Wound Infection in Clinical Practice made easy

© Wounds International | November 2022 www.woundsinternational.com

Introduction

Wound infection can lead to protracted wound healing, multiple health service visits and increased hospital admission duration. This comes at significant economic cost and negatively impacts quality of life outcomes for the patient with a wound and their family. Accurate and timely identification of the signs and symptoms of wound infection is critical to achieving effective management of wound infection. This Made Easy will introduce the new edition of *Wound Infection in Clinical Practice* (International Wound Infection Institute [IWII], 2022) and provide an overall view of prevention and management of wound infection from identification and assessment to antimicrobial resistance (AMR) and antimicrobial stewardship (AMS).

International consensus update 2022

The 2022 edition of *Wound Infection in Clinical Practice*, authored by the IWII Committee, is an update from the previous consensus document published in 2016 (IWII, 2016). Advances in research and clinical practice relating to the wound environment, risk factors for infection, biofilm, AMR, and new technologies for identification and management of wound infection have been incorporated into the update (IWII, 2022). The intention is to provide practical information based on the latest understanding of the science and clinical applications regarding wound infection, which continues to be challenging for people with a wound, their families and health professionals.

In updating the document, rigorous methodology was implemented, including a systematic literature review, a Delphi process (to refine definitions), critical appraisal of the evidence on clinical efficacy of topical antimicrobials, and peer review from global key interdisciplinary opinion leaders.

Identification and assessment

Wound infection is when the quantity of microorganisms in a wound becomes imbalanced, the host response is overwhelmed and wound healing becomes impaired (Swanson et al, 2015). The transition from non-infected to infected is a gradual process determined by the quantity and virulence of microbial burden and the individual's immune response (IWII, 2016; IWII, 2022).

The IWII Wound Infection Continuum (IWII-WIC)

The IWII-WIC has evolved over time as the understanding of wound infection advances [Figure 1]. Conceptually, the concept of covert (subtle) local wound infection is now used to describe the clinical indicators primarily observed in the chronic wound before the wound exhibits overt (classic) signs and symptoms of local wound infection.

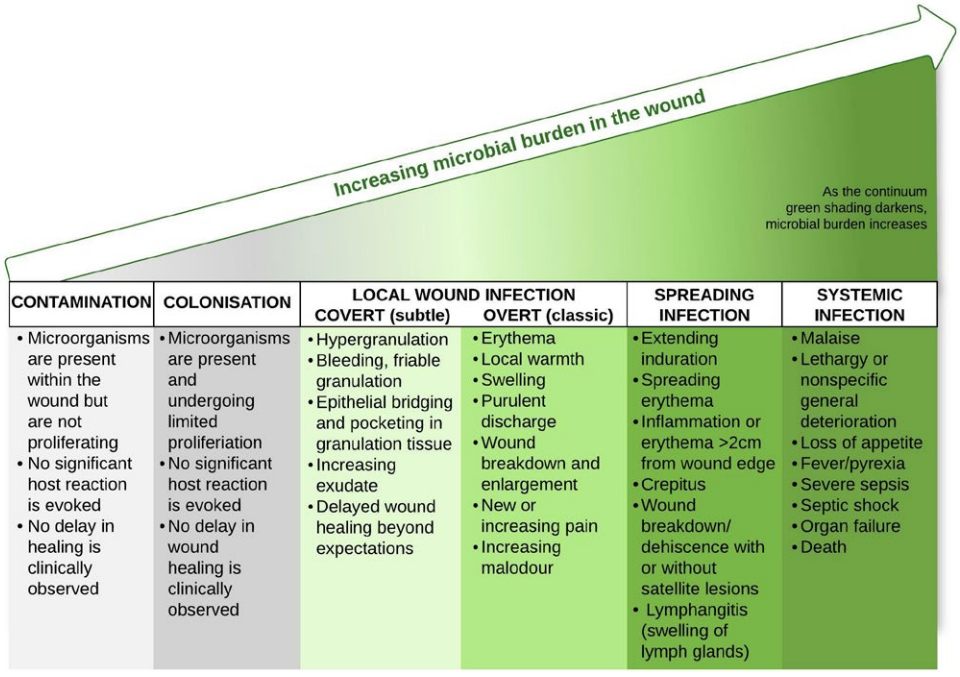

Figure 1: IWII Wound Infection Continuum (IWII-WIC)

