Australian Wound Management Association Inc.

Bacterial impact on wound healing: From contamination to infection

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POSITION PAPER

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Foreword

Health professionals face many challenges in their practice but for those tasked with healing wounds there seems to be an abundance of situations where diagnosis and choice of appropriate therapies is not always straightforward. The interactions between microbes and wounds create some of the more difficult dilemmas – is the delayed healing due to bacteria, do I need to swab the wound, how do I respond to the bacteria the lab has cultured, do I use topical antiseptics or systemic antibiotics, what dressings best handle topical infection? These are just a sample of the issues the clinician often needs to resolve. Sue Templeton and her committee have produced this Australian Wound Management Association (AWMA) position document to provide the clinician with the latest knowledge on the complex interactions between bacteria and wounds, and assist them in their role as wound healer. It is not a clinical practice guideline, as that requires a much longer and more extensive appraisal of the literature, but AWMA feel that this document will be extremely useful. It is clear, concise and well presented- and I have no doubt it will be widely referred to and utilised. There will be many people with wounds, currently and in the future, who will suffer less and regain quality of life as a result of this work, and that is what we are all striving for.

Associate Professor Michael Woodward
President, Australian Wound Management Association.

Summary of recommendations:

1	Service providers should consider mechanisms to collect data on wound infections including prevalence, organisms cultured and bacterial resistance in all healthcare settings. More advanced data collection to evaluate the outcomes of wound infection such as treatment and patient response may be considered where appropriate.
2	Local health authorities, service providers and practitioners should use the Australian framework as outlined above for defining and collecting data related to surgical site infection (SSI).
3	Service providers and practitioners should adopt a consistent consensus framework for defining the level of bacterial impairment of wound healing based on assessment of the patient and their wound.
4	A wound management regimen should include strategies to minimise infection risk. These strategies should be embedded in service provider protocols and practices.
5	All wounds should be assessed regularly for the indicators of infection and outcomes of the assessment documented.
6	A wound should be considered infected if the clinical signs of local infection are present (even if wound swab results do not indicate infection).
7	A wound swab should generally be taken to guide appropriate antibiotic therapy but should not be regarded as binding.
8	Agents for treatment of wound infection should be tailored to the extent of infection and based on recommended treatment guidelines.
9	For complex, unresponsive, recalcitrant or recurrent infections consultation with a microbiologist or infectious disease specialist is recommended.
10	The length of treatment with topical and/or systemic agents should be determined by the response of the wound and the patient.
11	Topical antiseptic solutions should generally be used for treatment of topical contamination or minor skin infections and their use avoided on clean, healing wounds.
12	Topical antibiotics are rarely recommended for use on wounds due to the risk of resistance developing.
13	Topical antimicrobials should be used judiciously for appropriate clinical indications and their use evaluated regularly.
14	Regular wound assessment and documentation includes: • Identification of factors that might indicate infection and, if present those signs are acted upon. • Evaluation of the response of the patient and wound to any treatment for wound infection.

Preface

Bacteria are an essential component of life and are found in all corners of the planet. The human body relies on bacteria for normal physiological functioning. Indeed, the cellular organelle the mitochondria was probably once a bacteria that has become essential to cellular function. However, bacteria can also cause disease, injury and death.

A delicate balance exists in maintaining the bacteria humans need and preventing the opportunistic invasion of bacteria that will result in infection.

The wound offers bacteria an attractive environment in which they can potentially flourish and, if left unchecked, cause significant damage. With the potential for damaging infection and the surge in multi-resistant bacteria, practitioners have become increasingly challenged to find solutions to wound infection. There is considerable research and development focused on new technologies and innovations to identify and manage wound infection. It is hoped that using a global, collaborative approach new solutions will be found to reduce the burden of wound infection.

Scope of this document

Surgical site infection (SSI) is well defined and monitored (http://www.health.gov.au/internet/safety/publishing.nsf). Therefore, this document will only briefly address this. However, infection in wounds healing via secondary intention lacks definition and management can be variable so the majority of this document will address infections in these wounds.

Introduction and background

It is well recognised that bacteria can impair wound healing. This document outlines the position of the Australian Wound Management Association (AWMA) regarding definitions, diagnosis, investigation and management of the bacterial impairment of wound healing. Whilst it is acknowledged other microbes, such as viruses, parasites and fungi can impair wound healing, management of these infections is not within the scope of this document.

This document should be considered in conjunction with local influences including service provider characteristics and protocols, and professional and legal requirements.

Scope of the problem

The true extent of bacterial impairment of wound healing is unknown.

