



AUSTRALIAN COMMISSION ON
SAFETY AND QUALITY IN HEALTHCARE



AUSTRALIAN GUIDELINES FOR THE Prevention and Control of Infection in Healthcare



WORKING TO BUILD A HEALTHY AUSTRALIA

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ISBN Online: 1864965223

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Paper-based publication

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ISBN Print: 1864965282

This document should be cited as: NHMRC (2010) Australian Guidelines for the Prevention and Control of Infection in Healthcare. Commonwealth of Australia.

Acknowledgements

Infection Control Guidelines Steering Committee

The production of a document such as this requires a considerable effort over a long period. Special thanks and acknowledgment are due to the Infection Control Guidelines Steering Committee members for their generous donation of time, their technical advice and ongoing commitment to the project.

Dr Ann Koehler (Chair); Dr Nick Demediuk; Prof Chris Baggoley; Ms Sylvia Gandossi; Clinical Prof Keryn Christiansen; A/Prof Tom Gottlieb; Dr Liz Coates; Mr Brett Mitchell; Prof Peter Collignon; Assoc Prof Peter Morris; Dr Celia Cooper; Ms Claire Boardman

NHMRC—ICG Project Team, Canberra

Tanja Farmer; Cathy Mitchell; Stephanie Goodrick; Kay Currie

Technical writers—Ampersand Health Science Writing

Elizabeth Hall; Jenny Ramson

Australian Commission for Safety and Quality in Health Care

Marilyn Cruickshank; Susanne Panasko; Sue Greig

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Summary of recommendations

These guidelines provide recommendations that outline the critical aspects of infection prevention and control. The recommendations were developed using the best available evidence and consensus methods by the Infection Control Steering Committee.¹ They have been prioritised as key areas to prevent and control infection in a healthcare facility. It is recognised that the level of risk may differ according to the different types of facility and therefore some recommendations should be justified by risk assessment. When implementing these recommendations all healthcare facilities need to consider the risk of transmission of infection and implement according to their specific setting and circumstances.

The recommendations should be read in the context of the evidence base. This is discussed in Sections B1, B2 and B3, which also include advice on the practical application of the recommendations. The table below lists recommendations and the section of the guidelines in which they are discussed.

Recommendation	Refer to:
Standard precautions (see Section B1)	
Hand hygiene	
<p>1 Routine hand hygiene</p> <p>Hand hygiene must be performed before and after every episode of patient contact. This includes:</p> <ul style="list-style-type: none"> • before touching a patient • before a procedure • after a procedure or body substance exposure risk • after touching a patient • after touching a patient's surroundings. <p>Hand hygiene must also be performed after the removal of gloves.</p>	<p>Section B1.1.2 Page 35</p>
<p>2 Choice of product for routine hand hygiene practices</p> <p>For all routine hand hygiene practices in healthcare settings, use alcohol-based hand rubs that:</p> <ul style="list-style-type: none"> • contain between 60% and 80% v/v ethanol or equivalent • meet the requirements of EN1500. 	<p>Section B1.1.3 Page 37</p>
<p>3 Choice of hand hygiene product when hands are visibly soiled</p> <p>If hands are visibly soiled, hand hygiene should be performed using soap and water.</p>	<p>Section B1.1.3 Page 37</p>
<p>4 Hand hygiene for Clostridium difficile and non-enveloped viruses</p> <p>Hand hygiene should be performed using soap and water when Clostridium difficile or non-enveloped viruses such as norovirus are known or suspected to be present and gloves have not been worn. After washing, hands should be dried thoroughly with single-use towels.</p>	<p>Section B1.1.3 Page 40</p>
Personal protective equipment	
<p>5 Wearing of aprons/gowns</p> <p>Aprons or gowns should be appropriate to the task being undertaken. They should be worn for a single procedure or episode of patient care and removed in the area where the episode of care takes place.</p>	<p>Section B1.2.3 Page 47</p>

¹ Membership and terms of reference of the Infection Control Steering Committee are given in Appendix 1.

Recommendation	Refer to:
<p>6 Use of face and protective eyewear for procedures</p> <p>A surgical mask and protective eyewear must be worn during procedures that generate splashes or sprays of blood, body substances, secretions or excretions into the face and eyes.</p>	<p>Section B1.2.4 Page 49</p>
<p>7 Wearing of gloves</p> <p>Gloves must be worn as a single-use item for:</p> <ul style="list-style-type: none"> • each invasive procedure • contact with sterile sites and non-intact skin or mucous membranes • any activity that has been assessed as carrying a risk of exposure to blood, body substances, secretions and excretions. <p>Gloves must be changed between patients and after every episode of individual patient care.</p>	<p>Section B1.2.5 Page 51</p>
<p>8 Sterile gloves</p> <p>Sterile gloves must be used for aseptic procedures and contact with sterile sites.</p>	<p>Section B1.2.5 Page 51</p>
<p>Handling and disposal of sharps</p>	
<p>9 Safe handling of sharps</p> <p>Sharps must not be passed directly from hand to hand and handling should be kept to a minimum.</p> <p>Needles must not be recapped, bent or broken after use.</p>	<p>Section B1.3.2 Page 63</p>
<p>10 Disposal of single-use sharps</p> <p>The person who has used the single-use sharp must be responsible for its immediate safe disposal. Used disposable sharps must be discarded into an approved sharps container at the point-of-use. These must not be filled above the mark that indicates the bin is three-quarters full.</p>	<p>Section B1.3.3 Page 69</p>
<p>Routine environmental cleaning</p>	
<p>11 Routine cleaning of surfaces</p> <p>Clean frequently touched surfaces with detergent solution at least daily, and when visibly soiled and after every known contamination.</p> <p>Clean general surfaces and fittings when visibly soiled and immediately after spillage.</p>	<p>Section B1.4.2 Page 69</p>
<p>12 Cleaning of shared clinical equipment</p> <p>Clean touched surfaces of shared clinical equipment between patient uses, with detergent solution.</p> <p>Exceptions to this should be justified by risk assessment.</p>	<p>Section B1.4.2 Page 69</p>
<p>13 Surface barriers</p> <p>Use surface barriers to protect clinical surfaces (including equipment) that are:</p> <ul style="list-style-type: none"> • touched frequently with gloved hands during the delivery of patient care • likely to become contaminated with blood or body substances • difficult to clean. <p>Exceptions to this should be justified by risk assessment.</p>	<p>Section B1.4.2 Page 73</p>
<p>14 Site decontamination after spills of blood or other potentially infectious materials</p> <p>Spills of blood or other potentially infectious materials should be promptly cleaned as follows:</p> <ul style="list-style-type: none"> • wear utility gloves and other PPE appropriate to the task; • confine and contain spill, clean visible matter with disposable absorbent material and discard the used cleaning materials in the appropriate waste container • clean the spill area with a cloth or paper towels using detergent solution. <p>Use of chemical disinfectants such as sodium hypochlorite should be based on assessment of risk of transmission of infectious agents from that spill.</p>	<p>Section B1.4.3 Page 76</p>

Recommendation	Refer to:
Transmission-based precautions (see Section B2)	
Contact precautions	
<p>15 Implementation of contact precautions</p> <p>In addition to standard precautions, implement contact precautions in the presence of known or suspected infectious agents that are spread by direct or indirect contact with the patient or the patient's environment.</p>	<p>Section B2.2.2 Page 94</p>
<p>16 Hand hygiene and personal protective equipment to prevent contact transmission</p> <p>When working with patients who require contact precautions:</p> <ul style="list-style-type: none"> • perform hand hygiene • put on gloves and gown upon entry to the patient-care area • ensure that clothing and skin do not contact potentially contaminated environmental surfaces • remove gown and gloves and perform hand hygiene before leaving the patient-care area. 	<p>Section B2.2.3 Page 94</p>
<p>17 Patient-care equipment for patients on contact precautions</p> <p>Use patient-dedicated equipment or single-use non-critical patient-care equipment.</p> <p>If common use of equipment for multiple patients is unavoidable, clean the equipment and allow it to dry before use on another patient.</p>	<p>Section B2.2.3 Page 94</p>
Droplet precautions	
<p>18 Implementation of droplet precautions</p> <p>In addition to standard precautions, implement droplet precautions for patients known or suspected to be infected with agents transmitted by respiratory droplets that are generated by a patient when coughing, sneezing or talking.</p>	<p>Section B2.3.2 Page 97</p>
<p>19 Personal protective equipment to prevent droplet transmission</p> <p>When entering the patient-care environment, put on a surgical mask.</p>	<p>Section B2.3.3 Page 98</p>
<p>20 Placement of patients requiring droplet precautions</p> <p>Place patients who require droplet precautions in a single-patient room.</p>	<p>Section B2.3.3 Page 98</p>
Airborne precautions	
<p>21 Implementation of airborne precautions</p> <p>In addition to standard precautions, implement airborne precautions for patients known or suspected to be infected with infectious agents transmitted person-to-person by the airborne route.</p>	<p>Section B2.4.2 Page 100</p>
<p>22 Personal protective equipment to prevent airborne transmission</p> <p>Wear a correctly fitted P2 respirator when entering the patient-care area when an airborne-transmissible infectious agent is known or suspected to be present.</p>	<p>Section B2.4.3 Page 100</p>
<p>23 Placement of patients requiring airborne precautions</p> <p>Patients on airborne precautions should be placed in a negative pressure room or in a room from which the air does not circulate to other areas.</p> <p>Exceptions to this should be justified by risk assessment.</p>	<p>Section B2.4.3 Page 101</p>

Recommendation	Refer to:
Multi-resistant organisms (MROs) (see Section B3)	
<p>24 Implementation of core strategies in the control of MROs (MRSA, MRGN, VRE)</p> <p>Implement transmission-based precautions for all patients colonised or infected with a multi-resistant organism, including:</p> <ul style="list-style-type: none"> performing hand hygiene and putting on gloves and gowns before entering the patient-care area using patient-dedicated or single-use non-critical patient-care equipment using a single-patient room or, if unavailable, cohorting patients with the same strain of multi-resistant organism in designated patient-care areas ensuring consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and healthcare workers. 	<p>Section B3.1.2 Page 113</p>

Finding information

These recommendations provide the basis for appropriate infection prevention and control practice in the healthcare setting. Practical guidance on their implementation is given in Part B of these guidelines. The following table provides a directory for this guidance.

Table 1: Directory of key information in these guidelines

When you need to know...	Read page...
Infection prevention and control basics	
What are standard precautions and how are they applied	Basics p33
How are transmission-based precautions applied	Basics p93
How to help patients become involved in infection control	Section A3; Patient-care tips also highlighted
How to apply the process of risk management	Section A2; Case studies pp24, 42, 57, 66, 75, 82, 96, 99, 100, 109, 120, 128
Hand hygiene	
When to perform hand hygiene	Basics p35; Contact 95; Droplet p98; MROs p114
What hand hygiene products to use and how	Basics pp37 to 40; Case studies pp42; MROs p113
What to do if there are cuts or abrasions on your hands	Basics p40
About jewellery or artificial fingernails and infection	Basics p40
How to care for your hands	Basics pp41
Personal protective equipment	
How to decide what PPE is needed for a particular situation	Basics p46
What PPE to wear for routine clinical practice	Standard p46
What PPE to wear when there is a risk of contamination with blood, body substances, secretions, or excretions	Aprons and gowns p47, face and eye protection p49; gloves p51
What PPE to wear when transmission-based precautions are implemented	Contact p95; Droplet p98; Airborne p101; MROs p114; Summary p113
When to wear aprons and gowns	Basics p48; Contact 95
When to wear face and eye protection	Basics p49; Droplet p98; Airborne p101
When to wear gloves	Basics p52; Contact p95; Case study p57

When you need to know...	Read page...
What is the correct procedure for putting on and removing PPE	Basics p55
Handling and disposal of sharps	
How to avoid sharps injuries	Basics p63 ; Case study p69
How to use needleless devices	Basics p64
How to safely dispose of sharps	Basics p63
What to do if a sharps injury is sustained	Basics p64
Environmental cleaning	
What products and processes to use for routine environmental cleaning of surfaces	Basics p70
When to use disinfectants	Basics p70; transmission-based precautions p93; MROs p114
How to minimise contamination of cleaning implements and solutions	Basics p72
What products and processes to use when there is a spill of blood or body substances	Basics p73; Case study p75
How often to clean specific surfaces and items	Basics p159
Reprocessing of reusable medical instruments and equipment	
How to decide the level of reprocessing required for reusable medical equipment and instruments	Basics p81
How to decide which reprocessing is required	Basics p98; 81; Case study p82
Issues associated with standard precautions	
How to practice respiratory hygiene and cough etiquette	Basics p84
What is aseptic non-touch technique	Basics p85
How to handle clinical waste and linen	Basics p89, p90
When there is a suspected or known infection	
What transmission-based precautions are required for a specific infectious agent	Summary p92, p165
When to implement transmission-based precautions	General p93; Contact p94; Droplet p97; Airborne p100
How to wear a P2 respirator correctly	Basics p103
When to implement the use of single-use or patient-dedicated equipment	Contact p95; MROs p114
What to consider when transferring patients	Contact p96; Droplet p99; Airborne p104
Where to place patients to avoid cross-contamination	Contact p96; Droplet p99; Airborne p104; MROs p113; Outbreak p125

Introduction

Effective infection prevention and control is central to providing high quality health care for patients and a safe working environment for those that work in healthcare settings.

Healthcare-associated infection is preventable

There are around 200,000 healthcare-associated infections (HAIs) in Australian acute healthcare facilities each year². This makes HAIs the most common complication affecting patients in hospital. As well as causing unnecessary pain and suffering for patients and their families, these adverse events prolong hospital stays and are costly to the health system. The problem does not just affect patients and workers in hospitals—HAIs can occur in any healthcare setting, including office-based practices (e.g. general practice clinics, dental clinics) and long-term care facilities (see Glossary). Any person working in or entering a healthcare facility is at risk. However, healthcare-associated infection is a potentially preventable adverse event rather than an unpredictable complication. It is possible to significantly reduce the rate of HAIs through effective infection prevention and control.

Infection prevention and control is everybody's business

Understanding the modes of transmission of infectious organisms and knowing how and when to apply the basic principles of infection prevention and control is critical to the success of an infection control program. This responsibility applies to everybody working and visiting a healthcare facility, including administrators, staff, patients and carers.

Successful approaches for preventing and reducing harms arising from HAIs involve applying a risk-management framework to manage 'human' and 'system' factors associated with the transmission of infectious agents. This approach ensures that infectious agents, whether common (e.g. gastrointestinal viruses) or evolving (e.g. influenza or multi-resistant organisms [MROs]), can be managed effectively.

Development of the guidelines

As part of the Australian Commission on Safety and Quality in Health Care's (ACSQHC) HAIs priority program, the National Health and Medical Research Council (NHMRC) was asked to develop national guidelines that would provide a coordinated approach to the prevention and management of HAI. The NHMRC appointed an expert group to guide the development process (Steering Committee membership and terms of reference are given in Appendix 1).

The guidelines are based on the best available evidence. They build on existing guidelines and reviews, as well as systematic reviews of the evidence.

Aim

By assisting healthcare workers to improve the quality of the care they deliver, these guidelines aim to promote and facilitate the overall goal of infection prevention and control:

The creation of safe healthcare environments through the implementation of practices that minimise the risk of transmission of infectious agents.

2 Cruickshank M & Ferguson J (eds) (2008) Reducing Harm to patients from Health care Associated Infection: The Role of Surveillance. Australian Commission for Safety and Quality in Health Care. p3.

Scope

The scope of these guidelines was established, following an initial period of consultation that included forums involving a wide range of stakeholders (see Appendix 2).

The guidelines were developed to establish a nationally accepted approach to infection prevention and control, focusing on core principles and priority areas for action. They provide a basis for healthcare workers and healthcare facilities to develop detailed protocols and processes for infection prevention and control specific to local settings.

This approach is underpinned by a risk-management framework to ensure the basic principles of infection prevention and control can be applied to a wide range of healthcare settings including office-based practice, long-term care facilities, remote area health services, home and community nursing and emergency services.

The evidence base for the guidelines addresses the highest level of risk of infection transmission in the healthcare setting, and has predominantly been drawn from the acute-care setting. However, case studies giving examples of risk assessments have been included to help illustrate how these recommendations can be applied to other settings.

Supporting documents have been developed for healthcare workers, patients and health facility managers to assist with implementation of the guidelines. These materials will be available on the NHMRC website.

The guidelines make reference to but do *not* include detailed information on:

- infectious diseases
- pandemic planning
- the reprocessing of reusable medical instruments or devices
- occupational health and safety
- hospital hotel services such as food services, laundry services or waste disposal
- engineering/health facility design.

The guidelines do not duplicate information provided in existing Australian Standards but refer to specific standards wherever relevant.

Target audience

The guidelines are for use by all those working in healthcare—this includes healthcare workers, management and support staff.

Evidence base

These guidelines are based on the best available evidence and knowledge of the practicalities of clinical procedures. They draw from other work in this area, including the two previous national infection control guidelines,³ international infection control guidelines, systematic literature reviews conducted to inform the development of these guidelines, work on HAI prevention from ACSQHC, national discipline-based infection control guidelines, and Australian Standards relevant to infection prevention and control. Australian data are used wherever available.

3 CDNA (2004) Infection Control Guidelines for the Prevention of Transmission of Infectious Disease in the Health Care Setting. Communicable Diseases Network of Australia. NHMRC (1996) Infection Control in the Healthcare Setting. Guidelines for the Prevention of Transmission of Infectious Diseases. National Health and Medical Research Council. Rescinded.