The IWII-WIC includes five conceptual stages [Box 1] that details the signs and symptoms commonly exhibited by the individual and the wound as infection develops. Definitions for these five stages were recently agreed on in an international consensus process (Haesler et al, 2022).

Box 1. IWII five conceptual stages (IWII, 2022)

- **Contamination** — presence within the wound of microorganisms that are presumed not to be proliferating. No significant host reaction is evoked and no delay in wound healing is clinically observed (Haesler et al, 2022)
- **Colonisation** — presence of microorganisms within the wound that are presumed to be undergoing limited proliferation. In a colonised wound, no significant host reaction is evoked, and no delay in wound healing is clinically observed (Haesler et al, 2022)
- **Local infection (covert and overt stages)** — presence and proliferation of microorganisms within the wound that evoke a response from the host, often including a delay in wound healing. Local infection is contained within the wound and the immediate periwound region (less than 2cm)
- **Spreading infection** — invasion of the surrounding tissue by infective microorganisms that have spread greater than 2cm from a wound. Microorganisms proliferate and spread to a degree that signs and symptoms extend beyond the wound border (World Union of Wound Healing Societies [WUWHS], 2008; Leaper et al, 2012)
- **Systemic infection** — microorganisms spread throughout the body via the vascular or lymphatic systems, evoking a host response that affects the body as a whole. In the context of wound infection, microorganisms spread from a locally infected wound. Signs of systemic infection include sepsis — referral and immediate treatment in such instances is vital.

Scan the QR code to see Identifying and Assessing Infection in a Wound (IWII, 2022).

Importance of continuous, accurate, holistic assessment of the individual and their wound

Continuous, accurate, holistic assessment of the individual and their wound are essential for effective wound treatment (Siaw-Sakyi, 2017; Edwards et al, 2018). Early identification and subsequent treatment to reduce or eliminate infection is clinically and economically beneficial, and essential to facilitate wound healing (Guest et al, 2018a; 2018b; Dowsett et al, 2020; Oropallo et al, 2021) and to reduce the impact on the individual, their family caregivers and on healthcare systems. Holistic assessment should also include a clinical assessment of the wound. Clinical assessment of wound infection includes evaluation of anatomical location and presentation of the wound bed and the periwound region (Cornforth et al, 2018).

Collaboration, prevention and management

A holistic and collaborative approach is vital to the delivery of best practice in the prevention, diagnosis, assessment and management of wound infection. Ultimately, collaborating with the patient and their family caregiver in care decisions can help to reduce the physical and psychosocial impact of wound infection.

Enhancing patient engagement

A fundamental principle of holistic assessment and management is engagement of the patient and their family caregiver in the process to understand their priorities, care goals and ability to be involved in managing the wound (Wounds International, 2012; Fletcher and Barrett, 2018). Multidisciplinary teams are optimal, and a key player in the team is the patient themselves (WUWHS, 2020).

Empowering patients using clear communication and providing education tailored to the patient can offset anxiety about wound infection, enhance self-care skills and improve clinical outcomes (Wounds UK, 2018).

Holistic prevention and management of wound infection

Knowing the risk factors identified through assessment and then addressing them or encouraging modification of lifestyle choices through education and negotiation with the patient are essential.

It is important to inform the patient and team members that standard of care for the diagnosis is essential, as well as adequate wound bed preparation/hygiene. Table 1 outlines individual, wound and environmental risk factors associated with wound infection.