Many hospitals monitor their inpatient infection rates and these are reported through coding mechanisms. Studies have demonstrated that surgical site infections result in increased hospital length of stay and increased costs. However, for patients post hospital discharge and those who develop wound infections in the community, reporting mechanisms are often poor or non-existent. Infection in any setting can result in increased costs (e.g. diagnostic studies, antibiotics), increased resource use due to delayed wound healing, lost productivity and pain.

Severe infection leading to sepsis has the potential to result in significant patient morbidity or even death.

Recommendation 1
Service providers should consider mechanisms to collect data on wound infections including prevalence, organisms cultured and bacterial resistance in all healthcare settings. ***More advanced data collection to evaluate the outcomes of wound infection such as treatment and patient response may be considered where appropriate.***

Surgical site infections

Significant work has been undertaken by some health jurisdictions and service providers to define, detect, collect data on and manage surgical site infections (SSI).

Many service providers require that any infection that might be related to a surgical procedure must be reported as a clinical indicator.

Usually, recording of the rates for SSI are surgical procedure specific as identified by the ICD-10-AM coding system used to group like procedures. In 2004 the Australian Safety and Quality Council and the Australian Infection Control Association developed definitions and general reporting instructions for SSI. These were approved by the Healthcare Associated Infections Advisory Committee. Whilst the Australian Safety and Quality Council ceased its activities on 31 December 2005, the Australian Commission for Safety and Quality in Healthcare has assumed responsibility for the Council's documents and initiatives - including those related to Surgical Site Infection.

Please consult the relevant source (listed below) for a full description of diagnostic indicators and reporting recommendations.
http://www.health.gov.au/internet/safety/publishing.nsf

Table 1 Definitions for SSI

Superficial incisional SSI	Infection involves only skin or subcutaneous tissue of the incision and occurs within 30 days after the operative procedure.
Deep incisional/organ space SSI	Infection involves deep soft tissues (e.g. fascial and muscle layers) AND/OR organs/spaces opened or manipulated during an operation and occurs within 30 days after the operative procedure if implant not present or within one year if implant insitu.

Recommendation 2
Local health authorities, service providers and practitioners should use the Australian framework as outlined above for defining and collecting data related to SSI.

Wounds healing by secondary intention

With over 270,000 Australians living with chronic wounds, the burden of infection is unknown, but likely to be considerable.

AWMA encourages policy makers, health jurisdictions and service providers to consider methodologies for monitoring and reporting chronic wound infection rates and evaluation of management strategies.

With collaborative analysis and commitment to evidence based practice, optimal outcomes for the patient and the health system can be achieved. This document is a guide to be used in conjunction with clinical judgement and consideration of individual patient and service delivery parameters to identify and manage bacterial impairment of wound healing. This guide does not replace the advice of an appropriately trained and skilled health care practitioner.

The bacterial impact continuum

There are several classification systems and many definitions used to categorise the impact of bacteria on a wound and the patient. Some practitioners continue to use the concept that $>10^5$ microorganisms per gram of tissue constitutes infection. Whilst this might remain true in some circumstances, this does not account for factors that might compromise the patient's immune response or for bacteria that are particularly virulent. The effect of bacteria on wound healing can best be conceptualised by the following relationship:

$$\frac{\textbf{Number of bacteria x virulence}}{\textbf{Patient resistance}}$$

For some practitioners and in certain care settings quantitatively determining the numbers and types of bacteria accurately through wound swabbing or biopsy may not be possible.
Reliance on clinical signs is paramount in establishing where on a bacterial impact continuum a particular wound and patient is at any given time.

Table 2 outlines a classification system that can be used to assist practitioners determine how bacteria might be impacting on the wound healing process in wounds healing via secondary intention. This classification system considers the effect of the bacteria on the wound and patient. It is not necessarily related to increasing numbers of bacteria, but in many instances increasing numbers of bacteria and an increasing variety of bacteria will result in greater impairment to wound healing and possibly local and/or systemic effects.

Wound infection can be defined as multiplication of bacteria that overwhelm host defences, resulting in disruption of healing and damage to the wound.

Wound infection can result in local and systemic host responses.

A wound can move in either direction along the bacterial impact continuum.
In clinical practice the boundaries between levels of bacterial impairment of wound healing are often difficult to distinguish and data can be misleading or may not support the expected results.

For example, clinically a wound can exhibit signs of local infection but a wound swab shows 'no growth'. Therefore, it is important for practitioners to remain vigilant and flexible in their practice and use all available tools and evaluation methods.