Table 2: Sources of evidence to support recommendations⁴⁵

Systematically developed international guidelines⁴
World Health Organization Guidelines on hand hygiene in health care (2009)
United States Centers for Disease Control and Prevention Workbook for designing, implementing and evaluating a sharps injury prevention program (2008) Guideline for disinfection and sterilisation in healthcare facilities (2008) Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings (2007) Management of multidrug-resistant organisms in healthcare settings (2006) Guidelines for infection control in the dental setting (2003) Guidelines for environmental infection control in health-care facilities (2003) Guidelines for prevention of intravascular device-related infections (2002; draft 2009)
United Kingdom National Institute for Health and Clinical Excellence Surgical site infection prevention and treatment of surgical site infection (2008) Prevention of healthcare-associated infection in primary and community care (2003)
UK Department of Health Epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England (2007)
British Society for Antimicrobial Chemotherapy Guidelines for UK practice for the diagnosis and management of methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) infections presenting in the community (2008) Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for Antimicrobial Chemotherapy (2008)
Canadian Critical Care Trials Group Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: prevention (2008)
European Association of Urology European and Asian guidelines on management and prevention of catheter-associated urinary tract infections (2008)
Australian discipline-specific guidance
RACGP (2006) <i>Infection Control Standards for Office Based Practices</i> (4 th edition)
Australian Dental Association (2008) <i>Guidelines for Infection Control</i>
Separate systematic reviews of published scientific and medical literature for recognised gaps in evidence⁵
Alcohol products and other agents for hand hygiene
Infection control measures related to the use of intravascular devices
Positive pressure rooms in reducing risk for immunocompromised patients
Staff exclusion policies relating to norovirus gastroenteritis
Personal protective equipment in reducing the transmission of multi-resistant organisms
Isolation measures for patients infected with vancomycin-resistant enterococci or multi-resistant Gram negative bacteria
Education interventions for the prevention of HAIs

⁴ These guidelines were selected based on analysis using the AGREE tool, which ensures that guidelines have been developed in a rigorous, transparent and robust manner. This process is discussed in detail in Appendix 2.

⁵ Due to a paucity of evidence or low quality evidence some systematic reviews were not used to draft recommendations

Limitations of the grading process as it applies to the practice of infection control

The recommendations in these guidelines were formulated by the Infection Control Steering Committee through a process of consensus. Recommendations are given when an action is deemed critical to preventing or managing infection. Recommendations are graded according to the revised NHMRC gradings for assessing evidence, with the addition of good practice points, which outline actions that are essential to infection prevention and control but where evidence grades cannot be applied.

In many areas of infection prevention and control, the evidence may be limited by the inability to conduct certain study designs that are difficult to implement in real practice. This has implications for the level of grading that is assigned to the recommendations, since grading systems will tend to favour study designs that are sometimes not feasible or ethical to conduct in infection control settings, such as randomised controlled trials. For example, it is unethical to compare the incidence of infection related to surgical instruments by allocating one patient group to have sterilised instruments used on them and one patient group to have non-sterile instruments used on them. This may result in a lower grading due to the available evidence but sterilisation of surgical instruments is universally deemed critical to infection control.

Given that there is limited evidence available to support many routine practices intended to reduce infection risk, practice is based on decisions made on scientific principles. Some activities, such as performing hand hygiene between administering care to successive patients, have a credible history to support their routine application in preventing cross-infection. Others, such as some uniform and clothing requirements, have more to do with the ethos of quality care and workplace culture than with a proven reduction of cross-infection.

It is not acceptable to discontinue practices for which there is a solid scientific basis, even if the level of evidence is not high. Rather, routine practices should continue unless there is sufficient evidence to support alternative procedures. Continuing research is needed to keep evaluating practice, to identify evidence gaps and promote research in these areas, and to ensure that poor practices do not continue.

Table 3: NHMRC grades of evidence

Grade	Description
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution

The ICG Steering Committee also assigned an additional ‘grade’ referred to as a good practice point (GPP).

GPP	Body of evidence is weak or non-existent. Recommendation for best practice based on clinical experience and expert opinion
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Structure of the guidelines

These guidelines are based around the following core principles:

- an understanding of the modes of transmission of infectious agents and of risk management
- effective work practices that minimise the risk of transmission of infectious agents
- governance structures that support the implementation, monitoring and reporting of infection prevention and control work practices
- compliance with legislation, regulations and standards relevant to infection control.

The parts of the document are based on these core principles and are organised according to the likely readership.

Part A presents background information that should be read by **everyone working in health care** (for example as orientation or as part of annual review)—this includes important basics of infection prevention and control, such as the main modes of transmission of infectious agents and the application of risk-management principles. This part of the guidelines does not include recommendations.

Part B is specific to the practice of **healthcare workers and support staff**, and outlines effective work practices that minimise the risk of transmission of infectious agents. Recommendations are given in Sections B1 to B3. Each section includes advice on putting the recommendations into practice, a risk-management case study and resources.

Section B1 describes standard precautions used at all times to minimise the risk of transmission of infectious agents

Section B2 outlines transmission-based precautions to guide staff in the presence of suspected or known infectious agents that represent an increased risk of transmission

Section B3 outlines approaches to the management of multi-resistant organisms (MROs) or outbreak situations

Section B4 outlines processes for risk identification and the application of standard and transmission-based precautions for certain procedures

Section B5 includes supplementary information to assist in the application of standard and transmission-based precautions.

Part C describes the responsibilities of **management of healthcare facilities**, including governance structures that support the implementation, monitoring and reporting of effective work practices. The chapters outline the main components of a systems approach to facility-wide infection prevention and control, giving guidance on management and staff responsibilities, protection of healthcare workers, requirements for education and training of all staff, considerations for facility design and renovation, and other important activities such as surveillance and antibiotic stewardship.

Legislation, regulations and standards relevant to infection prevention and control are listed at the end of each section before the references.

The **appendices** provide additional information on the guideline development process.

Key information is highlighted in the guidelines as follows.

Table 4: Key to types of information highlighted in the guidelines

<p>Summaries provide key information from each section of the guidelines</p>
<p>Recommendations (Sections B1, B2 and B3) outline the critical aspects of infection prevention and control</p>
<p>Patient-care tips highlight patient considerations in the application of infection prevention and control principles</p>

Case studies illustrate the application of risk-management principles (Sections B1, B2 and B3) and measures to support good practice (Part C)

The following table summarises the key topics discussed in the document.

Modes of transmission of infectious	Effective work practices that minimise the risk of transmission of infectious agents		Governance structures that support implementation, monitoring and reporting of infection prevention and control practices	
PART A	PART B		PART C	
Basics of Infection prevention and control	Standard and transmission-based precautions		Organisational support	
<p>A1 Infection prevention and control in the healthcare setting</p> <p>A1.1 Risks of contracting a healthcare-associated infection</p> <p>A1.2 Standard and transmission-based precautions</p> <p>A2 Overview of risk management in infection prevention and control</p> <p>A2.1 Risk-management basics</p> <p>A2.2 Risk-management process</p> <p>A3 A patient-centred approach</p> <p>A3.1 Patient-centred health care</p> <p>A3.2 How does patient-centred care relate to infection prevention and control?</p>	<p>B1 Standard precautions</p> <p>B1.1 Hand hygiene</p> <p>B1.2 Personal protective equipment</p> <p>B1.3 Handling and disposing of sharps</p> <p>B1.4 Routine management of the physical environment</p> <p>B1.5 Reprocessing of reusable instruments and equipment</p> <p>B1.6 Respiratory hygiene and cough etiquette</p> <p>B1.7 Aseptic technique</p> <p>B1.8 Waste management</p> <p>B1.9 Handling of linen</p> <p>B2 Transmission-based precautions</p> <p>B2.1 Application of transmission-based precautions</p> <p>B2.2 Contact precautions</p> <p>B2.3 Droplet precautions</p> <p>B2.4 Airborne precautions</p> <p>B2.5 Putting it into practice</p> <p>B2.6 Resources</p> <p>B2.7 References</p>	<p>B3 Management of multi-resistant organisms and outbreak situations</p> <p>B3.1 Management of multi-resistant organisms</p> <p>B3.2 Outbreak investigation and management</p> <p>B3.3 Putting it into practice</p> <p>B3.4 Resources</p> <p>B3.5 References</p> <p>B4 Applying standard and transmission-based precautions during procedures</p> <p>B4.1 Taking a risk-management approach to procedures</p> <p>B4.2 Therapeutic devices</p> <p>B4.3 Surgical procedures</p> <p>B4.4 Putting it into practice</p> <p>B4.5 Resources</p> <p>B4.6 References</p>	<p>C1 Management and clinical governance</p> <p>C1.1 Clinical governance in infection prevention and control</p> <p>C1.2 Roles and responsibilities</p> <p>C1.3 Infection prevention and control program</p> <p>C1.4 Risk management</p> <p>C1.5 Taking an organisational systems approach to infection prevention quality and safety</p> <p>C2 Staff health and safety</p> <p>C2.1 Roles and responsibilities</p> <p>C2.2 Health status screening and immunisation</p> <p>C2.3 Exclusion periods for healthcare workers with acute infection</p> <p>C2.4 Healthcare workers with specific circumstances</p> <p>C2.5 Exposure-prone procedures</p> <p>C2.6 Occupational hazards for healthcare workers</p> <p>C3 Education and training</p> <p>C3.1 Universities and training colleges</p> <p>C3.2 Healthcare worker education</p> <p>C3.3 Education strategies</p> <p>C3.4 Example of education in practice — hand hygiene</p> <p>C3.5 Patient engagement</p> <p>C3.6 Compliance and accreditation</p>	<p>C4 Healthcare-associated infection surveillance</p> <p>C4.1 Role of surveillance in reducing HAI</p> <p>C4.2 Types of surveillance programs</p> <p>C4.3 Data collection and management</p> <p>C4.4 Outbreak surveillance</p> <p>C4.5 Disease surveillance in office-based practice</p> <p>C4.6 Notifiable diseases</p> <p>C5 Antibiotic stewardship</p> <p>C5.1 Background</p> <p>C5.2 Antibiotic stewardship programs</p> <p>C5.3 Antibiotic stewardship surveillance methods</p> <p>C6 Influence of facility design on healthcare-associated infection</p> <p>C6.1 Facility design and its impact on infection prevention and control</p> <p>C6.2 Mechanisms for influencing healthcare-associated infection through environmental design</p> <p>C6.3 The benefits of single-bed rooms for patient isolation</p>
<p>Legislation, regulations and standards relevant to infection prevention and control</p>	<p>B1.1 Hand hygiene</p> <p>B1.2.9 PPE</p> <p>B1.3.6 Sharps</p> <p>B1.6.4 Waste and linen handling</p> <p>B2.6 Transmission-based precautions</p> <p>B3.4 MROs and outbreaks</p> <p>B4.5 Procedures</p> <p>B5 Supplementary information</p> <p>C7 Resources for organisations</p>			

PART A

BASICS OF INFECTION PREVENTION AND CONTROL

Summary

- Healthcare-associated infections (HAIs) can occur in any healthcare setting. While the specific risks may differ, the basic principles of infection prevention and control apply regardless of the setting.
- In order to prevent HAIs, it is important to understand how infections occur in healthcare settings and then institute ways to prevent them. Risk management is integral to this approach.
- If effectively implemented, the two-tiered approach of standard and transmission-based precautions recommended in these guidelines provides high-level protection to patients, healthcare workers and other people in healthcare settings.
- Infection prevention and control is integral to clinical care and the way in which it is provided. It is not an additional set of practices.
- Involving patients and their carers is essential to successful clinical care. This includes ensuring that patients' rights are respected at all times, that patients and carers are involved in decision-making about care, and that they are sufficiently informed to be able to participate in reducing the risk of transmission of infectious agents.

The information presented in this part is relevant to everybody employed by a healthcare facility, including management, healthcare workers and support service staff.

AI Infection prevention and control in the healthcare setting

Summary

- Infectious agents (also called pathogens) are biological agents that cause disease or illness to their hosts. Many infectious agents are present in healthcare settings.
- Infection requires three main elements—a source of the infectious agent, a mode of transmission and a susceptible host.
- Patients and healthcare workers are most likely to be sources of infectious agents and are also the most common susceptible hosts. Other people visiting and working in health care may also be at risk of both infection and transmission. In some cases, HAIs are serious or even life threatening.
- In healthcare settings, the main modes for transmission of infectious agents are contact (including bloodborne), droplet and airborne.

AI.1 Risks of contracting a healthcare-associated

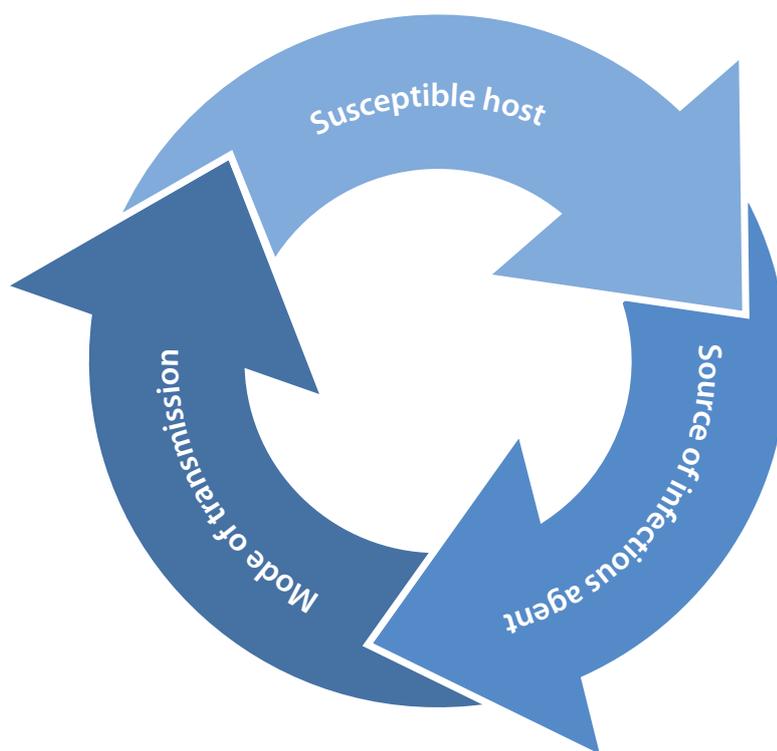
Most infectious agents are microorganisms. These exist naturally everywhere in the environment, and not all cause infection (e.g. 'good' bacteria present in the body's normal flora). Several classes of microorganism—including bacteria, viruses, fungi, parasites and prions—can be involved in either colonisation or infection, depending on the susceptibility of the host:

- With colonisation, there is a sustained presence of replicating infectious agents on or in the body, without the production of an immune response or disease.
- With infection, invasion of infectious agents into the body results in an immune response, with or without symptomatic disease.

Transmission of infectious agents within a healthcare setting requires the following elements:

- a source or reservoir of infectious agents
- a mode of transmission
- a susceptible host.

Figure A1.1: Chain of infection



Infectious agents transmitted during health care come primarily from human sources, including patients, healthcare workers and visitors. Source individuals may be actively ill, may have no symptoms but be in the incubation period of a disease, or may be temporary or chronic carriers of an infectious agent with or without symptoms. Other sources of transmission include:

- endogenous flora of patients (e.g. bacteria residing in the respiratory or gastrointestinal tract)
- environmental sources such as air, water, medications or medical equipment and devices that have become contaminated.

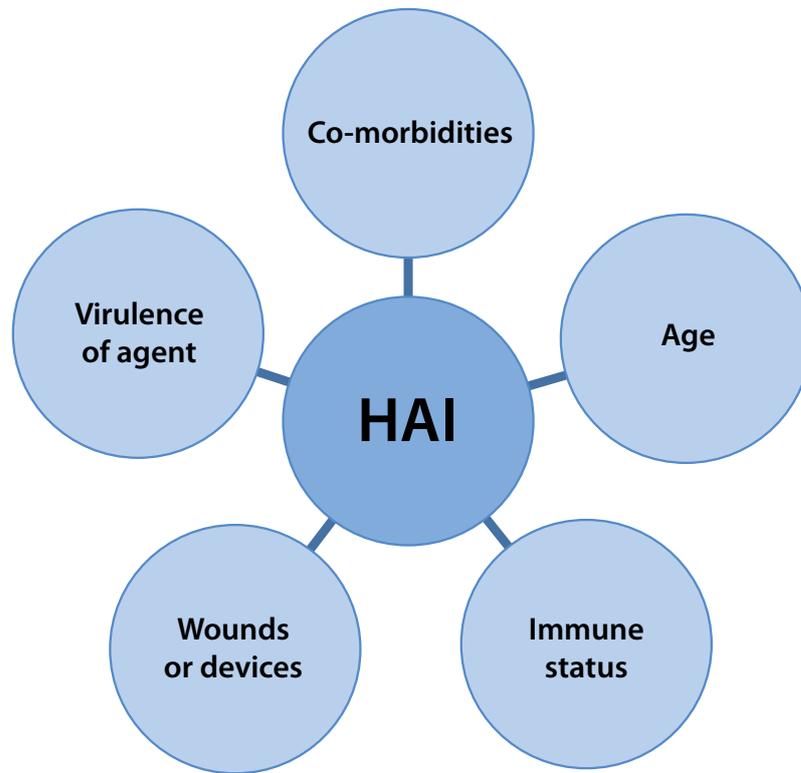
Infection is the result of a complex interrelationship between a host and an infectious agent and people vary in their response to exposure to an infectious agent:

- some people exposed to infectious agents never develop symptomatic disease while others become severely ill and may die
- some individuals may become temporarily or permanently colonised but remain asymptomatic
- others progress from colonisation to symptomatic disease either soon after exposure, or following a period of asymptomatic colonisation.

Important predictors of an individual's outcome after exposure include his or her:

- immune status at the time of exposure (including whether immune status is compromised by medical treatment such as immunosuppressive agents or irradiation)
- age (e.g. neonates and elderly patients are more susceptible)
- health status (e.g. when a patient has other underlying disease such as diabetes or is a smoker);
- the virulence of the agent
- other factors that increase the risk of transmission of infection (e.g. undergoing surgery, requiring an indwelling device such as a catheter, or remaining in hospital for lengthy periods).

Figure A1.2: Factors influencing healthcare-associated infection



In healthcare settings, the most common susceptible hosts are patients and healthcare workers.