A comprehensive wound infection prevention and management plan should develop from assessment outcomes and aim to achieve the patient's goals of care. Holistic management addresses:

- Optimising the individual host response (WUWHS, 2008)
- Reducing local microbial burden (WUWHS, 2008)
- Promoting a positive environment for wound healing (WUWHS, 2008; Burden and Thornton, 2018).

Strategies to address these domains are summarised in Figure 2.

Table 1. Factors associated with increased risk of wound infection (IWII, 2022)

Individual (host) risk factors

- Poorly controlled diabetes (i.e. hyperglycaemia)
- Peripheral neuropathy (sensory, motor, and autonomic)
- Neuroarthropathy
- Radiation therapy or chemotherapy
- Conditions associated with hypoxia and/or poor tissue perfusion (e.g. anaemia, cardiac disease, respiratory disease, peripheral arterial disease, renal impairment or rheumatoid arthritis)
- Immune system disorders (e.g. acquired immune deficiency syndrome)
- Connective tissue disorders (e.g. Ehlers-Danlos syndrome)
- Corticosteroid use
- Malnutrition or obesity
- Alcohol, smoking or illicit drug use
- Poor compliance with treatment plan

Wound risk factors

Acute wounds	Chronic wounds	Acute and chronic wounds
■ Contaminated or dirty wounds ■ Traumatic injuries ■ Operation is classified as contaminated or dirty ■ Inappropriate hair removal ■ Operative factors (e.g. prolonged surgery, blood transfusion or hypothermia)	■ Duration of wound ■ Large wounds ■ Anatomically located near a site of potential contamination (e.g. perineum or sacrum)	■ Foreign body presence (e.g. drains, sutures or wound dressing fragments) ■ Haematoma ■ Necrotic or sloughy wound tissue ■ Impaired tissue perfusion ■ Increased exudate and oedema that is not adequately managed ■ Wounds over bony prominences or probing to bone ■ Involvement of tissue deeper than skin and subcutaneous tissues (e.g. tendon, muscle, joint or bone)

Environmental risk factors

- Unhygienic environment (e.g. dust, unclean surfaces, or presence of mould/mildew)
- Hospitalisation (due to increased risk of exposure to antibiotic resistant microorganisms)
- Inadequate hand hygiene and aseptic technique
- Inadequate management of moisture (e.g. due to exudate, incontinence or perspiration)
- Interface pressure that is inadequately off-loaded

Antimicrobial resistance and antimicrobial stewardship

Implementing an organisational-level antimicrobial stewardship (AMS) committee to provide guidance, monitoring and education on appropriate antimicrobial use is key. It is also recommended that the principles of AMS are embedded into undergraduate healthcare curricula — these are discussed in detail below.

What is antimicrobial resistance?

Antimicrobial resistance (AMR) occurs when microorganisms naturally evolve in ways that cause medications used to cure infections to be ineffective. When the microorganisms become resistant to most antimicrobials they are often referred to as 'superbugs' (Edwards-Jones, 2018; World Health Organization, 2020).

Studies suggest there is excessive use of antibiotics in individuals with non-healing wounds (IWII, 2022). More judicious antimicrobial use in wound practice will contribute significantly to a reduction in AMR and help to reduce both poor health outcomes and the economic burden associated with side effects of antimicrobials. Reviewing wound care practice and aligning wound infection prevention and management with the goals and principles of AMS is imperative to addressing the global problem of AMR.

