

Developed in collaboration with the Wound Care Champions, Wound Care Specialists, Enterostomal Nurses, and South West Regional Wound Care Program (SWRWCP) members from Long Term Care Homes, Hospitals, and South West CCAC contracted Community Nursing Agencies in the South West Local Health Integration Network.



**Title**  
**Guideline: The Assessment and Management of Bacterial Burden in Acute and Chronic Wounds**

**Background**

- As per the concept of *Preparing the Wound Bed*, local factors must be assessed and managed in order to promote timely and orderly closure of wounds. This includes consideration of increased bacterial burden and/or wound infection and persistent inflammation<sup>1</sup>
- Assessment of infection needs to be of the whole person, and specifically the person’s ability to resist infection, as:

$\text{Infection} = \frac{\text{dose} \times \text{virulence}}{\text{Host resistance}}$
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- Whereas:
  - Dose = the amount of microorganisms which is sufficient to cause infection. It is generally accepted that organisms in a quantity greater than 10<sup>6</sup> (the dose) will not only impair healing, but will produce sufficient toxins and proteolytic enzymes to harm living tissue<sup>10</sup>
  - Virulence = the competence of a noxious agent to produce its effect. Different bacteria have different virulent properties, so that a more virulent species may have more deleterious effects on the wound than the actual quantity of bacteria present
  - Host resistance = the ability of an individual to withstand the noxious influence. Systemic and local factors can increase the risk of infection:

Systemic Factors	Local Factors
Malnutrition	Large wound area and/or depth
Edema	High degree of wound chronicity
Vascular disease and/or diabetes mellitus	Anatomic location, i.e. near anus
Use of corticosteroids and other immunosuppressant medications	Presence of foreign bodies and/or necrotic tissue in the wound
Inherited neutrophil deficits and/or immune deficient conditions	Mechanism of injury, i.e. trauma or perforated viscus
Prior surgery or radiotherapy	High degree of contamination
Alcoholism	Reduced tissue perfusion
Rheumatoid arthritis	Long or contaminated surgery

- All wounds contain bacteria at levels ranging from contamination to systemic infection (see “Definitions of Bacterial Burden in Chronic Wounds”). It is the interpretation of the clinical signs of increased bacterial burden/infection that directs treatment (if required) (see “Bioburden Assessment Tool and Interpretation”). There is **NO** single scientific test to definitively diagnose infection

