 - Suspected agent and any other medications administered or procedures completed around the same time period
 - Treatment interventions
 - Notification of Provider/Primary Care Providers (physicians, nurse practitioners, and physician assistants)
 - Plan for follow-up care
- **Patient safety:** Report as an occurrence in RL6 or other site-specific system

9. Chart of Medical Devices which can cause Skin and Tissue Injury

Location	Device	Issues
All	Adhesive	Blisters and skin tears from removal Dermatitis from adhesive Maceration and folliculitis under adhered products
All	Cables	Pressure injuries from pulse oximetry and cardiorespiratory leads when they rest under patient
All	Electrodes (EEG & EKG)	Blisters and skin tears from removal Dermatitis from adhesive Maceration and folliculitis under adhered products Pressure injuries from buttons
All	Extravasation	Mild to severe tissue damage including necrosis can occur
All	Pulse Oximetry	Pressure injuries caused by constricted blood flow in infants and young children by probes wrapped around digits, hands, wrists and feet
Arms	Arterial Lines	Post fluid resuscitation edema causes pressure on skin from tubing and securement devices
Arms	Backslab	Burn from exothermic reaction Pressure injuries from hard/sharp edges, limb swelling, poor fit
Arms	Casts	Burn from exothermic reaction Pressure injuries from hard/sharp edges, limb swelling, poor fit
Arms	Identification tags	Pressure injures from hard plastic securing buttons
Arms	IVs	Extravasation injuries Pressure injuries from hard plastic ports, locks, and flow controllers
Arms	PICC line	Pressure injuries from hard plastic clips and ports
Arms	Restraints	Friction and shearing injuries from straps as patient moves
Arms	Splints	Pressure injuries from hard plastic, straps, heat and humidity
Arms	Tubular bandages with or without elastic	Pressure injuries from bunching or wrinkling, or if sized too small, too large
Ear	Oxygen tubing	Pressure injuries from tubing, hard plastic
Ear	Pillow	Pressure injuries from immobility

Ear lobe	Pulse Oximetry	Burns caused by light from pediatric and infant probes Pressure injuries from high pressure from device clip on small area.
Ear	Glasses	Pressure injuries from hard plastic/metal
Face	CPAP/BiPAP	Pressure injuries caused by edema from devices being urgently placed and tightly secured on thin skin on the bridge of nose, and face Pressure injuries from incorrect sizing of CPAP/BiPAP or difficulty with sizing due to patients being "in between" sizes especially in pediatrics
Head ²⁷	Rigid Cervical Collar	Pressure injuries caused by device being urgently placed and secured tightly in trauma and extraction situations. Pressure injuries from plastic components, high heat and humidity under collar Pressure injuries from incorrect sizing of cervical collars or difficulty with sizing due to patients being "in between" sizes especially in pediatrics
Head	Soft Cervical collar	Pressure injuries from high heat and humidity, pressure from collar edge or plastic reinforcement
Head	EEG leads	Pressure injuries caused by metal buttons Skin tears caused by removal of glued leads when used long term
Neck ²⁸	Tracheostomy	Pressure injuries from high pressures from the skin/tracheostomy interface, as tracheostomy is sutured to secure airway; Pressure injuries from securement straps, and hard plastic flanges and tubes
Nose	Nasal Cannula	Pressure injuries on nares and nose Mucosal membrane pressure injury
Nose	Nasogastric tubes	Skin tears from securement tape Mucosal membrane pressure injury from tube
Nose	Glasses	Pressure injuries from hard plastic/metal on sides of nose
Mouth	Endotracheal tube	Skin tears from securement tape Pressure injuries on lips Mucosal membrane pressure injury from hard plastic
Mouth	Bite Block	Pressure injuries on lips Mucosal membrane pressure injury from hard plastic
Chest Scapula/Sternum	Halo traction	Pressure injuries from hard plastic and metal components
Chest Spine	Tubular bandages with or without elastic	Pressure injuries from bunching or wrinkling, or if sized too small , too large