Table 2 Bacterial impact on wound healing by secondary intention (Also refer to appendix 1)

Level of bacterial impairment	*Bacterial activity*	*Degree of impairment to wound healing & clinical signs*
Contamination	Bacteria are on the wound surface. No division is occurring.	No impairment to healing. No obvious clinical signs of infection.
Colonisation	Bacteria are dividing.	No impairment to healing. No obvious clinical signs of infection. (Clinical wound appearance does not usually differ from contamination)
Topical infection (Critical colonisation)	Bacteria are dividing. Bacteria and/or their products have invaded the wound surface. There might be an increasing variety of bacteria present. Biofilm may be present.	Impairment to healing. Clinical signs of infection may not be obvious or are subtle. (Refer to table 3)
Local infection	Bacteria and/or their products have invaded the local tissues.	Impairment to healing. Usually obvious clinical signs of infection localised to wound environment and immediate peri-wound tissue. (Refer to table 3
Regional / Spreading infection / Cellulitis	Bacteria and/or their products have invaded surrounding tissues.	Impairment to healing. Usually obvious clinical signs of infection. May have systemic signs.
Sepsis	Bacteria and/or their products have entered the bloodstream and may spread to distant sites or organs.	Impairment to healing. Usually obvious systemic clinical signs: patient usually acutely unwell. Damage to organs may occur.

There is controversy about the use of the term Critical Colonisation. Whilst the term is widely used and accepted in current literature, the term implies a level of colonisation – and colonisation is not associated with impaired healing. As the clinical significance of infection is bacterial impairment of wound healing, the term 'topical infection' might be a more accurate descriptor than critical colonisation.

Topical infection implies that there is impairment to wound healing at a wound bed level and accounts for the improvement often seen when topical antimicrobials (which may include topical antiseptic washes) are used. The term implies that infection has not invaded the deeper tissues.

Whatever term is used, many practitioners believe they can identify a level of bacteria delaying wound healing; however, the clinical signs are often not consistent with those commonly recognised as features of infection.

Recommendation 3

Service providers and practitioners should adopt a consistent consensus framework for defining the level of bacterial impairment of wound healing based on assessment of the patient and their wound.

Effects of bacteria on the wound environment

Bacteria can impair wound healing through the following mechanisms:

- Formation of biofilm and the effects of the biofilm – including an overall increase in pathogenic effect due to the interactions of bacteria within the biofilm
- Production of toxins and destructive enzymes
- Release of free radicals
- Degradation of growth factors
- Secretion of immune-evasive factors and down-regulation of the immune response
- Consumption of local oxygen
- Localised thrombosis and release of vasoconstricting metabolites
- Interference with collagen formation
- Production of overexuberant small vessel angiogenesis
- Production of metabolic products

This can lead to a chronic inflammatory state and promote increased exudate that can have a range of toxic effects including degrading growth factors and matrix metalloproteinases

Biofilms

It is recognised that healing of many chronic wounds is impaired by formation of biofilms. A biofilm forms when bacteria (often several species) attach to a wound and encase themselves in an exopolymeric substance. These bacteria vary in morphology and physiology to planktonic, single cell bacteria. The bacteria living in a biofilm are likely to have increased metabolic efficiency, substrate accessibility, improved resistance to environmental stress and substances, and increased ability to cause local tissue damage and infection. A biofilm is very difficult to directly eradicate. Penetration of a biofilm by antibiotics and topical antimicrobials is very limited.

Wound swabbing techniques are less likely to collect bacteria within a biofilm as swabs generally only collect free, planktonic bacteria.

This can result in misleading findings, which in turn can lead to ineffective therapies being implemented. Aggressive debridement techniques are usually required to remove a biofilm. Managing all systemic and local conditions impacting on wound healing will assist in the body's ability to deal with a biofilm. However, if the underlying conditions that led to a biofilm - both at a systemic and local level - are not treated, the biofilm is likely to recur.

Minimising infection risk

Infection risk should be minimised for all patients with a wound through the following strategies:

- Optimisation of patient immune response through good nutrition, adequate rest, avoidance of smoking and control of other health conditions (e.g. diabetes, reduction of stress).
- Removal of non-viable wound tissue (unless contra-indicated).
- Adherence to strict infection control principles, including hand hygiene.
- Adequate wound cleansing to remove foreign bodies, debris and remnants of dressing products.
- Control of excess exudate including removal by cleansing and appropriate choice of dressing.
- Use of dressings that minimize potential for entry of bacteria where possible.
- Education of patients and practitioners.

Recommendation 4

A wound management regimen should include strategies to minimise infection risk. These strategies should be embedded in service provider protocols and practices.