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	<ul style="list-style-type: none"> <li>• The role of biofilms: <ul style="list-style-type: none"> <li>○ Biofilms are communities of bacteria/fungi that co-exist in a protective matrix on the surface of some chronic wounds<sup>5</sup></li> <li>○ The matrix protects the bacteria/fungi living within it from external threats, like topical antimicrobials and wound cleansing and superficial debriding measures</li> <li>○ They are present in up 60% of chronic wounds, and may be responsible for persistent inflammation, which delays wound closure<sup>4</sup></li> <li>○ Sharp debridement followed immediately by the application of a broad spectrum topical antimicrobial (repeated as necessary) is the only way to successfully remove and prevent biofilm reconstitution</li> </ul> </li> <li>• Strategies to reduce risk of wound infection: <ul style="list-style-type: none"> <li>○ Adhere to hand washing protocols before and after dressing changes</li> <li>○ Remember that dressings supplies are for single person use only, i.e. avoid sharing dressings between people</li> <li>○ Dressings pre-packaged for single use are intended to be used in that manner, i.e. not accessed and the remaining dressing fragments saved for future use. <b>NOTE: for those with ACUTE wounds receiving wound care, it is realized that in reality dressings are being accessed from sterile, single use packaging, used, and that the remaining dressing fragments are being used in future dressing changes. For ACUTE wound care, this may be acceptable, if your organization so indicates in their policies and if the following criteria are met:</b> <ul style="list-style-type: none"> <li>▪ The packaging is opened using aseptic technique</li> <li>▪ The dressing is cut using sterile forceps and scissors</li> <li>▪ The remaining dressing pieces are placed into a sterile C+S container, using aseptic technique, that has been labelled with the person’s name, the date, and the name of the dressing</li> <li>▪ The remaining dressing pieces are accessed from the C+S container in the future using aseptic technique</li> <li>▪ After two weeks in the C+S container, the container and its remaining contents are discarded</li> </ul> </li> <li>○ For those with CHRONIC wounds, although single use of pre-packaged dressings is indicated by dressing manufacturers, it too is realized that in reality this may not be happening, i.e. remaining dressing fragments are being saved for future use. <b>NOTE: for those with CHRONIC wounds receiving wound care, it may be appropriate to re-use dressing fragments, if your organization so indicates in their policies and if the following criteria are met:</b> <ul style="list-style-type: none"> <li>▪ The packaging is initially opened using aseptic</li> </ul> </li> </ul> </li> </ul>
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	<p><b>technique</b></p> <ul style="list-style-type: none"> <li>▪ <b>The dressing is cut using clean instruments</b></li> <li>▪ <b>The remaining dressing pieces are placed into a sterile C+S container that has been labelled with the person’s name, the date, and the name of the dressing</b></li> <li>▪ <b>The remaining dressing pieces are accessed from the C+S container in the future using clean technique</b></li> <li>▪ <b>After two weeks in the C+S container, the container and its remaining contents are discarded</b></li> </ul> <ul style="list-style-type: none"> <li>○ Single use saline or sterile water bottles (110mL) are used in their entirety at each dressing change, i.e. they are not re-capped and used for subsequent dressing changes, nor are they shared between people</li> <li>○ For those accessing larger containers of saline or sterile water, i.e. larger than 115mL, if accessed in a sterile manner, these bottles may be re-used <u>for the same person</u> for a period of 24 hours, before they are required to be discarded. The solution must be dated and labelled with the person’s name when opened, and may be stored at room temperature with the cap secured</li> <li>○ Assess and treat acute wounds, i.e. wounds that are less than four weeks old, using sterile (aseptic) technique. Those with neutrophil deficits and/or immune deficiency and who have chronic wounds, may also benefit from aseptic technique</li> <li>○ Assess and treat chronic wounds, i.e. wounds that are greater than four weeks old, using clean technique</li> <li>○ Take only the supplies needed for the single dressing change to the person’s bedside or into the person’s home, as such supplies cannot be returned to the dressing supply room/shelf/cart, etc. and <b>MUST BE DISCARDED</b> for infection control reasons</li> <li>○ If supplies are being stored in a person’s home, they must be stored according to manufacturer’s guidelines and in a location that is inaccessible to children and pets</li> <li>○ Remove non-viable tissue from the wound surface, as appropriate, as it provides an opportunity for microbial growth<sup>6</sup> [see “Guideline and Procedures: Wound Debridement (excluding conservative sharp debridement)’ and/or “Guideline and Procedure: Conservative Sharp Wound Debridement (CSWD”)]</li> <li>○ Optimize the moisture balance of the wound bed (in healable wounds)<sup>7</sup>, as dry wound beds may develop microscopic ‘cracks’ that may be portals of entry for bacteria</li> <li>○ Consider the use of topical antimicrobials in high-risk individuals/wounds to prevent wound infection<sup>7</sup>, i.e.: <ul style="list-style-type: none"> <li>▪ Those with a history of delayed healing/infection;</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>▪ Those with wounds in anatomical locations that increase the risk of contamination, i.e. the sacrum;</li> <li>▪ Wounds of 4+ weeks duration at initial presentation, that have no visible signs of ‘healing’ or with signs of deterioration;</li> <li>▪ Those with pathologies or activities that may compromise immunity, i.e. those with diabetes and poorly controlled blood sugars, smoking, alcohol abuse, etc.;</li> <li>▪ In areas of significantly compromised blood flow where healing is unlikely, and;</li> <li>▪ To reduce odor that may be affecting quality of life.</li> </ul>
<b>Indications</b>	<p>This guideline is intended to be used by front line registered health care providers, to guide their assessment and management of wound bacterial burden/infection in those individuals presenting with a wound.</p>
<b>Guideline</b>	<p><b>NOTE: The assessment and management of a person’s wound for bacterial burden/infection is but one part of the holistic assessment and management of individuals admitted with/presenting with a wound.</b></p> <p><b>Assessment</b></p> <ol style="list-style-type: none"> <li>1. Review the person’s medical records for the following information, as it may help you to determine if the person’s wound is critically colonized, or has spreading or systemic infection:       <ol style="list-style-type: none"> <li>a. History of stalled or slow wound closure</li> <li>b. History of increasing exudate/odor</li> <li>c. Presence of localized edema</li> <li>d. Increase in wound related pain experience</li> <li>e. New wound breakdown or satellite lesions</li> <li>f. History of lymphangitis, general malaise, fever, rigors, chills, hypotension, organ failure</li> </ol> </li> <li>2. Review the person’s medical records for the following information:       <ol style="list-style-type: none"> <li>a. “Healability’ status (see the “Determining Healability Tool”)</li> <li>b. Information re the size, location, and characteristics of the wound to be assessed/debrided/dressed, as this will help you anticipate supplies needed</li> <li>c. Current wound infection treatment and response</li> <li>d. Current wound care orders</li> </ol> </li> </ol> <p><b>Planning</b></p> <ol style="list-style-type: none"> <li>1. Expected outcomes:       <ol style="list-style-type: none"> <li>a. Information from the person’s chart , the person and/or their substitute decision maker (SDM)/power of attorney for personal care (POA C), and your assessment allows for the determination of the level of bacterial burden present in/on the wound (as per the “Bioburden Assessment Tool”), and as such the selection of the most appropriate interventions</li> <li>b. Information obtained will allow for the determination of</li> </ol> </li> </ol>