- Patients may be exposed to infectious agents from themselves (endogenous infection) or from other people, instruments and equipment, or the environment (exogenous infection). The level of risk relates to the healthcare setting (specifically, the presence or absence of infectious agents), the type of healthcare procedures performed and the susceptibility of the patient.
- Healthcare workers may be exposed to infectious agents from infected or colonised patients, instruments and equipment, or the environment. The level of risk relates to the type of clinical contact healthcare workers have with potentially infected or colonised patient groups, instruments or environments, and the health status of the healthcare worker (e.g. immunised or immunocompromised).

In healthcare settings, the main modes of transmission of infectious agents are contact (including bloodborne), droplet and airborne. The modes of transmission vary by type of organism. In some cases the same organism may be transmitted by more than one route (e.g. norovirus, influenza and respiratory syncytial virus [RSV] can be transmitted by contact and droplet routes).

AI.1.1 Routes of transmission

Contact transmission

Contact is the most common mode of transmission, and usually involves transmission by touch or via contact with blood or body substances. Contact may be direct or indirect.

- *Direct transmission* occurs when infectious agents are transferred from one person to another — for example, a patient's blood entering a healthcare worker's body through an unprotected cut in the skin.
- *Indirect transmission* involves the transfer of an infectious agent through a contaminated intermediate object or person—for example, a healthcare worker's hands transmitting infectious agents after touching an infected body site on one patient and not performing hand hygiene before touching another patient, or a healthcare worker coming into contact with fomites (e.g. bedding) or faeces and then with a patient.

Examples of infectious agents transmitted by contact include multi-resistant organisms (MROs), *Clostridium difficile*, norovirus and highly contagious skin infections/infestations (e.g. impetigo, scabies).

Droplet transmission

Droplet transmission can occur when an infected person coughs, sneezes or talks, and during certain procedures. Droplets are infectious particles larger than 5 microns in size.⁶ Respiratory droplets transmit infection when they travel directly from the respiratory tract of the infected person to susceptible mucosal surfaces (nasal, conjunctivae or oral) of another person, generally over short distances. Droplet distribution is limited by the force of expulsion and gravity and is usually at least 1 metre. However, droplets can also be transmitted indirectly to mucosal surfaces (e.g. via hands).

Examples of infectious agents that are transmitted via droplets include influenza virus and meningococcus.

Airborne transmission

Airborne dissemination may occur via particles containing infectious agents that remain infective over time and distance. Small-particle aerosols are created during breathing, talking, coughing or sneezing and secondarily by evaporation of larger droplets in conditions of low humidity. Certain procedures, particularly those that induce coughing, can promote airborne transmission. These include diagnostic sputum induction, bronchoscopy, airway suctioning, endotracheal intubation, positive pressure ventilation via face mask and high-frequency oscillatory ventilation. Aerosols containing infectious agents can be dispersed over long distances by air currents (e.g. ventilation or air conditioning systems) and inhaled by susceptible individuals who have not had any contact with the infectious person. These small particles can transmit infection into small airways of the respiratory tract.

Examples of infectious agents that are transmitted via the airborne route include measles (rubeola) virus, chickenpox (varicella) virus and *M. tuberculosis*.

Other modes of transmission

Transmission of infection can also occur via common sources such as contaminated food, water, medications, devices or equipment.

6 Siegel JD, Rhinehart E, Jackson M et al (Health Care Infection Control Practices Advisory Committee) (2007) Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, June 2007. United States Centers for Disease Control and Prevention. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>.

AI.2 Standard and transmission-based precautions

Successful infection prevention and control involves implementing work practices that prevent the transmission of infectious agents through a two-tiered approach including:

- routinely applying basic infection prevention and control strategies to minimise risk to both patients and healthcare workers, such as hand hygiene, personal protective equipment, cleaning and appropriate handling and disposal of sharps (*standard precautions*)
- effectively managing infectious agents where standard precautions may not be sufficient on their own—these specific interventions control infection by interrupting the mode of transmission (*transmission-based precautions*; formerly referred to as *additional precautions*).

If successfully implemented, standard and transmission-based precautions prevent any type of infectious agent from being transmitted.

AI.2.1 Standard precautions

All people potentially harbour infectious agents. Standard precautions refer to those work practices that are applied to everyone, regardless of their perceived or confirmed infectious status and ensure a basic level of infection prevention and control. Implementing standard precautions as a first-line approach to infection prevention and control in the healthcare environment minimises the risk of transmission of infectious agents from person to person, even in high-risk situations.

Standard precautions are used by healthcare workers to prevent or reduce the likelihood of transmission of infectious agents from one person or place to another, and to render and maintain objects and areas as free as possible from infectious agents. Guidance on implementing standard precautions is given in Sections B1 and B5.

Table AI.1: How standard precautions are implemented

Personal hygiene practices, particularly hand hygiene , aim to reduce the risk of contact transmission of infectious agents (see Section B1.1).
The use of personal protective equipment , which may include gloves, gowns, plastic aprons, masks/face-shields and eye protection, aims to prevent exposure of the healthcare worker and patients to infectious agents (see Section B1.2).
Appropriate handling and disposal of sharps assists in preventing transmission of blood-borne diseases to healthcare workers (see Section B1.3).
Environmental controls , including cleaning and spills management, assist in preventing transmission of infectious agents from the environment to patients (see Sections B1.4 and B5.1).
Appropriate reprocessing of reusable equipment and instruments , including appropriate use of disinfectants, aims to prevent patient-to-patient transmission of infectious agents (see Section B1.5).
Practising respiratory hygiene and cough etiquette reduces risk of transmission of infection (see Section B1.6).
Aseptic non-touch technique aims to prevent microorganisms on hands, surfaces or equipment from being introduced into a susceptible site (see Sections B1.7 and B5.4).
Appropriate handling of waste and linen assists in reducing transmission of infectious agents (see Sections B1.8 and B1.9).

AI.2.2 Transmission-based precautions

Any infection prevention and control strategy should be based on the use of standard precautions as a minimum level of control. Transmission-based precautions are recommended as extra work practices in situations where standard precautions alone may be insufficient to prevent transmission. Transmission-based precautions are also used in the event of an outbreak (e.g. gastroenteritis), to assist in containing the outbreak and preventing further infection.

Transmission-based precautions should be tailored to the particular infectious agent involved and its mode of transmission. This may involve a combination of practices.

Guidance on when and how to implement transmission-based precautions is given in Sections B2, B3 and B5.

Table AI.2: Strategies for implementing transmission-based precautions

<p>Transmission-based precautions may include one or any combination of the following:</p> <ul style="list-style-type: none"> • allocating a single room with closing door to patient with a suspected or confirmed infection (isolation) • placing patients colonised or infected with the same infectious agent and antibiogram in a room together (cohorting) • wearing specific personal protective equipment • providing patient-dedicated equipment • using a TGA-registered disinfectant with label claims specifying its effectiveness against specific infectious organisms • using specific air handling techniques • restricting movement both of patients and healthcare workers.
<p>Contact precautions are used when there is known or suspected risk of direct or indirect contact transmission of infectious agents that are not effectively contained by standard precautions alone (see Section B2.2).</p>
<p>Droplet precautions are used for patients known or suspected to be infected with agents transmitted over short distances by large respiratory droplets (see Section B2.3).</p>
<p>Airborne precautions are used for patients known or suspected to be infected with agents transmitted person-to-person by the airborne route (see Section B2.4).</p>

A2 Overview of risk management in infection prevention and control

Summary

- Identifying and analysing risks associated with health care is an integral part of successful infection prevention and control.
- Adopting a risk-management approach at all levels of the facility is necessary. This task requires the full support of the facility's management as well as cooperation between management, healthcare workers and support staff.
- Differing types and levels of risk exist in different healthcare settings. In developing local policies and procedures, each healthcare facility should conduct its own risk assessment (i.e. how to avoid, identify, analyse, evaluate and treat risks in that setting), and also refer to discipline-specific guidance where relevant.

A2.1 Risk management basics

In the context of these guidelines, 'risk' is defined as the possibility of acquisition or infection of patients or healthcare workers arising from activities within a healthcare facility. Risk management is the basis for preventing and reducing harms arising from healthcare-associated infection.

A successful approach to risk management occurs on many levels within a healthcare facility:

- *facility wide*—for example, providing support for effective risk management through an organisational risk-management policy, staff training, follow-up of outcomes and monitoring and reporting
- *ward or department based*—for example, embedding risk management into all policies so that risks are considered in every situation
- *individual*—for example, considering the risks involved in carrying out a specific procedure and questioning the necessity of the procedure as part of clinical decision-making, attending education sessions (e.g. hand hygiene or respirator fit testing).

As healthcare settings differ greatly in their day-to-day function, it is not possible to provide a one size fits all approach to risk management. Even within a single setting (e.g. primary care), increasingly complex care is delivered by a range of health professionals with diverse qualifications and training. All healthcare facilities need to be able to determine the risks in their own context and select the appropriate course of action. Therefore it is necessary for facilities to regularly conduct infection prevention risk assessments within their facility and ensure that all staff understand their responsibility in managing these risks.

The Australian/New Zealand Standard on Risk Management AS/NZS ISO 31000:2009 outlines a stepwise approach to risk management that allows continuous quality improvement and involves:

- *establishing context*—identifying the basic parameters in which risk must be managed (e.g. the type of health facility, the extent of and support for the facility's infection prevention and control program)
- *avoiding risk*—establishing whether there is a risk and whether potential risk can be averted (e.g. by questioning whether a procedure is necessary)
- *identifying risks*—a systematic and comprehensive process that ensures that no potential risk is excluded from further analysis and treatment (e.g. using root cause analysis)

- *analysing risks*—considering the sources of risk, their consequences, the likelihood that those consequences may occur, and factors that affect consequences and likelihood (e.g. existing controls) (see risk analysis matrix below)
- *evaluating risks*—comparing the level of risk found during the analysis process with previously established risk criteria and assessing available options for ease of implementation and impact, resulting in a prioritised list of risks for further action
- *treating risks*—implementing appropriate management options for dealing with identified risk (e.g. modifying procedures, protocols or work practices; providing education; and monitoring compliance with infection prevention and control procedures).

Table A2.1: Risk analysis matrix

Likelihood	Consequences				
	Negligible	Minor	Moderate	Major	Extreme
Rare	Low	Low	Low	Medium	High
Unlikely	Low	Medium	Medium	High	Very high
Possible	Low	Medium	High	Very high	Very high
Likely	Medium	High	Very high	Very high	Extreme
Almost certain	Medium	Very high	Very high	Extreme	Extreme

Low risk	Manage by routine procedures.
Medium risk	Manage by specific monitoring or audit procedures.
High risk	This is serious and must be addressed immediately.
Very high risk	The magnitude of the consequences of an event, should it occur, and the likelihood of that event occurring, are assessed in the context of the effectiveness of existing strategies and controls.
Extreme risk	

Monitoring and review is an essential component of the risk-management process.

This ensures that:

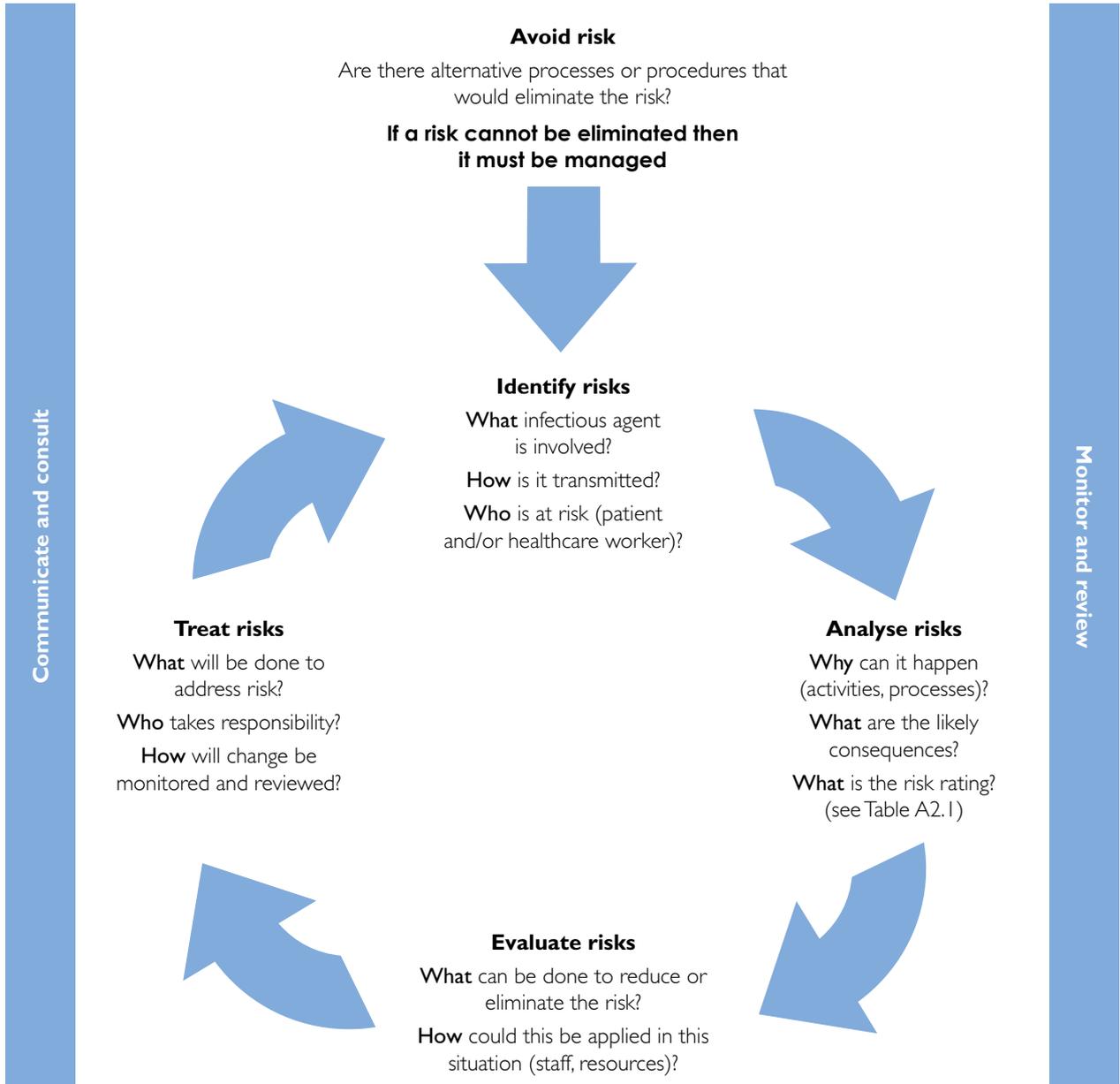
- new risks are identified
- analysis of risk is verified against real data, if possible
- risk treatment is implemented effectively.

Communication and consultation are also key elements of clinical risk management. An interactive exchange of information between management, healthcare workers, patients and other stakeholders provides the basis for increased awareness of the importance of infection prevention and control, identification of risks before they arise and prompt management of risks as they occur.

A2.2 Risk management process

The following flowchart outlines key considerations during the process of risk management in the context of infection prevention and control in the healthcare setting.

Figure A2.1: Risk-management flowchart



The following case study gives an example of applying the risk-management process in a primary care setting. Case studies giving examples of how to use this process in primary, acute and long-term care settings, including relevant considerations in specific situations, are included in Part B. While the basic process of risk management applies regardless of setting, all healthcare facilities should develop risk-management policies and procedures that are appropriate to the setting.

Case study: measles (rubeola) virus outbreak

State health authorities notify a general practice of an outbreak of measles, and will assist the practice with advice about management of potential exposures.

Communicate and consult

- Information about the outbreak is communicated to clinicians and practice staff.
- Collaboratively, protocols and procedures are formulated to implement at the practice if there is a presentation of measles (see below).
- Communication occurs between clinicians, managers and reception staff to ensure that all understand why protocols and procedures are in place and that there is a clear understanding of how to apply them.

Establish context

- In developing protocols and procedures, consideration is given to the following questions:
 - Are there members of the practice community likely not to be immunised against measles or at risk (e.g. young children, recent migrants)?
 - Is this an area where uptake of immunisation low due to issues of access or acceptance?
 - What aspects of the practice offer the opportunity for the transmission of measles infection?

Identify risks

- Consideration is given to how measles might be transmitted within the practice:
 - *What can happen?* This includes the range of activities undertaken at the facility and that are associated with the airborne transmission of measles.
 - *Where and when?* The primary risk is exposure of non-immune patients to infectious patients in the waiting room or contact with non-immune staff.
 - *How and why?* The infection can be transmitted to any susceptible person breathing the same air as an infectious patient for up to 2 hours after the patient has left the area.
 - Failure to ensure that all staff members are vaccinated/ immune, and inadequate use of PPE by non-immune staff.

Analyse risks

- Facility staff members consider and discuss the consequences and likelihood of transmission of infection in their particular setting.
- Using the risk analysis matrix above, the risks associated with the measles outbreak are assessed as high, requiring immediate action.

Note that in other settings, outcomes of the analysis may reveal a lower level of risk (e.g. if there is sufficient herd immunity in the community to not pose a risk) or a higher level of risk (e.g. if there are insufficient resources to manage airborne precautions and triage of patients).

Evaluate risks

- Consideration given to which risks can be managed and which cannot be tolerated using an ease of impact analysis—this involves examining the measures that can be implemented and the ease of implementing and impact of each measure (see examples below).
- Priority is given to the activities that are the simplest to do and have the greatest impact but does not exclude activities that are hard to do if their impact is high.

Note that priority must be given to activities that address risks that are high and which have a potentially catastrophic outcome.