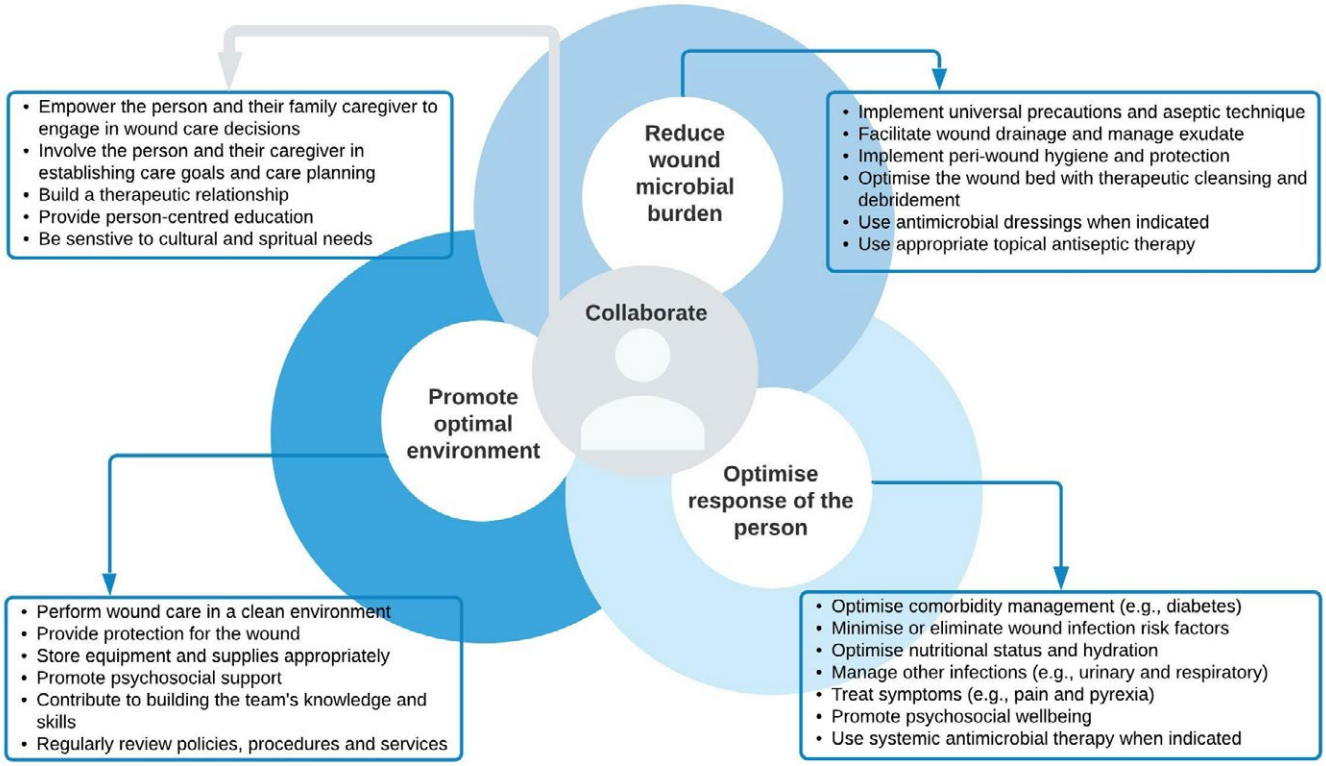

Figure 2: Holistic wound infection prevention and management

What is AMS?

AMS refers to the supervised and organised use of antimicrobial agents. In healthcare, this refers to a coordinated programme designed to decrease the spread of infections caused by multidrug-resistant organisms and improve clinical outcomes by encouraging appropriate and optimised use of all antimicrobials (The Association for Professionals in Infection Control and Epidemiology, 2021).

Initiatives that should form a component of AMS in the context of wound infection

Given the identified issues of AMR associated with wound care, the imperative to implement AMS strategies in ensuring judicious use of antimicrobials is clear. Table 2 provides an overview of initiatives that should form a component of AMS in the context of wound infection at governmental, organisational and clinical levels. The introduction of such initiatives will optimise antibiotic prescribing, reduce inappropriate antimicrobial use, reduce adverse consequences of antimicrobials (e.g. toxicity resistance) and reduce unnecessary economic burden (Rippon et al, 2021).

Clinicians play a significant role in ensuring their practice in prevention and management of wound infection is consistent with AMS. Clinicians should conduct an in-depth wound assessment to identify if the wound is clinically infected (Roberts et al, 2017).