	<p>whether or not the wound is positively responding to bacterial burden/infection management measures, i.e. the clinical signs of critical colonization, spreading infection, and systemic infection (see: "Definitions of Bacterial Burden in Chronic Wounds") are disappearing/resolving</p> <p>c. Registered nursing staff, in collaboration with the individual with the wound and/or their SDM/POA C, and other involved health care disciplines, are able to use the assessment information to initiate/modify and implement an appropriate person-centered, interdisciplinary plan of care which contains clear directions to staff and others who are providing the person with direct care</p> <ol style="list-style-type: none"> <li>2. Explain the procedure and its purpose to the person and/or their SDM/POA C, and obtain informed implied/verbal consent</li> <li>3. Assess the need for pre-procedure pain medication – removal of dressings, the dressing procedure itself, and/or debridement may be painful. If required, the person <b>must</b> be allotted enough time to achieve the drug's peak effect BEFORE initiating the dressing change/debridement</li> </ol> <p><b>Implementation</b></p> <ol style="list-style-type: none"> <li>1. Provide for privacy and ensure the person is in a comfortable position to facilitate assessment of the wound and for the wound debridement/dressing procedure</li> <li>2. Wash your hands and attend to the person with your assessment tools and anticipated debridement and/or wound dressing supplies</li> <li>3. If the person is in bed, raise the bed (if you are so able to) to an appropriate ergonomic position to allow for the wound assessment and treatment while preventing self-injury</li> <li>4. Ensure adequate lighting</li> <li>5. Don clean disposable gloves and additional personal protective equipment (PPE), i.e. gown, goggles, and/or mask as required if risk for splash back or spray exists</li> <li>6. Remove the existing wound dressing as per the manufacturer's instructions. Observe the dressing for the appearance of the drainage of on the dressing. Assess for odor</li> <li>7. Dispose of the soiled dressings in the proper receptacle and remove and dispose of your soiled gloves</li> <li>8. Wash your hands and apply new clean disposable gloves and cleanse the wound as ordered or as per the "SWRWCP's Dressing Selection and Cleansing Enabler – HEALABLE WOUNDS" or the "SWRWCP's Dressing Selection and Cleansing Enabler – MAINTENANCE/NON-HEALABLE WOUNDS"</li> <li>9. Gently pat the wound bed dry (if required) and dry the surrounding skin with gauze</li> <li>10. If indicated, and if you have the knowledge, skill, judgment, and</li> </ol>
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authority, conservatively sharp debride any necrotic tissue present and re-cleanse the wound as above [see: “Guideline and Procedure: Conservative Sharp Wound Debridement (CSWD)”]