Example	Ease	Analysis	Impact
Disinfect surfaces with spray	Easy	No more effective than detergent solution; surfaces not a high risk cause of measles transmission	Low
Provide ABHR in waiting, clinical rooms and consultation rooms	Easy	Shown to improve compliance with hand hygiene, which has an impact on the spread of HAI	Low ⁷
Change linen between each patient in consultation rooms	Hard	Linen not a high risk cause of measles transmission	Low
Educate infectious patients to report their infectious state prior to attending practice	Hard	May reduce the incidence of iatrogenic infection	High

Treat risks

- A sign is placed on the door advising patients who suspect they may have measles to phone before entering the practice, so that the doctor can see them in their home, or they can be put into a separate waiting area where they will not mix with other patients.
- Patient information is displayed at reception warning about suspected measles cases.
- Respiratory etiquette is encouraged and alcohol-based hand rub dispenser placed in waiting and consultation rooms (this is good practice but will not reduce transmission of measles).
- Additional education is provided for staff on measles identification and management.
- At-risk staff identified, vaccinated, and requested to wear a P2 respirator for which they have been fit-tested (see B2.4.3).
- Uptake of patient and staff immunisation against measles is encouraged; staff vaccination policy established.

Monitor and review

- Mechanisms are implemented to ensure early awareness of notifications from public health authorities to assist in the early implementation of additional infection control measures.

Source: Adapted from RACGP (2006) *Infection Control Standards for Office-Based Practices* (4th edition).

⁷ This action has a low impact in terms of measles because the virus is spread through airborne transmission. However, use of ABHR can have a high impact in reducing the spread of micrororganisms transmitted via contact or droplet routes (eg norovirus, influenza).

A3 A patient-centred approach

Summary

- A patient-centred health system is known to be associated with safer and higher quality care.
- A two-way approach that encourages patient participation is essential to successful infection prevention and control.

A3.1 Patient-centred health care

People receiving healthcare increasingly expect to be given information about their condition and treatment options and this extends to their rights and responsibilities as users of healthcare services. Although patient satisfaction with health services in Australia is generally high, patients' experiences are not always valued and their expectations are not always met. While this does not necessarily lead to poor outcomes for the individuals concerned, the best possible outcomes are more likely where patient-centred health care is a priority of the healthcare facility and a strong and consistent effort is made to respect patients' rights and expectations.

The ACSQHC has developed an *Australian Charter of Healthcare Rights*,⁸ which recognises that people receiving care and people providing care all have important parts to play in achieving healthcare rights. The Charter allows patients, families, carers and services providing health care to share an understanding of the rights of people receiving health care. The Charter stipulates that all Australians have the right to:

- access services that address their healthcare needs
- receive safe and high quality health services, provided with professional care, skill and competence
- receive care that shows respect to them and their culture, beliefs, values and personal characteristics
- receive open, timely and appropriate communication about their health care in a way they can understand
- join in making decisions and choices about their care and about health service planning
- have their personal privacy and personal health and other information properly handled
- comment on or complain about their care and have their concerns dealt with properly and promptly.

Patient-centred care cannot just be 'added on' to usual care. The rights, experiences and views of patients should be at the centre of the care process and drive the way in which care is delivered. In most healthcare facilities, a significant culture change is necessary to embed patient-centred care principles into the philosophy and practices of the organisation. Healthcare workers and organisations need to acknowledge and understand the Charter of Healthcare Rights and work to ensure that patients' rights are integral to the care process.

8 Available at: [http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/com-pubs_ACHR-roles/\\$File/17537-charter.pdf](http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/com-pubs_ACHR-roles/$File/17537-charter.pdf)

A3.2 How does patient-centred care relate to infection prevention and control?

Infection prevention and control is ultimately about people. Effective infection prevention and control is central to providing high quality, patient-centred health care.

Putting patients at the centre of infection prevention and control and enabling them to participate in the care process is not just about explaining the risks of treatments, but involves considering patients' needs at every level. This ranges from designing the facility to maximise patient comfort and safety to having a range of processes to engage patients in their care and listen and act on their feedback as well as providing the patient with education and support so that they can be involved in looking after themselves.

To support a two-way approach to infection prevention and control and encourage the patient participation required to minimise cross-infection or transmission, it is important to:

- take patients' perspectives into account when developing policies and programs
- familiarise patients with the infection prevention and control strategies that are employed in healthcare facilities to protect them, the people caring for them and the healthcare environment
- discuss with patients the specific risks associated with their medical and/or surgical treatment
- encourage patients to disclose their health or risk status if there is a potential risk or source of infection to healthcare workers or others within the healthcare facility
- provide opportunities for patients to identify and communicate risks and encourage them to use feedback procedures for any concerns that they have about infection prevention and control procedures
- provide educational materials about infection prevention and control using a variety of media (e.g. posters in waiting rooms, printed material and educational videos)
- inform patients about the protocols for protecting their privacy and confidentiality.

Specific guidance on providing patient-centred care is highlighted throughout the guidelines, in text boxes, in the 'Putting it into practice' section at the end of each chapter in Part B, and in each chapter of Part C.

PART B

STANDARD AND TRANSMISSION-BASED PRECAUTIONS

Summary

- The use of standard precautions is the primary strategy for minimising the transmission of healthcare-associated infections.
- Transmission-based precautions are used in addition to standard precautions, where the suspected or confirmed presence of infectious agents represents an increased risk of transmission.
- The application of transmission-based precautions is particularly important in containing multi-resistant organisms (MROs) and in outbreak management.
- Medical and dental procedures increase the risk of transmission of infectious agents. Effective work practices to minimise risk of transmission of infection related to procedures require consideration of the specific situation, as well as appropriate use of standard and transmission-based precautions.

The information presented in this part is particularly relevant to healthcare workers and support staff. It outlines effective work practices that minimise the risk of transmission of infectious agents.

Patient-care tip

In applying standard and transmission-based infection prevention and control strategies as part of day-to-day practice, healthcare workers should ensure that their patients understand why certain practices are being undertaken, and that these practices are in place to protect everyone from infection. Patients and visitors should also be aware of their role in minimising risks by following basic hand hygiene and respiratory hygiene and cough etiquette and informing staff about aspects of their care or services if necessary.

BI Standard precautions

Summary

It is essential that standard precautions are applied at all times. This is because:

- people may be placed at risk of infection from others who carry infectious agents
- people may be infectious before signs or symptoms of disease are recognised or detected, or before laboratory tests are confirmed in time to contribute to care;
- people may be at risk from infectious agents present in the surrounding environment including environmental surfaces or from equipment
- there may be an increased risk of transmission associated with specific procedures and practices.

Standard precautions consist of:

- hand hygiene, before and after every episode of patient contact
- the use of personal protective equipment
- the safe use and disposal of sharps;
- routine environmental cleaning;
- reprocessing of reusable medical equipment and instruments
- respiratory hygiene and cough etiquette
- aseptic non-touch technique;
- waste management;
- appropriate handling of linen.

Standard precautions should be used in the handling of: blood (including dried blood); all other body substances, secretions and excretions (excluding sweat), regardless of whether they contain visible blood; non-intact skin; and mucous membranes.

Evidence supporting practice

The majority of the recommendations in this section have been adapted from:⁹

- World Health Organization (2009) *Guidelines on Hand Hygiene in Health Care*
- Boyce JM & Pittet D, Healthcare Infection Control Practices Advisory C, Force HSAIHHT (2002) Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. *MMWR Recomm Rep* 51: 1–45
- Grayson L, Russo P, Ryan K et al (2009) *Hand Hygiene Australia Manual*. Australian Commission for Safety and Quality in Healthcare and World Health Organization
- Pratt RJ, Pellowea CM, Wilson JA et al (2007) epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *J Hosp Infect* 65S, S1–S64
- Siegel JD, Rhinehart E, Jackson M et al (Healthcare Infection Control Practices Advisory Committee), (2007) *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings*. United States Centers for Disease Control and Prevention
- Schulster LM & Chinn RYW (2003) *Guidelines for Environmental Infection Control in Health-care Facilities*. Recommendations of the CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Chicago IL: American Society for Healthcare Engineering/American Hospital Association.

⁹ These guidelines were selected based on analysis using the AGREE tool, which ensures that guidelines have been developed in a rigorous, transparent and robust manner. This process is discussed in detail in Appendix 2.

Further review of the evidence elicited good quality evidence on the use of alcohol-based hand rubs in reducing transmission of infectious agents.

Maiwald (2009) Systematic review of the efficacy of alcohol preparations and other agents for hand hygiene in the healthcare setting. Project report to the National Health and Medical Research Council (NHMRC), Canberra ACT, Australia.

The following Australian guidelines were also consulted during the development of this section:

- RACGP (2006) *Infection Control Standards for Office Based Practices* (4th edition)
- Australian Dental Association (2008) *Guidelines for Infection Control*.

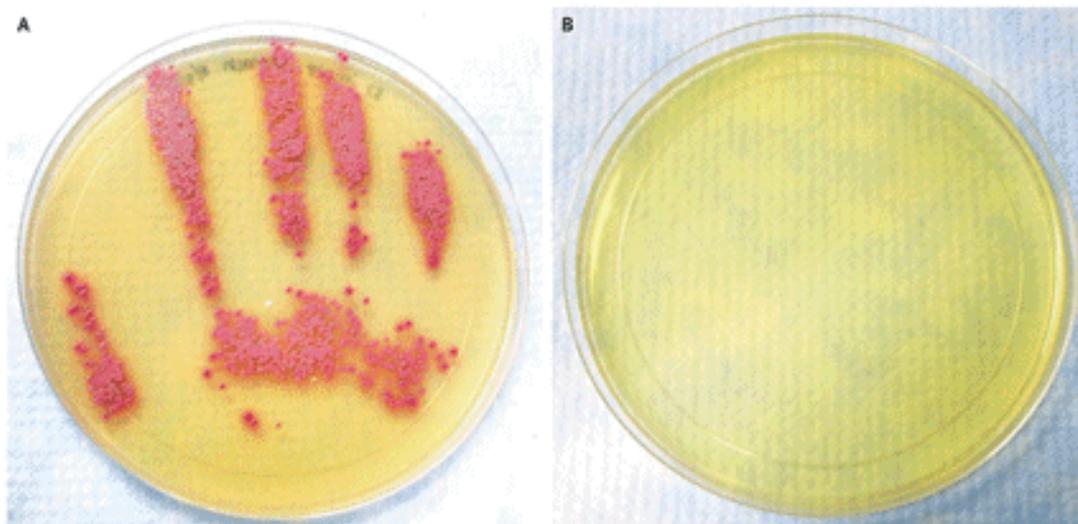
BI.1 Hand hygiene

BI.1.1 What are the risks?

Any infectious agent transmitted by the contact or droplet route can potentially be transmitted by touch.

Microorganisms are either present on the hands most of the time (resident flora) or acquired during activities such as healthcare (transient flora). Hands can also become contaminated through contact with respiratory secretions when coughing or sneezing. Contaminated hands can lead to cross-transmission of infectious agents in non-outbreak situations (Pratt et al 2001; Boyce & Pittet 2002; Pratt et al 2007) and contribute to outbreaks involving organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE) and multi-resistant Gram-negative (MRGN) microorganisms, such as *Acinetobacter* spp (Pratt et al 2001).

Figure BI.1: Importance of hand hygiene



These images illustrate the critical importance of hand hygiene in caring for patients, including those not known to carry antibiotic-resistant organisms. An imprint of a healthcare worker's ungloved hand was obtained after routine abdominal examination of a patient with no history of MRSA infection but found on routine surveillance to have MRSA colonisation. The resultant culture shows MRSA colonies (image on left). Another hand imprint obtained after the worker's hand had been cleaned with alcohol-based hand rub was negative for MRSA (image on right).

Source: Donskey CJ & Eckstein BC (2009).

Improved hand hygiene practices have been associated with:

- sustained decreases in the incidence of infections caused by MRSA and VRE (Webster et al 1994; Zafar et al 1995; Malik et al 1999; Larson et al 2000a; Pittet et al 2000; Pittet & Boyce 2001)
- reductions in healthcare-associated infections of up to 45% in a range of healthcare settings (Fendler et al 2002; Pittet et al 2000; Ryan et al 2001)
- greater than 50% reduction in the rates of nosocomial disease associated with MRSA and other multi-resistant organisms, after 1–2 years (Grayson et al 2009; Johnson et al 2005).

Hand hygiene practices alone are not sufficient to prevent and control infection and need to be used as part of a multifactorial approach to infection control.

This section discusses routine hand hygiene. Surgical hand preparation is discussed in Section B4.3.2.

BI.1.2 When should hand hygiene be performed?

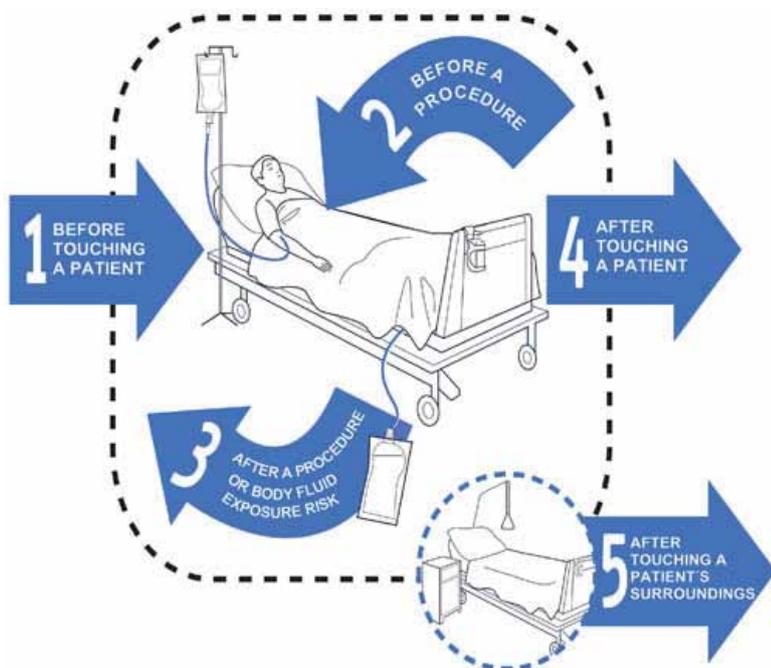
Hands can become contaminated with infectious agents through contact with a patient, patient surroundings, the environment, or other healthcare workers. Cross-contamination can occur from one site to another in the same patient, between healthcare worker and patient, between patient or healthcare worker and the environment, or between healthcare workers. Practicing hand hygiene *before* every episode of patient contact (including between caring for different patients and between different care activities for the same patient) and *after* any activity or contact that potentially results in hands becoming contaminated (such as removal of gloves) reduces the risk of cross-contamination.

The 5 moments for hand hygiene

The '5 moments for hand hygiene' developed by the World Health Organization (WHO 2009) and adopted by Hand Hygiene Australia (Grayson et al 2009):

- protect patients against acquiring infectious agents from the hands of the healthcare worker
- help to protect patients from infectious agents (including their own) entering their bodies during procedures
- protect healthcare workers and the healthcare surroundings from acquiring patients' infectious agents.

Figure B1.2: The 5 moments for hand hygiene



Note: Hand hygiene is also performed after the removal of gloves.

Source: Grayson et al (2009).

While Figure B1.2 illustrates application of the 5 moments in an acute-care setting, the 5 moments are still generally applicable to other healthcare settings including primary care. The key emphasis in any setting is to perform hand hygiene before and after any procedure, and after each consultation with a patient.

Recommendation		Grade
I	<p>Routine hand hygiene</p> <p>Hand hygiene must be performed before and after every episode of patient contact. This includes:</p> <ul style="list-style-type: none"> • before touching a patient • before a procedure • after a procedure or body substance exposure risk • after touching a patient; • after touching a patient's surroundings. <p>Hand hygiene must also be performed after the removal of gloves.</p>	B

In addition to the 5 moments, hand hygiene should be performed in a range of non-clinical situations (see Table B1.1).

Table B1.1: Non-clinical situations when hand hygiene should be performed

BEFORE	AFTER
<ul style="list-style-type: none"> Starting/leaving work Eating/handling of food/drinks (whether own or patient's) Using computer keyboard in a clinical area 	<ul style="list-style-type: none"> Hands becoming visibly soiled Eating/ handling of food/drinks (whether own or patient's) Visiting the toilet Using a computer keyboard in a clinical area Being in patient-care areas during outbreaks of infection Removing gloves Handling laundry/equipment/waste Blowing/wiping/touching nose and mouth
Before touching a patient	After touching a patient
<ul style="list-style-type: none"> Contact with patients particularly immuno-compromised patients 	<ul style="list-style-type: none"> After touching a patient, particularly patients being cared for in isolation or having transmission-based precautions applied due to the potential for spread of infection to others
	After touching a patient's surroundings
	<ul style="list-style-type: none"> Entering/leaving clinical areas Touching inanimate objects (e.g. equipment, items around the patient) and the patient environment, particularly if within an isolation room or where transmission-based precautions are applied Blood/body substance contamination

B1.1.3 What product should be used?

Existing guidelines (WHO 2009; Boyce & Pittet 2002; Pratt et al 2007; Canada Standards and Guideline Core Committee 2008; PIDAC 2008) and literature reviews (Pittet & Boyce 2001; Picheansathian 2004; Rotter 2004; Nicolay 2006; Larmer et al 2008; Grayson et al 2009) agree that hand hygiene using alcohol-based hand rubs is more effective against the majority of common infectious agents on hands than hand hygiene with plain or antiseptic soap and water.

One advantage of alcohol-based hand rubs is that they are easily accessible at point of care. They have (Grayson et al 2009):

- excellent antimicrobial activity against Gram-positive and Gram-negative vegetative bacteria, *Mycobacterium tuberculosis* and a wide range of fungi
- generally good antimicrobial activity against enveloped viruses
- lesser and/or variable antimicrobial activity against non-enveloped viruses (such as norovirus)
- no activity against protozoan oocysts and bacterial spores (such as *C. difficile*) (see Section B2.2).