Indicators of infection

There are several broad indicator categories available to assess for bacterial impairment of wound healing. These categories include clinical, microbiological, haematological and radiological. Some or all indicators can be used to determine infection, its severity and management.

Table 3 Clinical indicators of infection

Level of bacterial impairment	*Clinical indicators of bacterial impairment to wound healing*
Topical infection / Critical colonisation	Dull wound tissue – absence of vibrant granulation tissue Slough Failure of wound to decrease in size or increase in wound size Increased exudate Hypergranulation / friable tissue Demarcated and/or rolled and/or raised wound margins
Local infection	Wound breakdown / increase in wound size Erythema – usually localised to peri-wound tissue Increased pain or unexplained pain Oedema – usually localised to peri-wound tissue Purulent or discoloured, viscous exudate Malodour Bridging and/or pocketing within the tissue Increased temperature of peri-wound tissue
Regional/Spreading infection Cellulitis	Spreading erythema – more than 2cm from wound margin Induration of regional tissues Fever Oedema of regional tissues Malaise and/or general feeling of unwellness
Sepsis	High fever or hypothermia Lymphangitis and regional lymphadenopathy Delirium Organ compromise or failure Circulatory shock – hypotention, tachypnoea, tachycardia

Some or all of the above signs might be present. Bacterial impairment of wound healing is a continuum; therefore worsening infection may or may not include some or all of the factors in the preceding categories.

It should be noted that:

- *In some persons the traditional clinical signs of inflammation (erythema, oedema, pain, heat) may not be present due to a dampening of the immune response as a result of ischaemia, neuropathy or immunosuppression* (which can result from age, poor nutrition, other co-morbidities and medications).
- The traditional clinical signs of inflammation can also be seen in conditions not associated with bacteria, including: Charcot's arthropathy, pressure-related injury or recurrent tissue injury. In addition, some wounds are themselves part of an inflammatory but non- infection condition, such as vasculitis.
- Darkly pigmented skin or changes such as lipodermatosclerosis can make assessment of the peri-wound tissue difficult.
- Some wound aetiologies may present with a relatively specific range of signs that indicate infection.

Other indicators of infection:

Microbiological:

A wound swab should be performed, according to service provider protocol:

- When the signs of infection are present, in an attempt to determine the causative bacteria and most appropriate antibiotic treatment.
- When a wound has not responded to antibiotic therapy.

The Levine technique is recommended for collecting a wound swab.

Table 4: Levine Technique for Taking a Wound Swab

Procedure	*Precautions*	*Rationale*
Remove dressing and discard	Do not swab old dressing	May not collect causative organsims
If necessary, remove/debride non viable tissue	Avoid swabbing non viable tissue	May not collect causative organisms
Cleanse wound with saline or water	Do not cleanse wound with antiseptics Do not swab pooled, stale exudate	May kill or inhibit causative organisms May not collect causative organisms
Wait 2-5 minutes		Allows fresh exudate to rise to wound surface
If wound is fairly dry, moisten swab with sterile normal saline (available in boot stock), if wound is moist swab can be used dry.		Maximises uptake of exudate by swab to enhance a higher recovery rate of bacteria and therefore more precise data for sampling
Using moderate pressure depress and rotate the swab against a 1cm^2 area of viable wound tissue	Avoid wound margins	Assists in collection of fresh exudate
Place swab in transport medium and seal container.		
Transport to pathology laboratory for processing as soon as possible	Avoid over-heating of sample.	

A tissue biopsy might be useful for identifying causative bacteria in recalcitrant or unusual infections.

It should be noted that a wound swab may not provide an accurate representation of the bacteria impairing healing for several reasons including:

- Poor wound swabbing technique
- Failure to collect the causative bacteria or collection of non pathogenic bacteria
- Inability of regular swabs to collect anaerobic bacteria – specific swabs are required
- Presence of a biofilm
- Use of antiseptics prior to wound swabbing
- Use of antibiotic therapy at the time of wound swabbing

Blood cultures should be performed if sepsis is suspected.

Haematological:
Increased white cell counts, erythrocyte sedimentation rates (ESR) and/or C-reactive protein (CRP) can assist in detecting a physiological response to bacteria.

Radiological:
MRI, plain x-ray, bone scan, labelled leucocyte scan or bone biopsy can be useful for determining the presence of osteomyelitis. MRI is the recommended investigation for osteomyelitis. However, not all service providers have access to MRI and therefore alternative investigations may be necessary.