There is no requirement for using topical antimicrobial agents based on individual assessment recognising comorbidities if there are no clinical signs and symptoms of wound infection. Antimicrobials should only be used in identified infected wounds, based on identification of the infecting organisms; antimicrobial use for chronic prophylaxis should be avoided other than in exceptional circumstances.

Scan the QR code to see Antimicrobial Resistance and Stewardship (IWII, 2022).

Table 2. Antimicrobial stewardship initiatives (IWII, 2022)

Government level antimicrobial stewardship initiatives
■ Promote global regulation of prescription and supply of antimicrobials
■ Support global initiatives focused on reducing AMR
■ Promote awareness of AMR in the health and animal sectors and the general public
■ Support and stimulate ongoing research on AMR and development of new antimicrobial agents
Organisational level antimicrobial stewardship initiatives
■ Provide adequate funding and resources to support AMS
■ Convene an AMS committee responsible for guiding and monitoring the use of antimicrobial agents in the facility
■ Develop institutional policies and procedures on the use of antimicrobial agents based on global guidance
■ Implement best clinical practice in wound infection prevention and treatment
■ Facilitate accurate diagnosis of wound infection with appropriate policies, resources and care pathways
■ Monitor trends in microbial sensitives in the facility
■ Audit antimicrobial prescribing and patterns of use
■ Monitor and publish incidence of wound infection, types of wounds being managed with antimicrobial agents and their effectiveness
■ Provide regular education to all stakeholders on AMR and AMS
Clinical level antimicrobial stewardship initiatives
■ Educate patients, their families and healthcare professionals regarding AMR and responsible use of antimicrobial agents
■ Avoid use of antimicrobials as a prophylactic therapy, except for wounds identified at high risk of infection
■ Use non-medicated options (e.g. non-medicated wound dressings) to manage infection when possible
■ Only use antimicrobials when a wound has been clinically identified as infected
■ Base antimicrobial selection on identification of the infecting organisms
■ Select antimicrobial agents with narrow-spectrum activity where possible
■ Reserve broad-spectrum agents for more resistant bacterial infections where possible
■ Continue the use of antimicrobial therapy for an appropriate duration to prevent development of resistance
■ Monitor therapeutic response to guide ongoing selection and use of antimicrobials

Conclusion

The IWII is a volunteer organisation that has been promoting prevention, identification and management of wound infection since 2006. The IWII (2022) consensus document, available in multiple languages, is free to download via Wounds International (www.woundsinternational.com), and from www.woundinfectioninstitute.com.

References

Burden M and Thornton M (2018) Reducing the risks of surgical site infection: the importance of the multidisciplinary team. *Br J Nurs* 27(17): 976–9

Dowsett C, Bellingeri A, Carville K et al (2020) A route to more effective infection management: The Infection Management Pathway. *Wounds International* 11(3): 50–7

Eberlein T (2009) *Critical colonisation and local infection - current therapy by use of polihexanide*. Available at: https://lohmann-rauscher.co.uk/downloads/clinical-evidence/SXP010-T-Eberlein-Critical-colonisation-and-local-infect.pdf

Edwards HE, Parker CN, Miller C et al (2018) Predicting delayed healing: The diagnostic accuracy of a venous leg ulcer risk assessment tool. *Int Wound J* 15(2): 258–65

Edwards-Jones V (2018) Antimicrobial resistance – challenges for the 21st century. *Wounds UK* 14(3): 46–51

Fletcher J and Barrett S (2018) Improving holistic assessment of chronic wounds: how to meet patient expectation using the new Best Practice Statement. *Wounds UK* 14(5): 92–5

Guest JF, Fuller GW, Vowden P (2018a) Venous leg ulcer management in clinical practice in the UK: costs and outcomes. *Int Wound J* 15(1): 29–37

Guest JF, Fuller GW, Vowden P (2018b) Diabetic foot ulcer management in clinical practice in the UK: costs and outcomes. *Int Wound J* 15(1): 43–52