The range of antimicrobial activity in alcohol-based hand rubs varies with the alcohol compound (ethanol, isopropanol or n-propanol) used. Different alcohol species have different levels of activity (60% v/v n-propanol is approximately equivalent to 70% v/v isopropanol and to 80% v/v ethanol) and many commercial formulations consist of blends of different alcohol species. Most published clinical studies that have demonstrated reductions in HAIs with the use of alcohol-based hand rubs have been associated with products that contain at least 70% alcohol (isopropanol), 0.5% chlorhexidine and a skin emollient (Grayson et al 2009). However the efficacy of alcohol-based hand hygiene products is affected by a number of factors including the type of alcohol used, concentration of alcohol, contact time, volume of product used, and whether the hands are wet when the product is applied. These factors are generally assessed through testing standards for skin disinfectants, for which TGA is the regulatory body responsible for approving products for use in Australia.

Plain soaps act by mechanical removal of microorganisms and have no antimicrobial activity. They are sufficient for general social contact and for cleansing of visibly soiled hands. They are also used for mechanical removal of certain organisms such as *C. difficile* and norovirus.

When *C. difficile* and non-enveloped viruses are suspected or known to be present, use of alcohol-based hand rubs alone may not be sufficient to reduce transmission of these organisms. Alcohol-based hand rubs are effective at removing vegetative forms of *C. difficile*, but not effective at removing spores (Maiwald 2009). If gloves are worn during the care of patients in settings where *C. difficile* or non-enveloped viruses are suspected or known to be present, spore contamination of the hands will be minimal and alcohol-based hand rub remains the agent of choice for hand hygiene (Johnson et al 1990; Jabbar et al 2010). [41, 42] However, if gloves have not been worn or the hands are visibly soiled, they must be meticulously washed with soap and water and patted dry, to facilitate the mechanical removal of spores.

There is a tendency for antimicrobial soaps to be more effective than plain soaps, although the evidence around this is inconsistent. Antimicrobial soap is associated with skin care issues and it is not necessary for use in everyday clinical practice (Pratt et al 2001; Boyce & Pittet 2002; Pratt et al 2007.)

Neutral hand-wipe products may be considered in instances where hygienic access to soap and water is not readily available, such as in community care settings. Alcohol-based hand rubs are also suitable for use in resource-limited or remote areas with lack of accessibility to sinks or other facilities for hand hygiene (including clean water, towels etc.).

Choosing an alcohol-based handrub

It is necessary to choose products:

- that have excellent antimicrobial efficacy combined with good user acceptability and skin tolerability (dermal tolerance, fragrance, colour, texture and ease of use)
- that are TGA approved for skin antisepsis
- meet the requirements of EN1500 testing standard for bactericidal effect (which are currently referred to by TGA).

Healthcare worker acceptance of alcohol-based hand rub is a crucial factor in the success of any program to improve hand hygiene practice. Several studies showed that user acceptability and skin tolerability tend to be determined by the overall hand rub composition (e.g. consistency as gel or rub, texture, fragrance) and by emollient additives, but both are largely independent of a formulation's antimicrobial activity (Rotter et al 1991; Kramer et al 2002a; Girard et al 2006; WHO 2009). Even where emollient agents are present in the product, ready access to a moisturising skin-care product is essential (see Section B1.1.5). The selected alcohol-based hand rubs, soaps and moisturising lotions should be chemically compatible, to minimise skin reactions and ensure that the decontaminating properties of the hand hygiene product are not deactivated. It is advisable to purchase hand hygiene and hand-care products from a range made by a single manufacturer, as this ensures compatibility between the products.

Different healthcare workers and healthcare settings have different preferences, and the choice between a gel or liquid needs to be evaluated on an individual basis (Maiwald & Widmer 2007; Pittet 2007). In some healthcare facilities, it may be useful to offer both liquid and gel alongside each other, in order to provide a choice that suits a wide range of healthcare workers (Pittet 2007; Traore et al 2007, Girard R et al 2006). Some studies have noted that gel formulations have generally significantly less antimicrobial activity than liquid alcohol-based hand rub formulations, even if the total alcohol content is similar (Pietsch 2001; Kramer et al 2002b; Picheansathian 2004).

The *Hand Hygiene Australia Manual* (Grayson et al 2009) outlines the following alcohol-based hand rub features as important in influencing acceptability, as well as ready accessibility at each bedside and in all patient-care areas:

- *fragrance and colour*—these may increase the initial appeal but may cause allergic reactions, and are therefore discouraged
- *emollient agent(s) in the alcohol-based hand rub*—these should prevent skin drying and irritant skin reactions, but not leave a sticky residue on hands
- *drying characteristics*—in general, solutions have lower viscosity than gels and therefore tend to dry more quickly
- *risk of skin irritation and dryness*—proactive and sympathetic management of this problem is vital.

There is some evidence to suggest that gels are preferred to solutions (WHO 2009), however it is important for staff to evaluate products themselves before implementation where possible. Even where emollient agents are present in the product, ready access to a moisturising skin-care product is essential. All hand hygiene products should be chemically compatible. It is advisable that hand hygiene and hand-care products are from a range made by a single manufacturer, as this ensures compatibility between the products.

Other issues associated with alcohol-based hand rubs

Other factors that should be considered when choosing products include cost issues, availability, convenience and functioning of dispenser, and ability to prevent contamination. Consideration should also be given to occupational health and safety issues associated with alcohol-based hand rubs. Alcohols are flammable, and healthcare workers handling alcohol-based preparations should respect safety standards. Accidental and intentional ingestion and dermal absorption of alcohol-based products used for hand hygiene have also been reported (Roberts et al 2005; Brown et al 2007). The risk of these issues can be mitigated by appropriate placement of dispensers within the facility (see Section C; in addition, the Hand Hygiene Australia risk assessment form outlines the safety issues in more detail).

Recommendation

2 Choice of product for routine hand hygiene practices	Grade
For all routine hand hygiene practices in healthcare settings, use alcohol-based hand rubs that : <ul style="list-style-type: none"> • contain between 60% and 80% v/v ethanol or equivalent; and • meet the requirements of EN1500. 	<p>B</p> <p>GPP</p>
3 Choice of hand hygiene product when hands are visibly soiled If hands are visibly soiled, hand hygiene should be performed using soap and water.	<p>B</p>
4 Hand hygiene for <i>Clostridium difficile</i> and non-enveloped viruses Hand hygiene should be performed using soap and water when <i>Clostridium difficile</i> or non-enveloped viruses such as norovirus are known or suspected to be present and gloves have not been worn. After washing, hands should be dried thoroughly with single-use towels.	<p>GPP</p>

Technique

Effective hand hygiene relies on appropriate technique as much as on selection of the correct product. Inappropriate technique can lead to failure of hand hygiene measures to appropriately remove or kill microorganisms on hands, despite the superficial appearance of having complied with hand hygiene requirements.

Key factors in effective hand hygiene and maintaining skin integrity include (Boyce & Pittet 2002):

- the duration of hand hygiene measures
- the exposure of all surfaces of hands and wrists to the preparation used (Widmer & Dangel 2004)
- the use of rubbing to create friction
- ensuring that hands are completely dry.

Table BI.2: Use of alcohol-based hand rub

-
- Apply the amount of alcohol-based hand rub recommended by the manufacturer onto dry hands.
 - Rub hands together so that the solution comes into contact with all surfaces of the hand, paying particular attention to the tips of the fingers, the thumbs and the areas between the fingers.
 - Continue rubbing until the solution has evaporated and the hands are dry.
-

Table BI.3: Using soap (including antimicrobial soap) and water

-
- Wet hands under tepid running water and apply the recommended amount of liquid soap.
 - Rub hands together for a minimum of 15 seconds so that the solution comes into contact with all surfaces of the hand, paying particular attention to the tips of the fingers, the thumbs and the areas between the fingers.
 - Rinse hands thoroughly under running water; then pat dry with single-use towels.
-

BI.1.4 Other aspects of hand hygiene

As intact skin is a natural defence against infection, cuts and abrasions reduce the effectiveness of hand hygiene practices. Breaks or lesions of the skin are possible sources of entry for infectious agents (Larson 1996) and may also be a source of them. Similarly, the presence of fingernail disease may reduce the efficacy of hand hygiene and result in the transmission of pathogens (WHO 2009). To reduce the risk of cross-transmission of infectious agents, cuts and abrasions should be covered with waterproof dressings.

The type and length of fingernails can have an impact on the effectiveness of hand hygiene (Boyce & Pittet 2002; Lin et al 2003). Artificial or false nails have been associated with higher levels of infectious agents, especially Gram-negative bacilli and yeasts, than natural nails (Pottinger et al 1989; Passaro et al 1997; Foca et al 2000; Hedderwick et al 2000; Moolenaar et al 2000; Parry et al 2001; Boyce & Pittet 2002; Gupta et al 2004; Boszczowski et al 2005). Fingernails should therefore be kept short (e.g. the length of the finger pad) and clean, and artificial fingernails should not be worn. Studies have also demonstrated that chipped nail polish may support the growth of organisms on the fingernails (Grayson et al 2009). It is good practice to not wear nail polish, but if it must be used it should not be chipped and should be removed every 4 days (AORN 2007).

Although there is less evidence concerning the impact of jewellery on the effectiveness of hand hygiene, rings can interfere with the technique used to perform hand hygiene resulting in higher total bacterial counts (Boyce & Pittet 2002). Hand contamination with infectious agents is increased with ring wearing (Boyce & Pittet 2002; Trick et al 2003), although no studies have related this practice to healthcare worker-to-patient transmission. The consensus recommendation is to strongly discourage the wearing of watches, rings or other jewellery during health care; however if jewellery must be worn in clinical areas it should be limited to a plain band (e.g. wedding ring) and this should be moved about on the finger during hand hygiene practices. In high-risk settings such as operating suites/rooms, any jewellery, even a plain band, should not be worn.

Each healthcare facility should develop policies on the wearing of jewellery, artificial fingernails or nail polish by healthcare workers.

BI.1.5 Hand care

The main type of skin irritation associated with hand hygiene, irritant contact dermatitis, includes symptoms such as dryness, irritation, itching and sometimes cracking and bleeding. Allergic contact dermatitis is rare and represents an allergy, which may be to some ingredient in a hand hygiene product.

Generally, alcohol-based hand rubs cause significantly less skin reaction or irritation than hand hygiene with plain or antiseptic soaps (Pittet & Boyce 2001).

Expert opinion concludes that (Pratt et al 2001; Boyce & Pittet 2002; Grayson et al 2009):

- skin damage is generally associated with the detergent base of the preparation, poor hand hygiene technique and/or frequent use of alcohol-based hand rub immediately before or after performing hand hygiene with soap
- frequent use of hand hygiene agents may cause damage to the skin and alter normal hand flora
- excoriated hands are associated with increased colonisation by potentially infectious agents
- the irritant and drying effects of hand preparations are one reason why healthcare workers fail to adhere to hand hygiene guidelines
- appropriate use of hand lotion or moisturisers added to hand hygiene preparations is an important factor in maintaining skin integrity, encouraging adherence to hand hygiene practices and assuring the health and safety of healthcare workers.

Use of hand cream

An emollient hand cream should be applied regularly, such as after performing hand hygiene before a break or going off duty, and when off duty. Hand hygiene technique should be reviewed if skin irritation occurs. If the irritation persists or if it caused by a particular soap, antiseptic agent or alcohol-based product, the person with designated responsibility for infection control or occupational health should be consulted.

BI.1.6 Putting it into practice

Individual actions for reducing the risk

-
- Follow the 5 moments for hand hygiene, even when it seems that there is not enough time
 - Become familiar with your facility policy on hand hygiene and follow it
 - Use the appropriate product for the situation and use it as directed
 - Follow facility policy on cuts and abrasions, fingernails, nail polish and jewellery
 - Use hand-care products provided by your organisation; your own products may not be compatible with the hand hygiene products provided
 - Minimise physical contact with patient surroundings
 - Lead by example and champion hand hygiene in your setting
 - Attend hand hygiene education sessions regularly to refresh your knowledge and skills
 - Contact the person with designated responsibility for occupational health or infection prevention and control if you have a reaction to hand hygiene and hand-care products used in your setting
 - If alcohol-based hand rub is not readily accessible at key points of care in a patient-care area, consider approaching management
-

Involving patients in hand hygiene

The following information may be provided to patients to assist them in becoming involved in identifying and reducing risks related to poor hand hygiene.

- Hand hygiene is the most important aspect of reducing the risk of infection—this applies to everyone including healthcare workers, patients and visitors
- The '5 moments for hand hygiene' tell healthcare workers, patients and visitors when hand hygiene should be performed to reduce the risk of infection
- Healthcare workers generally use alcohol-based hand rub as it is effective and easy to use but, if their hands are visibly dirty, they need to use soap and water first
- Performing hand hygiene regularly reduces the risk of infection to you and others. If in hospital, remind your visitors to use alcohol-based hand rub when they come into the ward and before they leave
- No matter what product you use to clean your hands, the solution should come into contact with all surfaces
- After hand hygiene, the hands should be dry. If alcohol-based hand rub is used, the solution will dry on the hands. After hand hygiene with soap and water, hands should be patted dry
- Healthcare workers should have short, clean fingernails and not wear artificial fingernails or jewellery
- It's okay to question healthcare workers about their hand hygiene practices

Risk-management case study

Hand hygiene in a neonatal intensive care unit

The neonatal intensive care unit in a large regional hospital identifies colonisation or infection with *Pseudomonas aeruginosa* in a number of infants. Surveillance cultures from other infants in the unit, from the hands of staff on the unit and from possible environmental reservoirs are assessed. The cultures show that an additional three infants are colonised. Cultures of environmental specimens are negative but cultures of three of twenty-four healthcare workers are positive. Of these, two have recently joined the unit and received no education on hand hygiene in orientation and the third has artificial fingernails.

Eliminating risks	In this situation, it is not possible to eliminate risk, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of <i>Pseudomonas aeruginosa</i> . Ongoing surveillance would assist in identifying other infectious agents that may be present in the neonatal intensive care unit.
Analysing risks	One source of the risk is the lack of appropriate hand hygiene practices by some staff members. Each time these staff members are involved in the care of an infected or colonised infant, there is potential for spread of the infectious agent (to other infants and to staff members), with the risk continuing until appropriate hand hygiene practices are performed. There is no mention in the case study of existing controls to counter the risk (e.g. use of gloves) but these would need to be included in the analysis, as would other possible causes of the risk (e.g. line setup, type of hand hygiene products available, reprocessing of equipment).
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response including daily observations by clinical managers.
Treating risks	Immediate measures may include providing alcohol-based hand rub by each incubator; introducing clustering of patient-care activities to reduce contact, providing staff education sessions. In the longer term, improvements could be made to facility orientation processes. Banning the use of artificial fingernails in the unit might also be considered.
Monitoring	Hand hygiene compliance could be audited through direct observation by trained observers.

BI.1.7 Resources

Standards

- AORN (2007) Standards, Recommended Practices and Guidelines
<http://www.aorn.org/PracticeResources/AORNStandardsAndRecommendedPractices/>

Legislation

- National Occupational Health and Safety Commission. *National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (blood-borne) Viruses* [NOHSC 2010 (2003) 2nd ed.] Canberra: Australian Government National Occupational Health and Safety Commission. 2003.
- Australian Infection Control Association. Standard 13 Hand Hygiene. Brisbane: AICA. 2006

Guidelines

- ADA (2008) *Guidelines for Infection Control*
<http://www.ada.org.au/about/publications/guideinfectcont.aspx>
- *Hand Hygiene Australia Manual* (available at <http://www.hha.org.au/>)
- RACGP (2006) *Infection Control Standards for Office Based Practices* (4th edition)
http://www.racgp.org.au/AM/Template.cfm?Section=Pandemic_resources_for_general_practices&Template=/CM/ContentDisplay.cfm&ContentID=28165
- WHO (2009) *Guidelines on Hand Hygiene in Healthcare* http://www.who.int/patientsafety/information_centre/documents/index.html
- Boyce JM & Pittet D, Healthcare Infection Control Practices Advisory C, Force HSAIHTT (2002) Guideline for Hand Hygiene in Health-Care Settings. Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. Society for Healthcare Epidemiology of America/Association for Professionals in Infection Control/Infectious Diseases Society of America. *MMWR Recomm Rep* 51: 1–45.

Tools and web-based resources

- Hand Hygiene Australia's website contains numerous educational resources, tools, and information on implementing hand hygiene programs (available at <http://www.hha.org.au/>)

BI.1.8 References

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BI.2 Personal protective equipment

BI.2.1 What are the risks?

Any infectious agent transmitted by the contact or droplet route can potentially be transmitted by contamination of healthcare workers' hands, skin or clothing. Cross-contamination can then occur between the healthcare worker and other patients or healthcare workers, or between the healthcare worker and the environment. Infectious agents transmitted through droplets can also come into contact with the mucous membranes of the healthcare worker.

Personal protective equipment (PPE) refers to a variety of barriers, used alone or in combination, to protect mucous membranes, airways, skin and clothing from contact with infectious agents. PPE used as part of standard precautions includes aprons, gowns, gloves, surgical masks, protective eyewear and face shields. Selection of PPE is based on the type of patient interaction, known or possible infectious agents, and/or the likely mode(s) of transmission.

There have been few controlled clinical studies evaluating the relationship between the use of PPE and risk of HAIs. However, the use of barriers reduces opportunities for transmission of infectious agents (Pratt et al 2001; Clark et al 2002). PPE also protects patients from exposure to infectious agents in the surrounding environment carried by healthcare workers.

This section discusses the routine use of PPE as part of standard precautions. Specific PPE used when transmission-based precautions are applied is discussed in Section B2. The use of PPE during specific procedures is discussed in Section B4.

BI.2.2 Decision-making about personal protective equipment

Selection of protective equipment must be based on assessment of the risk of transmission of infectious agents to the patient or carer, and the risk of contamination of the clothing or skin of healthcare workers or other staff by patients' blood, body substances, secretions or excretions. Local policies and current health and safety legislation should also be taken into account (Clark et al 2002).

Factors to be considered are:

- probability of exposure to blood and body substances
- type of body substance involved
- probable type and probable route of transmission of infectious agents.