It should be noted that:

- Biopsy, haematological and radiological indicators are usually undertaken by specialist practitioners. However, lack of ready access to these services should not be a barrier to diagnosing infection.
- Wound swabs results should not over-rule clinical judgement. If a swab result seems inconsistent with the clinical features, antimicrobial therapy may need to be guided by clinical judgement. For instance, a bright green exudate is highly suggestive of *Pseudomonas* infection and appropriate antibiotics could be used even if the swab fails to culture Pseudomonas. Bright red 'beefy' tissue may be indicative of *Streptococci* infection.

Recommendation 5
All wounds should be assessed regularly for the indicators of infection and outcomes of the assessment documented.

Recommendation 6
A wound should be considered infected if the clinical signs of local infection are present (even if wound swab results do not indicate infection).

Recommendation 7
A wound swab should generally be taken to guide appropriate antibiotic therapy but should not be regarded as binding.

Management of infection

Management of wound infection will depend on: the severity of infection; available resources; and patient factors (i.e. preferences, allergies).

Management of infection involves:

- Treatment of the local wound environment - including regular debridement of non viable tissue (unless contraindicated).
- Support of the patient's immune system- e.g. reviewing immunosuppressant therapy and optimising nutritional status
- Control of other health factors and illnesses that might impair healing
  e.g. malnutrition, micronutrient deficiency, diabetes, smoking.
- Patient education and participation.

Appropriate management of wound infection involves treating the right bacteria with the right agent/s, delivered in the right manner for the right length of time.

Table 4: Management of wound infection

Level of bacterial impairment	*Management*
Topical infection (Critical colonisation)	Primary agents – topical antimicrobials and washes with topical antiseptic solution. (Antibiotics are not required.)
Local infection	Primary agent – systemic enteral antibiotics Adjunct agent – topical antimicrobials
Regional/Spreading infection Cellulitis	Primary agent – systemic enteral or parenteral antibiotics Adjunct agent – topical antimicrobials
Sepsis	Primary agent – systemic parenteral antibiotics

Primary management agents are those recommended as first-line treatment. Adjunct agents are recommended as secondary agents that might assist in controlling topical bioburden but will not be adequate to treat deeper infection. Adjunct agents might or might not be used depending on service provider, wound and patient factors.

In determining the most appropriate systemic antibiotic agents, authoritative texts can be used as a guide.

The Australian Therapeutic Guidelines for Antibiotic therapy include recommended treatment regimens for various skin and soft tissue infections and this is a valuable resource to guide practice. The Australian Medicines Handbook includes comprehensive information regarding use of systemic antibiotics. Referral for specialist services provided by microbiologists and infectious diseases practitioners should be considered for complex, unresponsive, recalcitrant or recurrent infections that do not respond to standard, recommended antibiotic therapy.

Empiric, systemic antibiotics should be commenced immediately when signs of clinical infection are present.

Review of the appropriateness of the antibiotic occurs when wound biopsy or wound swab or blood culture results are received. For most wound infections a defined course of systemic antibiotics is satisfactory treatment. However, occasionally prolonged treatment with systemic antibiotics might be indicated where cessation of antibiotics results in rapid deterioration of the wound, cessation of healing or wound recurrence.

Recommendation 8
Agents for treatment of wound infection should be tailored to the extent of infection and based on recommended treatment guidelines.

Recommendation 9
For complex, recurrent, recalcitrant or unresponsive infections consultation with a microbiologist or infectious disease specialist is recommended.

Recommendation 10
The length of treatment with topical and/or systemic agents should be determined by the response of the wound and the patient.

Topical antiseptics

Topical antiseptic solutions can be of benefit in wound management if they are used for the correct indications.

Antiseptics have generally remained free from the resistance problems experienced by antibiotics, as antiseptic agents act against bacteria and microbes in several ways, rather than the single mechanism of action antibiotics employ. Topical antiseptic solutions can be very useful for decontamination following wounding, particularly where the wound is likely to have been grossly contaminated. For example, a skin tear sustained in the garden or a laceration with a dirty knife. Topical antiseptic solutions can also be of benefit for some patients with minor skin-related infections.

Topical antiseptic solutions are not indicated for use on clean, healing wounds as they can impair healing.

The most efficacious topical antiseptic solutions are povidone iodine and chlorhexidine. However, occasionally other solutions may be appropriate for use in wound management (e.g. acetic acid or potassium permanganate). Most topical antiseptic solutions are rapidly inactivated in a wound environment, therefore their efficacy is usually short lived. When using topical antiseptic solutions it is recommended that they are not mixed with other topical applications as this can reduce their efficacy and potentially promote resistance. It is recommended that the solution is applied liberally, left it in contact with the skin and/or wound for 3-5 minutes, and then rinsed off with saline or potable water. Often, management with topical antiseptic solutions is only required for a limited time period. Once the problem is rectified, wound cleansing with saline or potable water is recommended.