Haesler E et al (2022) Establishing consensus on wound infection definitions. World Union of Wound Healing Societies 2022 Hybrid Congress. 2022. Abu Dhabi, UAE

International Wound Infection Institute (2016) *Wound Infection in Clinical Practice: Principles of Best Practice*. Wounds International, London. Available at: www.woundsinternational.com

International Wound Infection Institute (2022) *Wound Infection in Clinical Practice: Principles of Best Practice*. Wounds International, London. Available at: www.woundsinternational.com

Leaper DJ, Schultz G, Carville K et al (2012) Extending the TIME concept: what have we learned in the past 10 years? *Int Wound J* 9(Suppl 2): 1–19

Oropallo AR, Andersen C, Abdo R et al (2021) Guidelines for Point-of-Care Fluorescence Imaging for Detection of Wound Bacterial Burden Based on Delphi Consensus. *Diagnostics (Basel)* 11(7): 1219

Rippon MG, Rogers AA, Ousey K (2021) Antimicrobial stewardship strategies in wound care: evidence to support the use of dialkylcarbamoyl chloride (DACC)- coated wound dressings. *J Wound Care* 30(4): 284–96

Roberts CD, Leaper DJ, Assadian O et al (2017) The Role of Topical Antiseptic Agents Within Antimicrobial Stewardship Strategies for Prevention and Treatment of Surgical Site and Chronic Open Wound Infection. *Adv Wound Care (New Rochelle)* 6(2): 63–71

Siaw-Sakyi V (2017) Early wound infection identification using the WIRE tool in community health care settings: An audit report. *Br J Community Nurs* 22(Sup12): S20–S7

Siddiqui AR, Bernstein JM (2010) Chronic wound infection: facts and controversies. *Clin Dermatol* 28(5): 519–26

Swanson T et al (2015) Ten top tips: identification of wound infection in a chronic wound. *Wounds Middle East* 2(1): 20-5

The Association for Professionals in Infection Control and Epidemiology (2021) *Antimicrobial stewardship*. Available at: https://apic.org/Professional-Practice/PracticeResources/Antimicrobial-Stewardship/

World Health Organization (2020) *Antimicrobial resistance fact sheet*. WHO, Geneva, Switzerland. Available at: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance

World Union of Wound Healing Societies (2008) *Principles of best practice: Wound infection in clinical practice*. An international consensus. MEP Ltd: London

World Union of Wound Healing Societies (2020) *Optimising wound care through patient engagement*. Wounds International, London

Wounds International (2012) International consensus. *Optimising wellbeing in people living with a wound. An expert working group review*. Wounds International, London

Wounds UK (2018) *Best Practice Statement: Improving holistic assessment of chronic wounds*. Wounds UK, London

To cite this document:

Ousey K, Swanson T, Sussman G (2022) Wound Infection in Clinical Practice Made Easy. Available from: www. woundsinternational.com/made-easy

International Wound Infection Institute

This Made Easy supplement was developed by the IWII Committee with support from B Braun, ConvaTec, Essity, HARTMANN, Smith+Nephew and Urgo Medical

Authors

Dr Karen Ousey, Co-chair IWII, Professor of Skin Integrity, School of Human and Health Sciences, Institute of Skin Integrity and Infection Prevention, University of Huddersfield, Yorkshire

Terry Swanson NPWM, MHSc, FMACNP, Co-chair IWII, Fellow Wounds Australia, Wound Education Research Consultancy

Geoff Sussman, OAM, JP, Fellow Wounds Australia, Associate Professor of Wound Care Faculty of Medicine, Nursing and Health Science Monash University, Australia; Clinical Lecturer Medical Education, University of Melbourne, Australia