Appropriate sequences and procedures for putting on and removing PPE¹⁰ are shown in Section B1.2.7. Relevant Australian Standards are listed in B1.2.9.

All PPE must meet relevant Therapeutic Goods Administration (TGA) criteria for listing on the Australian Register of Therapeutic Goods (ARTG) or equivalent and should be used in accordance with manufacturer's recommendations.

¹⁰ While it is acknowledged that 'donning' and 'doffing' are accepted terms for putting on and removing PPE, in these guidelines plain English terms are used for simplicity and clarity.

Where to wear PPE

PPE is designed and issued for a particular purpose in a protected environment and should not be worn outside that area. Protective clothing provided for staff in areas where there is high risk of contamination (e.g. operating suite/room) must be removed before leaving the area. Even where there is a lower risk of contamination, clothing that has been in contact with patients should not be worn outside the patient-care area. Inappropriate wearing of PPE (e.g. wearing operating suite/room attire in the public areas of a hospital or wearing such attire outside the facility) may also lead to a public perception of poor practice within the facility.

BI.2.3 Aprons and gowns

International guidelines recommend that protective clothing (apron or gown) be worn by all healthcare workers when (Garner 1996; Pratt et al 2001; Clark et al 2002; Pratt et al 2007):

- close contact with the patient, materials or equipment may lead to contamination of skin, uniforms or other clothing with infectious agents
- there is a risk of contamination with blood, body substances, secretions or excretions (except sweat).

The type of apron or gown required depends on the degree of risk, including the anticipated degree of contact with infectious material and the potential for blood and body substances to penetrate through to clothes or skin:

- a clean non-sterile apron or gown is generally adequate to protect skin and prevent soiling of clothing during procedures and/or patient-care activities that are likely to generate splashing or sprays of blood or body substances
- a fluid-resistant apron or gown should be worn when there is a risk that clothing may become contaminated with blood, body substances, secretions or excretions (except sweat).

Gowns and aprons must be changed between patients.

Clinical and laboratory coats or jackets worn over personal clothing for comfort and/or purposes of identity are not considered to be PPE. These items of clothing need to be changed dependant on activity and the extent of exposure to potential pathogens.

Aprons/gowns are routinely used upon entering the room of a patient requiring contact precautions. This is discussed in Section B2.2.3.

Plastic aprons

Single-use plastic aprons are recommended for general use when there is the possibility of sprays or spills, to protect clothes that cannot be taken off (Garner 1996; Pratt et al 2001; Clark et al 2002; Pratt et al 2007). Unused aprons should be stored in an appropriate area away from potential contamination (Callaghan 1998).

Gowns

Gowns are used to protect the healthcare worker's exposed body areas and prevent contamination of clothing with blood, body substances, and other potentially infectious material (Boyce et al 1994; Boyce et al 1995; Hall 2000; Kohn et al 2004).

Considerations in choosing a type of gown (e.g. long or short-sleeved) that is appropriate for the activity are:

- the volume of body substances likely to be encountered
- the extent and type of exposure to blood and body substances
- the probable type and route of transmission of infectious agents.

If a fluid-resistant full body gown is required, it is always worn in combination with gloves, and with other PPE when indicated. Full coverage of the arms and body front, from neck to the mid-thigh or below, ensures that clothing and exposed upper body areas are protected.

Table B1.4: Characteristics of aprons/gowns

Plastic apron	<ul style="list-style-type: none"> • Impervious /fluid resistant • Single-use, for one procedure or episode of patient care • Disposable • Worn when there is a risk that clothing may become exposed to blood or body substances (usually from the environment) during low-risk procedures and where there is low risk of contamination to the healthcare worker's arms • Worn during contact precautions when contact with the patient or the patient environment is likely
Gown	<ul style="list-style-type: none"> • Single-use* • Disposable • Worn to protect skin and prevent soiling of clothing during procedures and/or patient-care activities that are likely to generate splashing or sprays of blood or body substances • Choice of sleeve length depends on the procedure being undertaken and the extent of risk of exposure of the healthcare worker's arms
Full body gown	<ul style="list-style-type: none"> • Fluid resistant • Single-use* • Long sleeved • Worn when there is a risk of contact of the healthcare worker's skin with a patient's broken skin, extensive skin to skin contact (e.g. lifting a patient with scabies or non-intact skin), or a risk of contact with blood and body substances which are not contained (e.g. vomiting, uncontrolled faecal matter) • Worn when there is the possibility of extensive splashing of blood and body substances • Worn when there is a risk of exposure to large amounts of body substances eg in some operative procedures
Sterile gown*	<ul style="list-style-type: none"> • Pre-packaged • Used for procedures requiring an aseptic field

* Some gown types can be re-used. Reusable gowns need to be laundered or reprocessed according to AS/NZS4146—2000 Laundry Practice

Removing aprons and gowns

Removal of aprons and gowns before leaving the patient-care area (e.g. in the room or anteroom) prevents possible contamination of the environment outside the patient's room. Aprons and gowns should be removed in a manner that prevents contamination of clothing or skin. The outer, 'contaminated', side of the gown is turned inward and rolled into a bundle, and then discarded into a designated container for waste or linen to contain contamination (see Section B1.2.7).

Recommendation

5 Wearing of aprons/gowns

Grade

Aprons or gowns should be appropriate to the task being undertaken. They should be worn for a single procedure or episode of patient care and removed in the area where the episode of care takes place.

C

BI.2.4 Face and eye protection

The mucous membranes of the mouth, nose and eyes are portals of entry for infectious agents, as are other skin surfaces if skin integrity is compromised (e.g. by acne, dermatitis) (Sartori et al 1993; Rosen 1997; Keijman et al 2001; Hosoglu et al 2003).

Face and eye protection reduces the risk of exposure of healthcare workers to splashes or sprays of blood and body substances (Dancer 1999; Pratt et al 2001; Clark et al 2002) and is an important part of standard precautions. Procedures that generate splashes or sprays of blood, body substances, secretions or excretions require either a face shield or a mask worn with protective eyewear (CDC 1978; Davidson et al 1995; Gehanno et al 1999; Scales et al 2003; Seto et al 2003; Fowler et al 2004; Loeb et al 2004; ADA 2008).

Face and eye protection is worn as part of transmission-based precautions as discussed in Sections B2.2.3, B2.3.3 and B2.4.3.

Table B1.5: Use of face and eye protection as part of standard precautions

Type of care	Examples	Face and eye protection required
Routine care	General examination (e.g. medical, physiotherapy, nursing) Routine observations	Not required unless caring for a patient on droplet precautions (surgical mask) (see Section B2.3) or airborne precautions (P2 respirator) (see Section B2.4)
Procedures that generate splashes or sprays	Dental procedures Nasopharyngeal aspiration Emptying wound or catheter bag	Protective eyewear/full-length face shield Surgical mask
Procedures involving the respiratory tract (including the mouth)	Intubation Nasopharyngeal suction	Protective eyewear P2 respirator

Surgical masks

Surgical masks are loose fitting, single-use items that cover the nose and mouth. They are used as part of standard precautions to keep splashes or sprays from reaching the mouth and nose of the person wearing them. They also provide some protection from respiratory secretions and are worn when caring for patients on droplet precautions. Surgical masks differ from P2 respirators, as outlined in Table B1.6.

Table B1.6: Properties of different types of mask

Properties	Surgical masks	P2 respirator (see Section B2.4.3)
Other names	Single-use face mask, medical mask, patient-care mask, general purpose mask	P2 respirator, N95 respirator, respiratory protection device, particulate respirator
Characteristics	<ul style="list-style-type: none"> • Pleated face • 2–3 polypropylene layers • Filtration through mechanical impaction • Fluid resistant 	<ul style="list-style-type: none"> • Raised dome or duckbill • 4–5 layers (outer polypropylene, central layers electret [charged polypropylene]) • Filtration through mechanical impaction and electrostatic capture
Sealing	<ul style="list-style-type: none"> • Ties at crown and bottom of head 	<ul style="list-style-type: none"> • Ties at crown and bottom of head, pliable metal nose bridge • Fit testing and fit checking required (see B2.4.3)
Australian standards	<ul style="list-style-type: none"> • AS4381:2002 	<ul style="list-style-type: none"> • AS1715:2009
Intended use	<ul style="list-style-type: none"> • Procedures that generate splashes or sprays of large droplets of blood, body substances, secretions and excretions • Procedures requiring a surgical aseptic technique (to protect patients from exposure to infectious agents carried in a healthcare worker’s mouth or nose) • Routine care of patients on droplet precautions 	<ul style="list-style-type: none"> • Routine care of patients on airborne precautions • High-risk procedures such as bronchoscopy when the patient’s infectious status is unknown • Procedures that involve aerosolisation of particles that may contain specific known pathogens
Notes		<ul style="list-style-type: none"> • Care must be taken when placing respirators on patients and must suit clinical need (i.e. if the patient has chronic obstructive airways disease [COAD] or is in respiratory distress, the respirator will exacerbate symptoms).

Surgical masks can be placed on coughing patients to limit potential dissemination of infectious respiratory secretions from the patient to others (see Section B2.3.3).

Considerations when using a surgical mask include:

- masks should be changed when they become soiled or wet
- masks should never be reapplied after they have been removed
- masks should not be left dangling around the neck
- touching the front of the mask while wearing it should be avoided
- hand hygiene should be performed upon touching or discarding a used mask.

Children should wear a specifically designed child mask and their oxygen saturation should be monitored.

Eye protection

Goggles with a manufacturer’s anti-fog coating provide reliable, practical eye protection from splashes, sprays, and respiratory droplets from multiple angles. Newer styles of goggles fit adequately over prescription glasses with minimal gaps (to be efficacious, goggles must fit snugly, particularly from the corners of the eye across the brow).

Other types of protective eyewear include safety glasses with side-shield protection, which are widely used in dentistry and other specialties that use operating microscopes (ADA 2008).

While effective as eye protection, goggles and safety glasses do not provide splash or spray protection to other parts of the face.

Personal eyeglasses and contact lenses are not considered adequate eye protection.

Face shields

Single-use or reusable face shields may be used in addition to surgical masks, as an alternative to protective eyewear. Compared with other forms of protective eyewear, a face shield can provide protection to other parts of the face as well as the eyes. Face shields extending from chin to crown provide better face and eye protection from splashes and sprays; face shields that wrap around the sides may reduce splashes around the edge of the shield.

Removing face and eye protection

Removal of a face shield, protective eyewear and surgical mask can be performed safely after gloves have been removed and hand hygiene performed. The ties, earpieces and/or headband used to secure the equipment to the head are considered 'clean' and therefore safe to touch with bare hands. The front of a mask, protective eyewear or face shield is considered contaminated.

Cleaning reusable face and eye protection

Reusable face shields and protective eyewear should be cleaned according to the manufacturer's instructions, generally with detergent solution, and be completely dry before being stored. If they are to be disinfected, they should be disinfected using either a TGA-registered instrument grade disinfectant - low level, or by heat as per AS/NZS 4187:2003.

Recommendation

6 Use of face and protective eyewear for procedures

A surgical mask and protective eyewear must be worn during procedures that generate splashes or sprays of blood, body substances, secretions or excretions into the face and eyes.

Grade

C

BI.2.5 Gloves

Gloves can protect both patients and healthcare workers from exposure to infectious agents that may be carried on hands (Duckro et al 2005). As part of standard precautions, they are used to prevent contamination of healthcare workers' hands when (Siegel et al 2007):

- anticipating direct contact with blood or body substances, mucous membranes, non-intact skin and other potentially infectious material
- handling or touching visibly or potentially contaminated patient-care equipment and environmental surfaces (Boyce & Pittet 2002; Bhalla et al 2004; Duckro et al 2005).

The capacity of gloves to protect healthcare workers from transmission of bloodborne infectious agents following a needlestick or other puncture that penetrates the glove barrier has not been determined (Siegel et al 2007).

Gloves are an essential component of contact precautions (in particular for patients with MROs) (see Sections B2.2.3 and B3.1.2) and may also be used as part of droplet precautions (see Section B2.3.3).

When and how should gloves be worn?

As with all PPE, the need for gloves is based on careful assessment of the task to be carried out, the related risk of transmission of microorganisms to the patient; and the risk of contamination of the healthcare worker’s clothing and skin by the patient’s blood and body substances (Pratt et al 2001; Clark et al 2002). Risk assessment includes consideration of:

- who is at risk (whether it is the patient or the healthcare worker)
- whether sterile or non-sterile gloves are required, based on contact with susceptible sites or clinical devices and the aspect of care or treatment to be undertaken
- the potential for exposure to blood or body substances
- whether there will be contact with non-intact skin or mucous membranes during general care and invasive procedures
- whether contaminated instruments will be handled.

When gloves are worn in combination with other PPE, they are put on last (see Section B1.2.7).

When should gloves be changed?

International guidance suggests that changing of gloves is necessary:

- between episodes of care for different patients, to prevent transmission of infectious material (Pratt et al 2001; Siegel et al 2007)
- during the care of a single patient, to prevent cross-contamination of body sites (CDC 1995; Boyce & Pittet 2002)
- if the patient interaction involves touching portable computer keyboards or other mobile equipment that is transported from room to room (Siegel et al 2007).

Prolonged and indiscriminate use of gloves should be avoided as it may cause adverse reactions and skin sensitivity (Pratt et al 2001; Clark et al 2002).

Hand hygiene should be performed before putting on gloves and after removal of gloves. Single-use gloves should not be washed, but discarded.

Recommendations	
<p>7 Wearing of gloves</p> <p>Gloves must be worn as a single-use item for:</p> <ul style="list-style-type: none"> • each invasive procedure; • contact with sterile sites and non-intact skin or mucous membranes; and • activity that has been assessed as carrying a risk of exposure to blood, body substances, secretions and excretions. <p>Gloves must be changed between patients and after every episode of individual patient care.</p>	<p>Grade</p> <p>GPP</p>
<p>8 Sterile gloves</p> <p>Sterile gloves must be used for aseptic procedures and contact with sterile sites.</p>	<p>GPP</p>

What type of gloves should be worn?

Non-sterile single-use medical gloves are available in a variety of materials, the most common being natural rubber latex (NRL) and synthetic materials (e.g. nitrile). NRL remains the material of choice due to its efficacy in protecting against bloodborne viruses and properties that enable the wearer to maintain dexterity (Pratt et al 2001; Clark et al 2002). However, sensitivity to NRL in patients, carers and healthcare workers may occur (see below) and must be documented. A local policy is required on using alternative glove types when patients have latex allergies.

The selection of glove type for non-surgical use is based on a number of factors (Korniewicz et al 1994; Bolyard et al 1998; Korniewicz & McLeskey 1998; Ranta & Ownby 2004):

- the task to be performed (i.e. glove type should be fit for purpose and aim to avoid interference with dexterity, friction, excessive sweating or finger and hand muscle fatigue);
- anticipated contact with chemicals and chemotherapeutic agents; and
- personal factors, such as latex sensitivity and size.

Facility policies for creating a latex-free environment should also be taken into account.

Table B1.7: Selection of glove type

Glove	Indications for use	Examples
Non-sterile gloves	<ul style="list-style-type: none"> • Potential for exposure to blood, body substances, secretions or excretions • Contact with non-intact skin or mucous membranes 	<ul style="list-style-type: none"> • Venepuncture • Vaginal examination • Dental examination • Emptying a urinary catheter bag • Naso-gastric aspiration • Management of minor cuts and abrasions
Sterile gloves	<ul style="list-style-type: none"> • Potential for exposure to blood, body substances, secretions or excretions • Contact with susceptible sites or clinical devices where sterile conditions should be maintained 	Surgical aseptic technique procedures e.g. <ul style="list-style-type: none"> • Urinary catheter insertion • Complex dressings • Central venous line insertion site dressing • Lumbar puncture • Clinical care of surgical wounds or drainage sites • Dental procedures requiring a sterile field
Reusable utility gloves	<ul style="list-style-type: none"> • Indicated for non-patient-care activities 	<ul style="list-style-type: none"> • Handling or cleaning contaminated equipment or surfaces • General cleaning duties • Instrument cleaning in sterilising services unit
Gloves suitable for clinical use		
NRL (latex) gloves	<ul style="list-style-type: none"> • Preferable for clinical procedures that require manual dexterity and/or will involve more than brief patient contact • Select powder-free latex gloves to minimise the risk of latex sensitivity or allergies 	
Synthetic gloves (e.g. nitrile)	<ul style="list-style-type: none"> • Procedures involving high risk of exposure to blood-borne virus and where high barrier protection is needed • Provides suitable alternative to latex if there are no issues with glove fit or sensitivity 	
Utility/cleaning gloves		
<ul style="list-style-type: none"> • Intended for use when a more physically protective glove is required (e.g. for instrument cleaning and housekeeping activities) • Reusable, cleaned according to the manufacturer's instructions and stored dry between uses • Should be replaced when they are showing signs of deterioration 		

Sources: Derived from Kotilainen et al 1989; Korniewicz et al 1989; Korniewicz et al 1993; Rego & Roley 1999; Pratt et al 2001; Korniewicz et al 2002; Schulster & Chinn 2003; Siegel et al 2007; Queensland Health 2010.

Latex allergy

Latex allergy is a reaction to certain proteins in latex rubber. The amount of latex exposure needed to produce sensitisation or an allergic reaction is unknown. However, current understanding of latex allergy is as follows (NIOSH 1998):

- increasing the exposure to latex proteins increases the risk of developing allergic symptoms—most people who are allergic to latex have had frequent exposure to latex over many years; the majority are nurses, doctors, dentists or patients who have had a number of operations
- in sensitised people, symptoms usually begin within minutes of exposure; but they can occur hours later and can be quite varied—mild reactions involve skin redness, rash, hives, or itching; more severe reactions may involve respiratory symptoms such as runny nose, sneezing, itchy eyes, scratchy throat, and asthma (difficult breathing, coughing spells, and wheezing); and rarely, shock may occur although a life-threatening reaction is seldom the first sign of latex allergy
- the risk of latex allergy is influenced by the amount of protein/allergen and powder in the latex glove; not by powder alone (Hunt et al 2002).