Topical antiseptic solutions can cause sensitivity and irritation in some patients. If this occurs, their use should be discontinued.

Recommendation 11
Topical antiseptic solutions should generally be used for treatment of topical contamination or minor skin infections and their use avoided on clean, healing wounds.

Topical antimicrobials

Antimicrobial is a broad term used to describe a variety of agents that kill or inhibit the growth or replication of bacteria and other microbes.

However:
Topical antimicrobials should be used judiciously for appropriate clinical indications. Topical antimicrobials are not indicated for use in clean, healing wounds. The most commonly used topical antimicrobials include (but are not limited to) products containing silver, therapeutic honey, hypertonic salt, iodine, chlorhexidine, metronidazole, murpirocin or polyhexamethylene biguanide (PHMB).

Topical antimicrobials can be divided in several ways:

- *Antiseptic and antibiotic*
- *Mild and powerful*

An antiseptic is an agent that non-selectively inhibits the growth of bacteria and micro-organisms.

- Most agents promoted as ‘topical antimicrobial’ have antiseptic effects.

A mild topical antimicrobial is generally an agent that:

- Is only held within the product and not released, or
- Is released in only very small quantities, and/or
- Does not have a sustained mechanism of action

A powerful topical antimicrobial is generally an agent that:

- Is released from the product into the wound environment, and
- Is released in moderate to high quantities, and
- Has a sustained mechanism of action

An antibiotic is an agent that can selectively inhibit or kill bacteria.

Due to the risk of resistance and sensitisation, topical antibiotics are rarely appropriate for wound management.

Generally powerful topical antimicrobials are indicated where the practitioner believes that:

- *Bacteria (or other microbes) are impairing wound healing and a topical agent will be of benefit, and/or*
- *The wound is at significant risk of infection and if infection occurred catastrophic consequences could result*
  (e.g. patients with major burns or a neuro-ischaemic foot wound).

Topical antimicrobials are sometimes indicated for highly exuding or malodorous wounds as these clinical signs are often due to the actions of bacteria.
The effectiveness of topical antimicrobials should be evaluated regularly. Patient and wound management should be reviewed if topical antimicrobials fail to result in wound improvement.

If a wound has failed to improve after four weeks use of topical antimicrobials:

- *Other factors impairing healing should be considered as these may be the cause of failure to heal, or*
- *Consider the need for treatment with a more powerful agent (topical antimicrobial or systemic antibiotic).*

Recommendation 12
Topical antibiotics are rarely recommended for use on wounds due to the risk of resistance developing.

Recommendation 13
Topical antimicrobials should be used judiciously for appropriate clinical indications and their use evaluated regularly.

Local wound management

Good local wound management utilising the principles of wound bed preparation will assist in managing bacterial impairment of wound healing and preventing recurrence of infection. The concept of TIME (refer to table 5) can be used to guide local wound management.

Table 5: Local wound management for infected wounds

Element	*Aim*	*Practice application*
T tissue viability	Remove non viable tissue (unless contra-indicated)	Debride wound as necessary (unless contraindicated). Regular, repeated debridement of chronic wounds may be necessary. Cleanse wound at each dressing change.
I infection and inflammation control	Treat infection and chronic inflammation and prevent recurrence	Use antimicrobial agents and antibiotics as indicated and regularly evaluate patient and wound response. Use good infection control practices including hand hygiene. Use dressings that minimise environment contact wherever possible. Seek specialist advice for management of chronic inflammation.
M moisture balance	Maintain optimal wound moisture, temperature and pH	Use dressings that regulate the wound moisture level to maintain a moist wound environment (unless contra-indicated). Avoid changing dressings too frequently. Minimise wound exposure. Avoid using hot or cold solutions.
E edge of wound and evaluation	Monitor wound progress to determine if management is effective	Assess the wound systematically and regularly. Document wound size and progress regularly. Reassessment treatment if the wound fails to progress and this is the expectation.