11. Assess the wound using the “NPUAP PUSH Tool 3.0” (see “Procedure: NPUAP PUSH Tool 3.0”)
12. Observe for clinical signs of increased bacterial burden/infection using the “Bioburden Assessment Tool”, determining the level of risk, i.e. colonized, critically colonized, spreading infection, or systemic infection, as noted on the Tool itself
13. Cross reference the bacterial burden risk level with the document “Definitions of Bacterial Burden in Chronic Wounds”, as this will suggest appropriate clinical interventions based on level of risk, i.e.

Bacterial Burden Level	Clinical Interventions
Contaminated	Monitor and risk reduction*
Colonized	Monitor and risk reduction*
Critical Colonization	<ul style="list-style-type: none"> <li>• Topical antimicrobials</li> <li>• Effective debridement</li> </ul>
Spreading Infection	<ul style="list-style-type: none"> <li>• Topical antimicrobials</li> <li>• Effective debridement</li> <li>• Systemic antibiotics</li> </ul>
Systemic Infection	<ul style="list-style-type: none"> <li>• Topical antimicrobials</li> <li>• Effective debridement</li> <li>• Systemic antibiotics</li> <li>• Rule out other infection sources</li> </ul>

\*Risk reduction suggestions can be found in the ‘Background’ section of this document

14. If the use of topical antimicrobials are indicated, see the following resources (found on the Program’s website: [www.swrwoundcareprogram.ca](http://www.swrwoundcareprogram.ca)) to inform your choice of antimicrobial(s). **NOTE: antimicrobials should be trialed for a 10-14 day period (a ‘Two Week Challenge’), and if the wound shows no improvement, the person and the wound should be re-evaluated, a wound swab should be considered, and the person should be assessed by their primary care provider to determine if systemic antibiotic treatment is warranted (see “Criteria for Interdisciplinary Referrals”).** If after two weeks the wound is progressing towards closure yet still exhibits signs of infection, continue the use of the antimicrobial dressing for another two weeks. If the person has had an antimicrobial dressing on for longer than four weeks, review the dressing regimen and consider a referral to Enterostomal (ET) Nurse or Wound Care Specialist (WCS) for further discussion of the management plan (see “Criteria for Interdisciplinary Referrals”):
  - a. “Safest Topical Antimicrobials for Use in Wound Care”
  - b. “Topical Antimicrobials for Selective Use in Wound Care”
  - c. “Topical Antimicrobials for Cautionary Use in Wound Care”

**NOTE: STOP using topical antimicrobials when the signs of infection resolve, when the wound starts to progress towards**

**closure, and/or if the person experiences an antimicrobial related adverse event**

15. Antimicrobial dressings should be selected based on their ability regarding:
- a. Absorbency and ability to be used with highly exudating or low exudating wounds
  - b. Conformability to the wound surface – i.e. the more that the dressing matches the contours of the wound surface and directly contacts it, the better the antimicrobial effect
  - c. Management of odor and/or pain
  - d. Activity against the specific bacteria in the wound
  - e. Sufficient levels of the agent to achieve bacterial kill as opposed to bacterial inhibition (and within what length of time)
  - f. Cytotoxicity, i.e. are the components of the dressing likely to damage healthy living cells
  - g. Allergenicity
  - h. What the person can tolerate
  - i. The cost of the dressing vs the frequency of dressing changes
16. If debridement is indicated see “Guideline and Procedures: Wound Debridement (excluding conservative sharp debridement)”, “Guideline and Procedure: Conservative Sharp Wound Debridement (CSWD)”, and/or consider a referral to a general surgeon or other such professional skilled in sharp debridement (and who has the authority to perform such a procedure), i.e. see “Criteria for Interdisciplinary Referrals” **NOTE: aggressive debridement of slough and the underlying tissue may disrupt the bacterial burden and suppress biofilm regrowth<sup>8</sup>**. Debridement should be followed by wound cleansing (see #19) and application of an antimicrobial dressing that is appropriate for the clinical indications (i.e. exudate and odor management), as well as safe for and acceptable for the person with the wound. See:
- a. “Safest Topical Antimicrobials for Use in Wound Care”
  - b. “Topical Antimicrobials for Selective Use in Wound Care”
  - c. “Topical Antimicrobials for Cautionary Use in Wound Care”
17. If systemic antibiotics are indicated, refer the person to their primary care provider for assessment and consideration of systemic antibiotics (see “Criteria for Interdisciplinary Referrals”). Systemic antibiotics should be used in addition to debridement and the use of topical antimicrobials (see #19 and #20). Prescribing professionals must take into consideration the following when choosing an antibiotic<sup>10</sup>:
- a. The most likely or confirmed antibiotic susceptibilities of the suspected or known pathogen(s). **NOTE: in wounds less than 4 weeks old, the most common pathogens are**