Healthcare workers with latex allergies should inform their managers to ensure that their work areas can be latex free.

If latex gloves are used, they should be non-powdered due to the risks associated with aerosolisation and an increased risk of latex allergies.

Removing and disposing of gloves

Gloves (other than utility gloves) should be treated as single-use items. They should be put on immediately before a procedure and removed as soon as the procedure is completed.

When removing gloves, care should be taken not to contaminate the hands. After gloves have been removed, hand hygiene should be performed in case infectious agents have penetrated through unrecognised tears or have contaminated the hands during glove removal (Olsen et al 1993; Tenorio et al 2001; Boyce & Pittet 2002).

Gloves must not be washed for subsequent re-use—infectious agents cannot be removed reliably from glove surfaces and continued glove integrity cannot be ensured. Glove re-use has been associated with transmission of methicillin-resistant *Staphylococcus aureus* (MRSA) and Gram-negative bacilli (Doebbeling et al 1988; Maki et al 1990; Olsen et al 1993).

Gloves should be disposed of as soon as they are removed, with disposal complying with local policies and standards.

BI.2.6 Other items of clothing

Ties and lanyards

There is some evidence to suggest that lanyards and neckties may play a role in transmission of infection but it is difficult to demonstrate the precise role (Kotsanas et al 2008).

Footwear

Footwear suitable for the duties being undertaken must be worn and preferably be designed to minimise the risk of injury from dropped sharps.

Uniforms

In areas of clinical practice where there is a high risk of repeated exposure to blood and other body substances, it is recommended that uniforms be worn as well as the appropriate PPE.

While some studies show that uniforms and white coats become progressively contaminated during clinical care, no studies have demonstrated that uniforms transmit infectious agents or lead to HAIs (Loveday et al 2007).

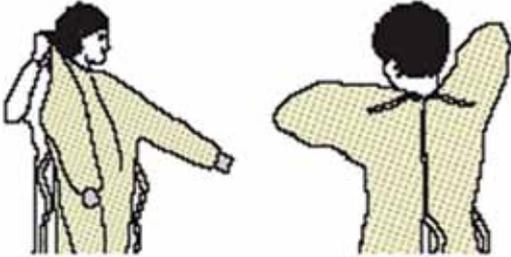
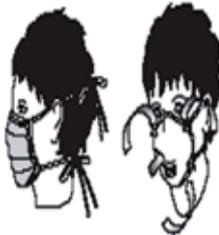
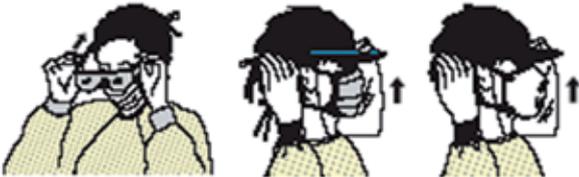
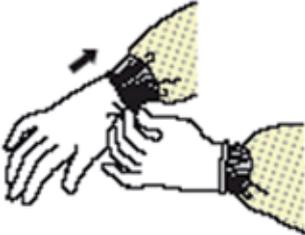
Uniforms should be washed daily. There is no evidence to suggest that home laundering is inferior to commercial reprocessing of uniforms (Loveday et al 2007).

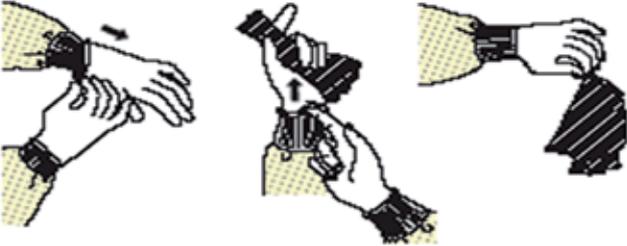
BI.2.7 Sequence for putting on and removing PPE

To reduce the risk of transmission of infectious agents, PPE must be used appropriately. The following table outlines sequences and procedures for putting on and removing PPE.

Hand hygiene must be performed before putting on PPE and after removing PPE

Table BI.8: Putting on and removing PPE

SEQUENCE FOR PUTTING ON PPE	
<p>GOWN</p> <ul style="list-style-type: none"> • Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back • Fasten at the back of neck and waist 	
<p>MASK</p> <ul style="list-style-type: none"> • Secure ties or elastic bands at middle of head and neck 	
<p>PROTECTIVE EYEWEAR OR FACE SHIELD</p> <ul style="list-style-type: none"> • Place over face and eyes and adjust to fit 	
<p>GLOVES</p> <ul style="list-style-type: none"> • Extend to cover wrist of isolation gown 	

SEQUENCE FOR REMOVING PPE	Remove PPE at doorway or in anteroom.
<p>GLOVES</p> <ul style="list-style-type: none"> • Outside of gloves is contaminated! • Grasp outside of glove with opposite gloved hand; peel off • Hold removed glove in gloved hand • Slide fingers of ungloved hand under remaining glove at wrist • Peel glove off over first glove • Discard gloves in waste container 	
PERFORM HAND HYGIENE	
<p>PROTECTIVE EYEWEAR OR FACE SHIELD</p> <ul style="list-style-type: none"> • Outside of eye protection or face shield is contaminated! • To remove, handle by head band or ear pieces • Place in designated receptacle for reprocessing or in waste container 	
<p>GOWN</p> <ul style="list-style-type: none"> • Gown front and sleeves are contaminated! • Unfasten ties • Pull away from neck and shoulders, touching inside of gown only • Turn gown inside out • Fold or roll into a bundle and discard 	
<p>MASK*</p> <ul style="list-style-type: none"> • Front of mask is contaminated—DO NOT TOUCH! • Grasp bottom, then top ties or elastics and remove • Discard in waste container 	
PERFORM HAND HYGIENE IMMEDIATELY AFTER REMOVING ALL PPE	

Source: Adapted from <http://www.cdc.gov/hicpac/2007ip/2007isolationprecautions.html>.

* Surgical masks can be removed at the point of care. To remove a P2 respirator, perform hand hygiene and step outside the room or into an anteroom before removing and disposing of the respirator in a closed container and performing hand hygiene again.

Note that for surgical procedures and dentistry, the sequence for putting on PPE differs. In these situations, masks and protective eyewear are applied first prior to hand preparation. Gown and gloves are then put on. (see Section B4.3.2).

BI.2.8 Putting it into practice

Individual actions for reducing the risk

- Before putting on PPE explain to the patient that it is a routine part of infection prevention and control
- Assess the risk of spraying or splashing in the specific situation and choose PPE accordingly
- If you have a sensitivity or allergy to latex, inform your manager and ensure you always use an alternative glove type
- Follow appropriate sequence and procedure for putting on and removing PPE outlined in table 1.8
- Remove PPE before leaving the patient-care area and follow the sequence and procedure outlined in table 1.8
- Lead by example and champion the appropriate use of PPE in your setting

Involving patients in their care

The following information may be provided to patients to assist them in becoming involved in identifying and reducing risks related to the use of PPE.

- The wearing of PPE such as gowns, masks and gloves is a routine part of infection prevention and control in healthcare—it is used for everybody's safety
- The use of PPE alone is not enough—healthcare workers should perform hand hygiene before putting on and after removing the protective items
- PPE is used in the patient care area only—healthcare workers remove the equipment before they leave the area to reduce the risk of spreading infection
- Gowns or aprons are used so that the healthcare worker's clothing or skin does not become contaminated
- Healthcare workers wear a mask if there is risk of them inhaling an infectious agent
- Masks, eye protection or faceshields are worn by a healthcare worker in situations where the patient's body substances may splash onto his or her face
- Healthcare workers wear gloves when they will have direct hand contact with blood or body substances, mucous membranes or wounds or if there is a chance that touching the patient could transmit infection.
- Patients who are sensitive or allergic to latex should tell their healthcare workers so that an alternative glove type can be used
- It's okay to question a healthcare worker about whether they should be using protective personal equipment or whether they are using it properly

Risk-management case study

Glove use and hand hygiene in office-based practice

Following an audit of healthcare-associated infections in the practice and comparison of the results with Division benchmarks, a GP identifies a higher than usual rate of Staphylococcus aureus cross-transmission in her practice. The practice comprises three GPs and a part-time practice nurse. Practice policy is that staff members use gloves for patient contact, changing gloves between patients. There is no recommendation in the policy for hand hygiene between different care activities for the same patient or after removing gloves.

Eliminating risks	As patients may present with <i>Staphylococcus aureus</i> infections or asymptomatic colonisation, in this situation it is not possible to eliminate risk, so it must be managed.
Identifying risks	The risk has been identified as cross-transmission of <i>Staphylococcus aureus</i> , with higher than usual rates occurring. Audit of cases of other infections that may be transmitted in the healthcare environment would assist in identifying other infectious agents that may occur at high rates in the practice.
Analysing risks	One source of the risk has been identified as the lack of hand hygiene before and after use of gloves. Each time a patient carrying <i>Staphylococcus aureus</i> is examined, there is potential for the spread of the infectious agent from the glove to the healthcare worker's hand and then to the gloves worn for subsequent patients. The same applies for other infectious agents spread by contact. Existing controls and other sources of risk (e.g. low availability of alcohol-based hand rub) would also need investigation.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	Immediate measures may include provision of alcohol-based hand rub at all points of care and staff education in hand hygiene and PPE. Long-term measures would include revision and implementation of PPE and hand hygiene policies. This could be carried out by the GP as practice leader, in consultation with other staff.
Monitoring	Changes in practice could be monitored through audit of amounts of gloves and alcohol-based hand rub used. Repeating the audit of patient infections at regular intervals would assist in monitoring improvements.

BI.2.9 Resources

Standards

Gloves

- Standards Australia/Standards New Zealand. AS/NZS 4011:1997/Amdt 1:1998. Single use examination gloves – Specification. Sydney: Standards Australia International Ltd
- Standards Australia/Standards New Zealand. AS/NZS 4179:1997/Amdt 1:1998. Single use sterile surgical rubber gloves – Specification. Sydney: Standards Australia International Ltd

Masks

- Australia/New Zealand Standards, 2002, AS/NZS 4381: Single use facemasks for use in healthcare
- Australia/New Zealand Standards, 2009, AS/NZS 1715 Respiratory protective devices

Protective eyewear

- Australia/New Zealand Standards, 2002, AS/NZS 4381: Single use facemasks for use in healthcare

Gowns

- Australia/New Zealand Standards 3789.2 and Australia/New Zealand Standards 3789.3
- AS/NZS4146-2000 Laundry practice
- Australian Infection Control Association. AICA Standard 14. *Personal Protective Equipment*. Brisbane: AICA. 2006

Legislation/codes of practice

- State/territory workplace/occupational health and safety legislation/regulation outline the requirement for PPE (e.g. Queensland Workplace Health and Safety Act 1995, and associated regulations and WA Worksafe Commission Code of Practice – Personal Protective Clothing and Equipment 2002).
- Australian Therapeutic Good Register (ATGR)
<http://www.tga.gov.au/docs/html/artg.htm>

Tools and web-based resources

- Department of Health and Ageing *Putting on and Removing PPE - Pandemic Influenza* <http://www.healthemergency.gov.au/internet/healthemergency/publishing.nsf/content/safe-use-dvd.htm>
- Centers for Disease Control and Prevention *Decision Aid on Choosing PPE* <http://www.cdc.gov/ncidod/dhqp/ppe.html>

Latex allergy

- National Institute of Occupational Safety and Health Latex allergy prevention guide <http://www.cdc.gov/niosh/98-113.html>
- Australasian Society of Clinical Immunology and Allergy (ASCI) <http://www.allergy.org.au/content/view/107/1/>

BI.2.10 References

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BI.3 Handling and disposing of sharps

BI.3.1 What are the risks?

The use of sharp devices exposes healthcare workers to the risk of injury and potential exposure to bloodborne infectious agents, including hepatitis B virus, hepatitis C virus and human immunodeficiency virus (HIV) (CDC 2001; Do et al 2003).

Sharps injuries can occur in any healthcare setting, including non-hospital settings such as in office-based practices, home health care and long-term care facilities. Injuries most often occur (CDC 2008):

- during use of a sharp device on a patient (41%);
- after use and before disposal of a sharp device (40%); and
- during or after appropriate or inappropriate disposal of sharp devices (15%).

There are many possible mechanisms of injury during each of these periods.

Hollowbore needles are of particular concern, especially those used for blood collection or intravascular catheter insertion, as they are likely to contain residual blood and are associated with an increased risk for bloodborne virus transmission. Non-hollowbore sharps such as glass vials and butterfly needles have also been involved in sharps incidents (ASCC 2008).

Table BI.9: Examples of sharps associated with sharps injuries in healthcare settings

Examples of hollowbore sharps	Non-hollowbore sharps
<ul style="list-style-type: none"> • Disposable needles/ syringes • Steel-winged (butterfly) needles • Intravenous catheter stylets • Multi-sample blood collection needles • Arterial blood collection syringe needles • Aspiration needles • Injector pen needles 	<ul style="list-style-type: none"> • Glass vials • Dental probes • Scalpel blades • Suture needles • Retractors • Skin or bone hooks • Sharp electrosurgical tips

A survey of occupational exposures in Australian nurses (ASCC 2008) found that in the 12 months prior to the survey, 11.2% of nurses had sustained at least one needlestick or other sharps injury. Eliminating workplace hazard and risk is a fundamental principle of all occupational health and safety (OH&S) legislation in Australia. To limit the risk of sharps injuries, the hierarchy of controls method is a well recognised approach to prevent sharps injuries (CDC 2008; NOHSC (2010 [2003])). The first priority is to eliminate and reduce the use of needles and other sharps where possible. Next is to isolate the hazard, thereby protecting an otherwise exposed sharp, through the use of an engineering control. When these strategies are not available or will not provide total protection, the focus shifts to work-practice controls and PPE. An organisational approach to reducing sharps injuries is discussed in Section C1.5.2 and sharps injuries and post-exposure prophylaxis (PEP) in Section C6.3.

BI.3.2 Handling of sharps

All healthcare workers should take precautions to prevent injuries caused by needles, scalpels and other sharp instruments or devices: during procedures; when cleaning used instruments; during disposal of used needles; and when handling sharp instruments after procedures.

Standard measures to avoid sharps injuries include handling sharp devices in a way that prevents injury to the user and to others who may encounter the device during or after a procedure.

Examples include (CDC 2008):

- using instruments, rather than fingers, to grasp needles, retract tissue, and load/unload needles and scalpels
- giving verbal announcements when passing sharps
- avoiding hand-to-hand passage of sharp instruments by using a basin or neutral zone
- using round-tipped scalpel blades instead of pointed sharp-tipped blades.

The extent to which gloves protect healthcare workers from transmission of bloodborne infectious agents following a needlestick or other puncture that penetrates the glove has not been determined (Siegel et al 2007). Although gloves may reduce the volume of blood on the external surface of a sharp (Mast et al 1993), the residual blood in the lumen of a hollowbore needle would not be affected; therefore, the effect on reduction of transmission risk is not quantifiable (Siegel et al 2007).

Recommendations

9 Safe handling of sharps

Grade

Sharps must not be passed directly from hand to hand and handling should be kept to a minimum.
Needles must not be recapped, bent or broken after use.

D

BI.3.3 Disposal of single-use sharps

Any person who has used a disposable sharp instrument or equipment must be responsible for its safe management and immediate disposal after use.

After they are used, single-use syringes and needles, scalpel blades and other sharp items should be placed in an appropriate container. These containers should be clearly labelled, puncture and leak proof, and conform to AS4031 or AS/NZ 4261. The containers should be located at the point of use or, if this is not possible, as close as practical to the use area. Reusable sharps requiring transport to a reprocessing area must be placed in a puncture-resistant lidded container.

Sharps containers must be appropriately placed so that they are out of reach of children. They should also be placed in a secure position or mounted on the wall to prevent tipping.

There are numerous safety devices available that assist with safe removal and disposal of sharps (eg scalpel blade removers). Local protocol and procedures need to be developed to outline their appropriate use.

Table BI.10: Reducing risks if a sharps injury is sustained

- Seek care immediately if you sustain a sharps injury
- If skin is penetrated, wash the affected area immediately with soap and water. Alcohol-based handrub can be used to clean the area if soap and water are not available.
- Do not squeeze the affected area.
- Report the incident immediately to your supervisor.
- Ask about follow-up care, including post-exposure prophylaxis, which is most effective if implemented soon after the incident.
- Complete an accident / incident report form, including the date and time of the exposure, how it happened, and name of the source individual (if known).
- If a sharps injury happens to you, you can be reassured that only a small proportion of accidental exposures result in infection. Taking immediate action will lower the risk even further.

Recommendation

I0 Disposal of single-use sharps

Grade

The person who has used the single-use sharp must be responsible for its immediate safe disposal. Used disposable sharps must be discarded into an approved sharps container at the point-of-use. These must not be filled above the mark that indicates the bin is three-quarters full.

D

BI.3.4 Safety-engineered devices

A broad range of devices has been designed with built-in safety features that reduce the risk of injury involving a sharp. Examples include devices such as syringes with guards, sliding sheaths, shielded, blunting or retracting needles, blunt suture needles and surgical blades with protective covers.

The use of devices with safety-engineered protective features (e.g. safety or retractable devices) was mandated in the US in 2000 and is thought to have reduced the rate of incidence of needlestick injuries (Jagger et al 2008). Their use has recently been mandated in the UK and Europe, but not yet in Australia. Further research is required on their efficacy in reducing sharps injuries and their impact on patient safety.

Needleless devices

Needleless devices do not use needles for procedures such as the collection or withdrawal of body substances after initial venous or arterial access is established, or administering medication or fluids.

Since their adoption in healthcare facilities, needleless devices have contributed to a decrease in percutaneous injuries among healthcare workers (Jagger et al 2008). While it is difficult to assess the overall effect of needleless devices because of the wide variety of devices and systems that are in use, some studies have shown an increased risk of bloodstream infections (BSI) among patients (Rupp et al 2007; Salgado et al 2007).