Recommendation 14

Regular wound assessment and documentation includes:

- ***Identification of factors that might indicate infection and, if present those signs are acted upon.***
- ***Evaluation of the response of the patient and wound to any treatment for wound infection.***

Refer to appendix 2 for an overview of the prevention, classification, diagnosis and management of infection

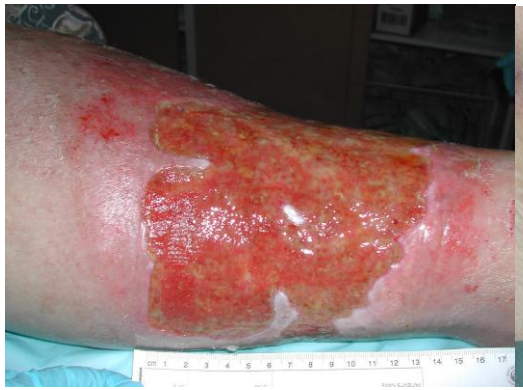
Conclusion

Bacterial impairment of wound healing is a significant burden on patients, service providers and the health system. A systematic approach to preventing, identifying and managing wound infection can reduce this burden and improve the lives of persons with a wound. Policy makers, service providers and practitioners are encouraged to adapt these recommendations to their local care setting. It is only through coordinated, consistent and persistent efforts that the impact of bacteria on wound healing can be minimised.

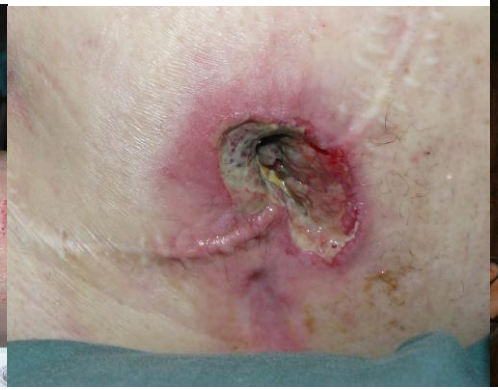
Appendix 1: The infection continuum

Increasing clinical signs and increasing harm to patient

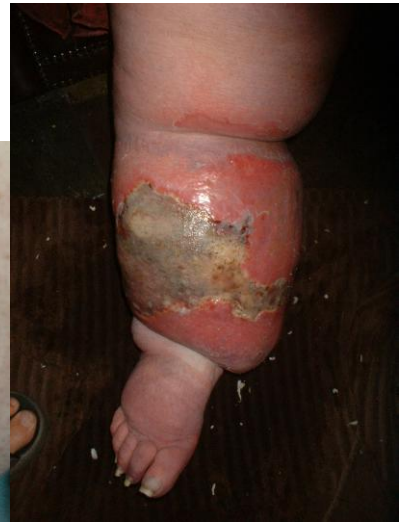
Contamination	Colonisation	Topical infection	Local infection	Regional infection	Sepsis
No overt signs of infection		May be local subtle signs of infection	Usually overt local signs of infection	Usually overt regional signs of infection	Usually overt systemic signs of infection
Wound healing progresses		Wound healing impaired			Patient health impaired
Host/Patient defences prevail					Bacteria prevail



Topical infection



Local infection



Regional infection (cellulitis)