	<p><b>gram +. In wounds greater than 4 weeks old, the most common pathogens are gram +, gram – and anaerobes. If empirical treatment is necessary, start with an appropriate broad-spectrum antibiotic and when susceptibilities become available, if the wound is not responding to the aforementioned treatment, consider switching to a narrower-spectrum agent(s)</b></p> <ul style="list-style-type: none"> <li>b. The person with the wound, i.e. allergies, potential interactions with current medications, comorbidities, ability/willingness to comply with treatment</li> <li>c. Guidelines for the treatment of infection in specific wound types, i.e. diabetic foot ulcers</li> <li>d. Severity of the infection (NOTE: IV antibiotics are usually reserved for serious or life-threatening infections)</li> <li>e. Availability, cost and safety</li> </ul> <p>18. Wound swab cultures often tell you what microbes are present on the surface of the wound, which may not be the same as those causing infection deeper in the wound, often making the results inconclusive. It is appropriate to swab a wound (using the Levine Technique, see “Procedure: Quantitative Wound Swab Technique”)<sup>10</sup>:</p> <ul style="list-style-type: none"> <li>a. When you have an acute wound with clinical signs of infection</li> <li>b. When you have a chronic wound with signs of spreading or systemic infection</li> <li>c. When you have a chronic wound that has not responded to or is deteriorating despite antimicrobial treatment</li> <li>d. As required by local surveillance protocols</li> </ul> <p>19. For those with spreading and systemic infection, it is important to optimize the host response so that their immune system may best fight the infection, i.e. optimize the management of comorbidities, minimize risk factors for infection, optimize nutrition and hydration, and treat other sources of infection</p> <p>20. For all individuals exhibiting signs of increased bacterial burden/wound infection, effective wound cleansing is important to remove debris that supports bacterial growth (in the presence of infection, you will likely be cleansing with an antiseptic using 15psi of pressure - see “Procedure: Wound Cleansing”)</p> <p>21. Once you have provided wound care, remove your gloves and other PPE and dispose of them and of any soiled supplies in the appropriate receptacle</p> <p>22. Dispose of any used sharps in a sharps container</p> <p>23. Clean reusable equipment/surfaces touched during the procedure with soap and water or detergent wipes and dry thoroughly to prevent cross infection, returning reusable equipment to the appropriate places</p> <p>24. Wash your hands</p> <p>25. Assist the person to a comfortable position if required, and assess for</p>
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	<p>any concerns</p> <ol style="list-style-type: none"> <li>26. Lower the person’s bed to an appropriate height (if applicable), and ensure the person’s safety, i.e. apply side rails, personal alarms, restraints, etc. as per the person’s care plan/medical orders</li> <li>27. Discuss your findings of the assessment and your thoughts re the presence/absence of signs of infection with the person and/or their SDM/POA C and implement referrals and further interventions as indicated</li> <li>28. Share your wound assessment and intervention implementation findings/outcomes with the interdisciplinary members of the person’s wound care team</li> <li>29. Complete/update and implement an appropriate, person-centered, interdisciplinary plan of care, based on your holistic assessment and interventions, and as per your organization’s policy</li> </ol> <p><b>Evaluation</b></p> <ol style="list-style-type: none"> <li>1. Unexpected outcomes: <ol style="list-style-type: none"> <li>a. The person reports poorly managed pain associated with this procedure</li> <li>b. There is an increase in clinical signs of wound infection, despite implementation of appropriate interventions</li> </ol> </li> <li>2. Re-assess the wound using the “NPUAP PUSH Tool 3.0” at a minimum of weekly to ensure your bacterial balance interventions were effective, and to determine if consideration of other/additional forms of infection management interventions are necessary</li> </ol>
<p><b>References</b></p>	<ol style="list-style-type: none"> <li>1. Sibbald RG, Orsted HL, Coutts PM, et al. Best practice recommendations for preparing the wound bed: Update 2006. <i>Wound Care Canada</i>. 2006;4(1):15-29.</li> <li>2. Cutting KF, Harding KG. Criteria for identifying wound infection. <i>Journal of Wound Care</i>. 1994;3:198-201.</li> <li>3. Caputo GM, Joshi N, Weitekamp MR. Foot infections in patients with diabetes. <i>Am Fam Phys</i>. 1997;56:195-202.</li> <li>4. James GA, Swogger E, Wolcott R, et al. Biofilms in chronic wounds. <i>Wound repair Regeneration</i>. 2008;16(1):37-44.</li> <li>5. Wolcott RD, Rhoads DD. A study of biofilm-based wound management in subjects with critical limb ischemia. <i>J Wound Care</i>. 2008;17(4):145-155.</li> <li>6. Penhallow K. A review of studies that examine the impact of infection on the normal wound-healing process. <i>J Wound Care</i>. 2005;14(3):123-126.</li> <li>7. Wounds UK Best Practice Statement. The use of topical antimicrobial agents in wound management (3<sup>rd</sup> edn). London: Wounds UK, 2013. Accessed at: <a href="http://www.wounds-uk.com">http://www.wounds-uk.com</a>.</li> <li>8. Schultz G. Understanding biofilm-based wound care: What you need to know. Wounds International webcast. 2001. Accessed at <a href="http://www.woundsinternational.com">http://www.woundsinternational.com</a></li> <li>9. World Union of Wound Healing Society Principles of Best Practice</li> </ol>