INTERNATIONAL WOUND INFECTION INSTITUTE

IWII WOUND INFECTION CONTINUUM AND MANAGEMENT GUIDE

Increasing microbial burden in the wound

As the continuum green shading darkens, microbial burden increases

CONTAMINATION	COLONISATION	LOCAL WOUND INFECTION COVERT (subtle)	LOCAL WOUND INFECTION OVERT (classic)	SPREADING INFECTION	SYSTEMIC INFECTION
Assess for wound infection					
• Microorganisms are present within the wound but are not proliferating • No significant host reaction is evoked • No delay in healing is clinically observed	•Microorganisms are present and undergoing limited proliferiation •No significant host reaction is evoked •No delay in wound healing is clinically observed	•Hypergranulation •Bleeding, friable granulation •Epithelial bridging and pocketing in granulation tissue •Increasing exudate •Delayed wound healing beyond expectations	•Erythema •Local warmth •Swelling •Purulent discharge •Wound breakdown and enlargement •New or increasing pain •Increasing malodour	•Extending induration •Spreading erythema •Inflammation or erythema >2cm from wound edge •Crepitus •Wound breakdown/ dehiscence with or without satellite lesions • Lymphangitis (swelling of lymph glands)	•Malaise •Lethargy or nonspecific general deterioration •Loss of appetite •Fever/pyrexia •Severe sepsis •Septic shock •Organ failure •Death
	Be alert for clinical indicators of potential biofilm				
	•Failure of appropriate antibiotic treatment •Recalcitrance to appropriate antimicrobial treatment •Recurrence of delayed healing on cessation of antibiotic treatment •Delayed healing despite optimal wound management and health support			• Increased exudate/moisture • Low-level chronic inflammation • Low-level erythema • Poor granulation/friable hypergranulation • Secondary signs of infection	
Initiate biofilm-based wound care when appropriate using step-down/step-up approach (see below)					
Perform therapeutic cleansing*					
• Select and use a wound cleansing solution based on resources and local policy • Use an inert cleansing solution prior to taking a wound sample • Cleanse the wound and periwound region					
				Confirm microorganisms and sensitivities	
				• Antibiotics as per culture sensitivities • Determine review dates	
		Debridement and post debridement care			
Debridement usually not required		• Use a topical antiseptic cleanser or surfactant soak • Initiation and method selected based on clinical need, goal, resources and local policy			
Apply a wound dressing					
• Select a wound dressing based on clinical assessment, goals of care, tissue type, exudate level, resources and local policy • Consider either a medicated/active wound dressing or a non-medicated wound dressing with antimicrobial action, consistent with local antimicrobial stewardship policy					
Following each review, document assessment and treatment, monitor progress and evaluate management					

Holistic management

Step-down/step-up biofilm based wound care#

INITIATE MULTIPLE THERAPIES IN COMBINATION	OPTIMISE THERAPY ACCORDING TO HEALING STATUS	DE-ESCALATE TREATMENT AS WOUND IMPROVES	EVALUATE WOUND HEALING TO DECIDE	STEP UP TO ADVANCED THERAPIES
• Aggressive debridement • Empirical topical antiseptics and systemic antibiotics • Manage host factors (e.g., pressure off-loading, compression therapy, diabetes management, optimise nutritional status) • DNA identification of microorganisms and point-of-care diagnostics where available	• Assess inflammation and healing status • Maintenance debridement • Optimise topical antiseptics and systemic antibiotics • Continue management of host factors	• Assess inflammation and healing status • Maintenance debridement • Re-evaluate need for topical antiseptics and systemic antibiotics • Continue management of host factors	• Standard care	• Standard care • Advanced therapy options: • Growth factors • Skin grafts • Combination products • Negative pressure wound • Cellular and tissue based products • Protease inhibitors
DAYS 1-4 (approx.)	DAYS 5-7 (approx.)	1-4 WEEKS (approx.)	CONTINUE UNTIL HEALED	

* refer to *Aseptic technique when performing a wound dressing procedure*.

Schultz, G. et. al., Consensus guidelines for the identification and treatment of biofilms in chronic nonhealing wounds. Wound Repair and Regeneration, 2017. 25(5): p. 744-757. Reproduced with permission.