Chest Scapula Spine	Wheelchair	Pressure injuries from wheelchair, seating component sizing, plastic and metal on wheelchair and seating system Pressure injuries from seating components inserted incorrectly
Head/chest	Cervical Thoracic Orthosis (CTO)	Pressure injuries from hard plastic and metal components
Chest/Hips	Thoracic Sacral Lumbar Orthosis (TSLO)	Pressure injuries from hard plastic and metal components
Abdomen	GT tubes	Tissue/Skin injury or irritation from: <ul style="list-style-type: none"> 1. Leakage of contents on to skin due to inappropriate tube size, inappropriate balloon volume, poor tube stabilization or general poor tube management (contact irritant dermatitis, injury to mucous membrane, formation of hypergranulation tissue and maceration) 2. Tube bolster or bumper too tight or ill-fitting (pressure injury, maceration)
Abdomen	Ostomy	Tissue/Skin injury or irritation from: <ul style="list-style-type: none"> 1. Frequent leakage of contents on to skin due to poor stoma location, poorly fashioned stoma, appliance (pouch) issues and/or frequent pouch changes (contact irritant dermatitis, injury to mucous membrane) 2. Reaction to adhesive in the appliance or pouching accessory (allergic or non-allergic dermatitis) 3. Hair follicle irritation caused by ripping out hair that is located under the pouch or appliance upon removal (folliculitis) 4. Pressure from appliance, accessories, sutures or stoma rod (pressure injury)
Abdomen	Tubular bandages with or without elastic	Pressure injuries from bunching or wrinkling, or if sized too small, too large

Hips	Hip Spica	Burns from exothermic reaction Pressure injuries from foreign objects (children tend to put items into the cast, food falls into cast), sharp edges, limb swelling, poor fit
Hips	Wheelchairs	Pressure injuries from wheelchair, seating component sizing, plastic and metal on wheelchair and seating system Pressure injuries from seating components inserted incorrectly
Perineal area Mucosa	Urinary catheters	Mucosal membrane pressure injury (urethral erosion) from indwelling catheters in men if not secured correctly
Perineal area	Urinary catheters	Pressure injuries from aspiration and balloon inflation ports
Perineal area	Bed pans	Pressure injuries from rigid plastic or metal
Perineal area	Fecal containment devices	Mucosal membrane pressure injury of the rectum/perianal areas Pressure injuries caused by tubing resting under patient as ports become hidden in skin folds or under scrotum
Legs	Backslab	Burns from exothermic reaction Pressure injuries from hard/sharp edges, limb swelling, poor fit
Legs	Casts	Burns from exothermic reaction Pressure injuries from hard/sharp edges, limb swelling, poor fit
Legs	IVs	Extravasation injury Pressure injuries from hard plastic ports, locks, flow controllers, and tubing
Legs	Compression	Pressure injuries from being applied too tight, fluid shifts, and edema
Legs	Splints	Pressure injuries from hard plastic and straps, heat and humidity
Legs	Tensors/TEDs	Pressure injuries from being applied too tight, fluid shifts, and edema causing tourniquet effect
Feet	Walking boots	Pressure injuries from being applied too tight, fluid shifts, and edema

10. Critical Incidents

Manitoba's legislation defines a critical incident as "an unintended event that occurs when health services are provided to an individual and results in a consequence to him or her that is serious and undesired."

Upon discovery of a pressure injury, regardless of stage, an occurrence report (RL6 or equivalent) must be completed. Stage 3 and 4 pressure ulcers (injuries) are considered potential critical incidents and in Manitoba Unstageable Pressure Injuries are also considered potential critical incidents as when debrided they are usually Stage 3 or 4. Serious injury associated with the use of devices also forms part of the criteria.

See the following links for further details:

<https://www.gov.mb.ca/health/patientsafety/ci/guidelines.html>

<https://www.gov.mb.ca/health/patientsafety/docs/guidelines.pdf>

11. Medical Device Prescriber/Provider Staff Education Sheets

Shared Health: Health Sciences Centre (HSC) specific:

<https://hschome.hsc.mb.ca/clinical-education/learning-materials/#271-334-device-information-sheets>

Winnipeg Regional Health Authority: (Insite)

WRHA Medical Device Provider Instructions & Education Sheets (English and French)

<https://home.wrha.mb.ca/clinical-initiatives/wound-care/medical-device-prescription/>

- Backslab
- Cast
- Cast Boot
- Custom Splint
- Foot Drop Splint (Ankle Foot Orthosis)
- G2 Brace
- Knee Immobilizer (Zimmer)
- Rigid Cervical Collar

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11. Primary Author(s)

Nickolaus Gilmour CO (c), MSc, Orthotist, Health Sciences Centre

Maria Froese BMR-PT, MCISc-WH, Professional Lead, Physiotherapy, WRHA

Lora Jaye Gray, BSc Pharm, WRHA Drug Information Pharmacist, Health Sciences Centre
Winnipeg

Jason Linklater RT (Orthopaed), Former Orthopedic Technology Educator, Health Sciences
Centre

Kari Mann RN, MN, BSc, IIWCC, Clinical Nurse Specialist Skin and Wound Care, Health
Sciences Centre

Jane McSwiggan MSc, OT Reg. (MB), IIWCC, Education and Research Coordinator–Wound
Care, WRHA

Tanya Redecopp RN, BN, Quality Improvement Officer, Child Health, Health Sciences Centre

Blake Richison BMR-PT, Physiotherapy, Health Sciences Centre