	<p>Consensus. Wound Infection in Clinical Practice. London: WUWHS, 2008. Accessed at: <a href="http://www.woundsinternational.com/media/issues/71/files/content_31.pdf">http://www.woundsinternational.com/media/issues/71/files/content_31.pdf</a></p> <p>10. Woo KY, Sibbald RG. A cross-sectional validation study of using NERDS and STONEES to assess bacterial burden. <i>Ostomy Wound Management</i>. 2009;55(8):40-48.</p>
<p><b>Related Tools</b>  <b>(NOTE: these tools and their instructions can be found on the SWRWCP's website: <a href="http://swrwoundcareprogram.ca">swrwoundcareprogram.ca</a>)</b></p>	<ul style="list-style-type: none"> <li>• Definitions of Bacterial Burden in Chronic Wounds</li> <li>• Bioburden Assessment Tool and Interpretation</li> <li>• Determining Healability Tool</li> <li>• SWRWCP's Dressing Selection and Cleansing Enabler – HEALABLE WOUNDS</li> <li>• SWRWCP's Dressing Selection and Cleansing Enabler – MAINTENANCE/NON-HEALABLE WOUNDS</li> <li>• Guideline and Procedure: Conservative Sharp Wound Debridement (CSWD)</li> <li>• NPUAP PUSH Tool 3.0</li> <li>• Procedure: NPUAP PUSH Tool 3.0</li> <li>• Safest Topical Antimicrobials for Use in Wound Care</li> <li>• Topical Antimicrobials for Selective Use in Wound Care</li> <li>• Topical Antimicrobials for Cautionary Use in Wound Care</li> <li>• Guideline and Procedures: Wound Debridement (excluding conservative sharp debridement)</li> <li>• Criteria for Interdisciplinary Referrals</li> <li>• Procedure: Quantitative Wound Swab Technique</li> <li>• Procedure: Wound Cleansing</li> </ul>