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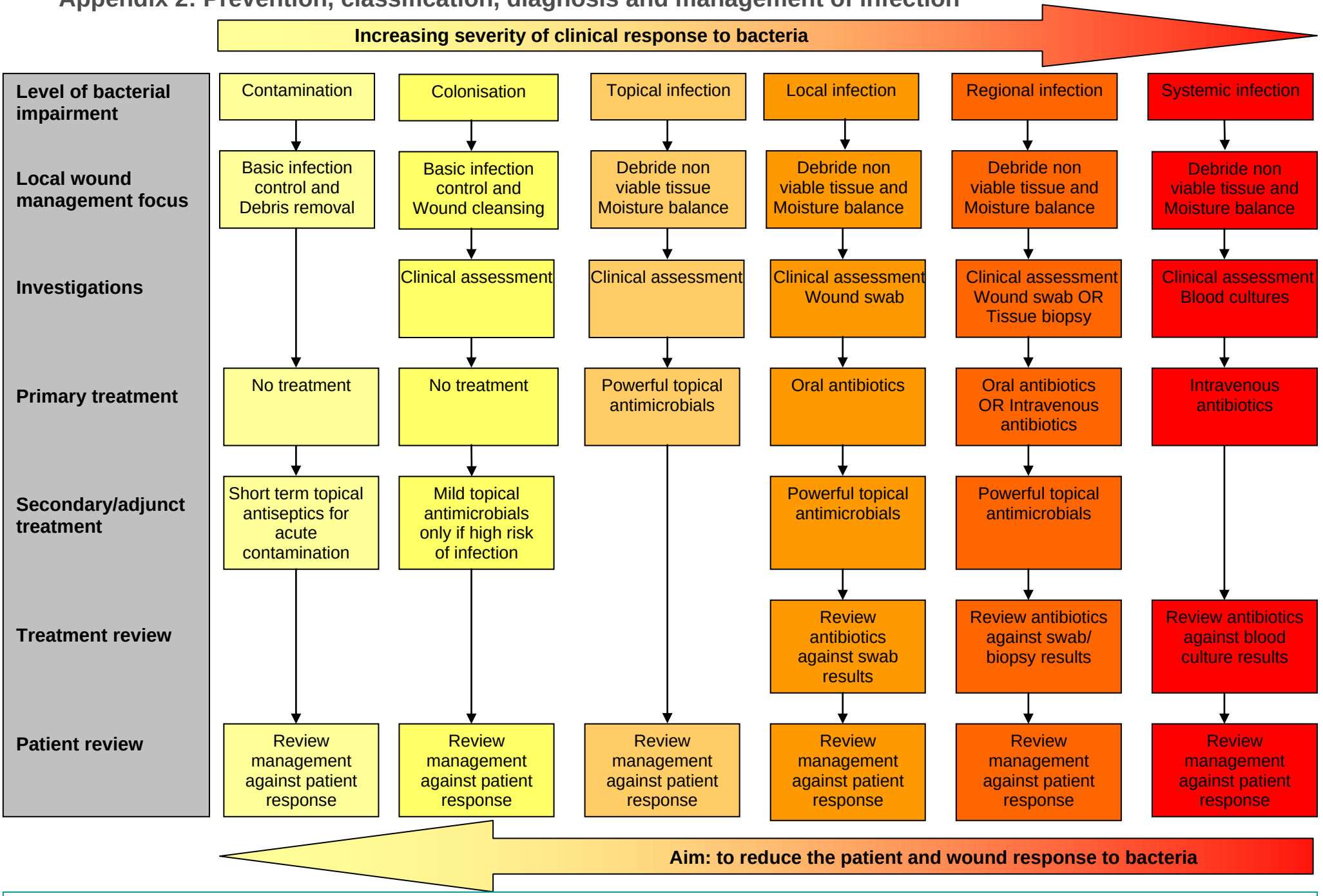
Appendix 2: Prevention, classification, diagnosis and management of infection



Glossary

Antimicrobial	A broad term used to describe a variety of agents that kill or inhibit the growth or replication of bacteria and other microbes.
Healing by secondary intention	Wounds that heal by granulation and contraction.
Patient	The person with a wound. Can also be known as a client, resident, consumer or customer.
Peri-wound	The area of integument immediately surrounding the wound.
Potable	Water suitable for human consumption.
Practitioner	An individual health care provider/clinician.
Service provider	Any person, organisation or institution providing wound management services.
Wound infection	Multiplication of bacteria that overwhelm host defences, resulting in disruption of healing and damage to the wound. Wound infection can result in local and systemic host responses.

Bibliography

AAWC (Association for the Advancement of Wound Care) 2008 Advancing your practice: Understanding wound infection and the role of biofilms, Malvern, PA.

Australian Commission on Safety and Quality in Healthcare 2004. www.health.gov.au/internet/safety/publishing.nsf Accessed 1/6/08

Australian Wound Management Association (AWMA) 2010 Standards for wound management 2nd Edition, www.awma.com.au

Cutting, K.F. & White, R. 2004, Defined and refined: criteria for identifying wound infection revisited, British Journal of Community Nursing, Vol 9, No 3, Supp, pp S6-S15.

EWMA (European Wound Management Association) 2004, EWMA Position Document: Wound bed preparation in practice, Medical Education Partnership, London.

EWMA (European Wound Management Association) 2005, EWMA Position Document: Identifying criteria for wound infection, Medical Education Partnership, London.

EWMA (European Wound Management Association) 2005, EWMA Position Document: Management of wound infection, Medical Education Partnership, London.

MacLellan, D.G. (ed) 2007, woundGLOSSARY: Terminology for wound practitioners, Health Education and Management Innovations.

Schultz, G.S. Barillo, D.J. Mozingo, D.W. & Chin, G. A. 2004, Wound bed preparation and a brief history of TIME, International Wound Journal, Vol 1, No 1, pp 19-32.

Sibbald, R.G. Orsted, H. Schultz, G.S. Coutts, P. & Keast, D. 2003. Preparing the wound bed 2003: focus on infection and inflammation, OstomyWound Management, Vol 49, No 11, pp 24-51.

Templeton, S. 2005. Management of chronic wounds: The role of silver-containing dressings, Primary Intention, Vol 13, No 4 pp 170-9.

WUWHS (World Union of Wound Healing Societies), 2008, Wound infection in clinical practice: An international consensus, International Wound Journal, Vol 5, Suppl 3, pp 1-11.

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