Unfamiliarity with the use of these complex devices, together with inadequate disinfection procedures, may contribute to increased BSI rates. The CDC recommends that (O'Grady et al 2002):

- the needleless components are changed at least as frequently as the administration set
- caps are changed no more frequently than every 3 days or according to manufacturer's recommendations
- all components of the system are compatible to minimise leaks and breaks
- contamination risk is minimised by wiping the access port with an appropriate antiseptic and accessing the port only with sterile devices.

Disinfection of needleless connectors with chlorhexidine/alcohol or povidone-iodine has been shown to significantly reduce external contamination (Casey et al 2003).

Retractable devices

The use of retractable safety devices on sharps has been associated with a significant reduction in needlestick injury in healthcare settings (Rogues et al 2004; Tuma & Sepkowitz 2006), although their direct impact is difficult to determine because their introduction is often accompanied by other interventions (e.g. training and education, overarching hospital policies and other technologies) that in isolation could also cause a reduction in needlestick injuries (Whitby et al 2008).

Retractable technology is only one example of the broad range of safety-engineered medical devices that have been designed and produced to assist in reducing the risk of occupational exposure to bloodborne pathogens in healthcare.

Implementation of safety-engineered devices must be accompanied by appropriate training and education for healthcare workers in the use of the new technology to achieve successful reduction in percutaneous injury rates (Tuma & Sepkowitz 2006).

BI.3.5 Putting it into practice

Individual actions for reducing the risk

-
- Explain to patients the risks to healthcare workers and others involved in the use and disposal of sharps and the measures taken to reduce these
 - Become familiar with facility protocols on handling and disposal of sharps
 - Use the appropriate product for the situation and use it as directed
 - Avoid using needles where safe and effective alternatives are available
 - Before using any sharp medical device such as needles or scalpels, always plan for their safe handling and immediate disposal at the point-of-use
 - Make sure every used sharp medical device such as needles, scalpels etc are disposed of properly in puncture-resistant sharps containers located at the point-of-use
 - Report any needlestick or sharps-related injuries promptly as relevant (e.g. to infection control or occupational health and safety professional, management, insurer) and ensure that you receive appropriate follow-up care
 - Ensure that you are vaccinated against blood-borne viruses such as hepatitis B
 - Participate in education sessions and professional development sessions on handling sharps, as well as those on new safety devices and how to use them
-

Involving patients in their care

The following information may be provided to patients to assist them in becoming involved in identifying and reducing risks related to the handling and disposal of sharps.

- Healthcare workers are at risk of injury and infection when using sharp equipment such as needles and scalpels
- Healthcare workers take measures to handle sharp devices in a way that prevents injury to the user and to others who may encounter the device during or after a procedure
- Special containers are used for the disposal of sharp devices
- It's okay to question a healthcare worker about the way in which they are handling or disposing of sharp devices
- Patients will be educated before discharge from hospital about how to safely dispose of sharps used in the home so there is no risk of injury to community members

Risk-management case study

Prevention of stick injury during surgery at a university hospital

As part of the revision of infection control policies at a university hospital, an analysis of the risk of percutaneous blood and body substance exposure during surgical procedures was undertaken. Separate analyses were conducted for different device types and for different members of the surgical team. Surgeons and first assistants were at highest risk for injury, suffering more than half of injuries in the operating room, followed by scrub nurses and technicians, anaesthetists and circulating nurses. Rates of stick injury increased with estimated blood loss and surgery duration. Suture needle injuries were the most common and mostly occurred during wound closure. A considerable number of injuries also occurred while passing sharp instruments hand to hand. As many as one-third of devices that caused injuries came in contact with the patient after the injury to the healthcare worker. However, only a small proportion of injuries to surgeons (0.5%) involved hollowbore vascular access needles, which are defined as 'high risk'.

Source: Based on Myers et al (2008) and Bergauer & Heller (2005).

Eliminating risks	Although the risk of injury varies for different healthcare team members, it is never zero and must be managed.
Identifying risks	In this case, the risk has been identified as exposure of healthcare workers to blood and body substances (and potential infection) through suture needle injury. As a high proportion of devices causing injury came into contact with the patient after injury to the healthcare worker, there could also be a risk of transmission of bloodborne infection to the patient.
Analysing risks	The fundamental source of risk is the need to use sharps coupled with the potential for a patient to be a source of infection. The level of risk increases with duration of procedure and amount of blood lost. Other factors that may contribute to the risk are levels of staff training and experience, staffing levels, the existence of a hospital policy for safe use of sharps and compliance with the policy. Other factors that would need to be included in the analysis are existing controls to mitigate risk (e.g. double gloving) and other possible causes (e.g. poor surgical technique increasing blood loss and procedure duration).
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	Immediate measures may include providing staff education, use of blunt suture needles and a neutral zone for passing surgical equipment, and double gloving during long surgery. In the longer term, reviewing local policy on the prevention of needlestick injury and raising awareness of measures to reduce injury among staff members might also be considered.
Monitoring	Changes in adverse events could be evaluated by repeating the analysis after implementation of changes.

BI.3.6 Resources

Standards

- AS AS4031 Non-reusable containers for the collection of sharp medical items used in health care areas 1992 /AMDT 1 1996
- AS/NZS 4261 Reusable containers for the collection of sharp items used in human and animal medical applications 1994/AMDT 1: 1997
- S25 Management of Sharps in the Perioperative Environment
<http://www.acorn.org.au/about-acorn-standards.html>

Legislation/codes of practice

- National Occupational Health and Safety Commission. *National Code of Practice for the Control of Work-Related Exposure to Hepatitis and HIV (Blood-Borne) Viruses* [NOHSC 2010 (2003) 2nd ed.] Canberra: Australian Government National Occupational Health and Safety Commission. 2003.
- State/territory workplace/occupational health and safety legislation/regulation

Tools and web-based resources

- CDC (2008) *Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program*. United States Centers for Disease Control.
- University of Virginia Health System Internal worker safety centre provides numerous resources on safety devices and the application of their use. http://www.healthsystem.virginia.edu/internet/epinet/about_center.cfm
- Queensland Health Sharps Safety Programs http://www.health.qld.gov.au/chrisp/resources/sharps_safety.asp

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BI.4 Routine management of the physical environment

BI.4.1 What are the risks?

Infectious agents can be widely found in healthcare settings and there is a body of clinical evidence, derived from case reports and outbreak investigations, suggesting an association between poor environmental hygiene and the transmission of infectious agents in healthcare settings (Garner & Favero 1986; Dancer 1999). Transmission of infectious agents from the environment to patients may occur through direct contact with contaminated equipment, or indirectly, for example, in the acute-care setting, via hands that are in contact with contaminated equipment or the environment and then touch a patient (Dancer 2008).

Environmental surfaces can be safely decontaminated using less rigorous methods than those used on medical instruments and devices. The level of cleaning required depends on the objects involved and the risk of contamination—for example, surfaces that are likely to be contaminated with infectious agents (e.g. shared clinical equipment) require cleaning between patient uses,

which is more often than general surfaces and fittings. However, all surfaces require regular cleaning. Thorough cleaning of all surfaces is necessary after spills and between patient uses of a room or patient-care area, especially in acute-care settings.

Intensive care units and isolation areas require additional levels of cleaning, especially where there is a risk of MRO transmission (see Section B2.2).

BI.4.2 Routine environmental cleaning

General surfaces can be divided into two groups—those with minimal hand contact (e.g. floors and ceilings) and those with frequent skin contact ('frequently touched' or 'high risk' surfaces). The methods, thoroughness and frequency of cleaning and the products used are determined by risk analysis and reflected in healthcare facility policy. Frequently touched surfaces in patient-care areas should be cleaned using a detergent solution and more frequently than surfaces with minimal hand contact. Infection control professionals typically use a risk-assessment approach to identify frequently touched surfaces and then coordinate an appropriately thorough cleaning strategy and schedule with the housekeeping staff. When MROs are suspected or known to be present, routine cleaning is intensified and the use of a detergent solution is followed by the use of a disinfectant so that surfaces are cleaned twice (see Section B3.1.2).

Cleaning schedules

The recommendations outlined for cleaning should be justified by the risk of transmission of infection within a particular healthcare facility. All organisations should have a documented cleaning schedule that outlines clear responsibilities of staff, a roster of duties and the frequency of cleaning required and the products that should be used to clean specific areas. Organisations should also facilitate job or task-specific education and training by accredited bodies for general and special cleaning of the physical environment.

If cleaning is outsourced to cleaning service providers, all cleaning service delivery procedures should be documented, including details of how the cleaning service will be undertaken. The procedures must include the following (VCSUG 2009).

- *Minimum cleaning frequencies and methods:* cleaning service providers are required to provide cleaning services at whatever frequencies are deemed necessary in order to meet required standards. Section B5.1 provides a guide for minimum frequencies for cleaning within a healthcare facility providing acute care. It can be used as a guide for other settings.
- *Staffing:* including rosters for full-time, part-time and relief staffing members, as well as for management and supervisory positions.
- *Equipment:* including provision of consumable items (such as cleaning fluids and toilet paper) and facilities to be used to deliver each cleaning service.
- Management of the cleaning service: how the cleaning services will be managed and controlled at the service level, including specific details of the on-site management functions.

The risk of transmission of particular infections should be assessed and the cleaning schedule should be adjusted if a known infectious agent is present (e.g. an outbreak of *C. difficile* requires surfaces to be disinfected with sodium hypochlorite after cleaning with detergent [HPS 2008]).

Cleaning

Most hard surfaces can be adequately cleaned with warm water and detergent as per manufacturers instructions. Allowing the cleaned surface to dry is an important aspect of cleaning.

Minimal touch surfaces

A detergent solution (diluted as per manufacturer’s instructions) is adequate for cleaning general surfaces (e.g. floors, walls), as well as non-patient-care areas (e.g. administrative offices). Damp mopping is preferable to dry mopping for routine cleaning (Andersen et al 2009).

Walls and blinds in patient-care areas should be cleaned with detergent solution when they are visibly dusty or soiled. Window curtains should be regularly changed in addition to being cleaned when soiled or exposed to MROs. Sinks and washbasins should be cleaned with a detergent solution on a regular basis as set by facility policy.

Frequently touched surfaces

Surfaces that are in close proximity to the patient and frequently touched surfaces in the patient-care areas should be cleaned more frequently than minimal touch surfaces. Examples include doorknobs, bedrails, over-bed tables, light switches, tabletops and wall areas around the toilet in the patient’s room.

Frequently touched surfaces can be cleaned with a detergent solution designed for general purpose cleaning. The exact choice of detergent will depend on the nature of the surface and the likely degree of contamination. Detergent-impregnated wipes may be used to clean single pieces of equipment and small surface areas. This method is not normally used for general ward cleaning and should not be considered a replacement for clean cloths and detergent solution.

Recommendation

II Routine cleaning of surfaces

Grade

Clean frequently touched surfaces with detergent solution at least daily, and when visibly soiled and after every known contamination.

GPP

Clean general surfaces and fittings when visibly soiled and immediately after spillage.

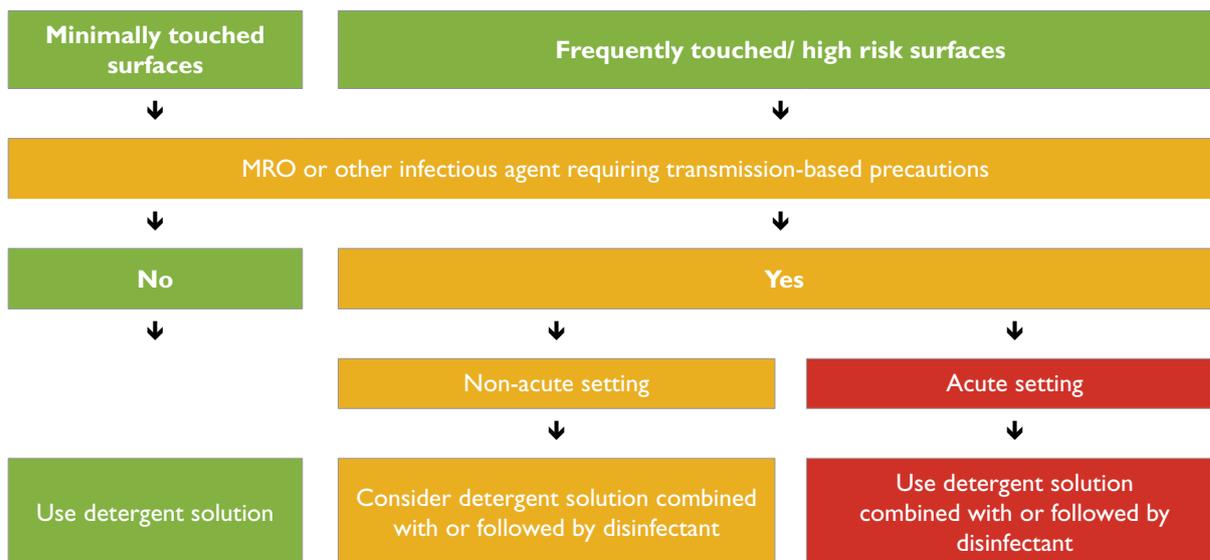
Use of disinfectants

In acute-care settings where there is uncertainty about the nature of soiling on the surface (e.g. blood or body fluid contamination versus routine dust or dirt) or the presence of MROs (including *C. difficile*) or other infectious agents requiring transmission-based precautions (e.g. pulmonary tuberculosis) is known or suspected, surfaces should be physically cleaned with a detergent solution, followed or combined with a TGA-registered disinfectant with label claims specifying its effectiveness against specific infectious organisms. This process must involve either:

- a physical clean using detergent followed by a chemical disinfectant (2-step clean) i.e. clean with detergent, then clean with a disinfectant
- a physical clean using a detergent and chemical disinfectant (2-in-1 clean) i.e. a combined detergent/disinfectant wipe or solution could be used if this process involves mechanical/manual cleaning.
- Physical (mechanical or manual) cleaning is the most important step in cleaning. Sole reliance on a disinfectant without mechanical/manual cleaning is therefore not recommended.

In office-based practice and less acute patient-care areas (e.g. long-term care facilities), the risk of contamination, mode of transmission and risk to others should be used to determine whether disinfectants are required.

Figure BI.3: Processes for routine cleaning



High-level disinfectants or liquid chemical sterilants are not appropriate for general cleaning; such use is counter to manufacturers’ instructions for these hazardous chemicals. Instrument disinfectants should not be used for surface disinfection. Alcohol should not be used to disinfect large environmental surfaces, given the risk of additional hazards such as flammability.

Technologies in this area are evolving and new technologies may replace the need for cleaning chemicals and disinfectants. Some current examples include ultramicrofibre cloths (Moore & Griffin 2006; Rutala 2007; Bergen et al 2008; Wren 2008) and hydrogen peroxide mist (Shapey 2008). More research is needed in these areas to assess the scope of organisms removed or killed and the practical application of these technologies.

Shared clinical equipment

While shared clinical equipment comes into contact with intact skin only and is therefore unlikely to introduce infection, it can act as a vehicle by which infectious agents are transferred between patients (Microbiological Advisory Committee to the Department of Health 2006). Examples of possible contaminated surfaces on shared medical equipment include knobs or handles on haemodialysis machines, x-ray machines, instrument trolleys and dental units (Schulster & Chinn 2003). Cleaning frequencies for specific shared clinical equipment is outlined in Section B5.1.

Surface barriers (e.g. clear plastic wrap, bags, sheets, tubing or other materials impervious to moisture) help prevent contamination of surfaces and equipment. Surface barriers on equipment (e.g. air water syringes, bedboards, computer keyboards) need to be placed carefully to ensure that they protect the surfaces underneath and should be changed and cleaned between patients. If surface barriers are unable to be used, cleaning clinical surfaces including equipment still applies.

Recommendation		Grade
I2	Cleaning of shared clinical equipment	GPP
Clean touched surfaces of shared clinical equipment between patient uses, with detergent solution. Exceptions to this should be justified by risk assessment.		
I3	Surface barriers	GPP
Use surface barriers to protect clinical surfaces (including equipment) that are: <ul style="list-style-type: none"> • touched frequently with gloved hands during the delivery of patient care • likely to become contaminated with blood or body substances • difficult to clean. Exceptions to this should be justified by risk assessment.		

Cleaning implements and solutions

Part of the cleaning strategy is to minimise contamination of cleaning solutions and cleaning tools. Proper procedures for effective use of mops, cloths, and solutions should be followed:

- prepare cleaning solutions daily or as needed, and replace with fresh solution frequently according to facility policy
- clean mops and cloths after use and allow to dry before reuse, or use single-use mop heads and cloths.

Table B1.11: Choosing cleaning/disinfection products

When choosing an appropriate product the following factors should be considered
<ul style="list-style-type: none"> • The product is approved by TGA for use in that particular circumstance • The intended purpose of the product as per manufacturer’s instructions • That manufacturer’s instructions are able to be complied with in the facility • The suitability of the product to the surface or setting • The practical application of using the product or technology with available resources including trained staff • The effectiveness of the product against particular organisms including microbiological activity and contact time to kill microorganisms

Carpet

Carpets in public areas and in general patient-care areas should be vacuumed daily with well-maintained equipment fitted with high efficiency particulate air (HEPA) filters to minimise dust dispersion (see also Section C6.2.3). After a spill has been removed as much as possible (see Section B1.4.3), the carpet should be cleaned using the hot water extraction method, which is recognised by AS/NZS 3733:1995 to minimise chemical and soil residue.

Carpets should undergo thorough cleaning on a regular basis as set by facility policy, using a method that minimises the production of aerosols, leaves little or no residue and is recommended by Australian Standards and manufacturer’s recommendations.

Checking, auditing and environmental sampling

Healthcare facilities use a variety of systems to ensure that cleaning standards are met. These include checklists, colour coding to reduce the chance of cross infection, cleaning manuals, model cleaning contracts, infection control guidance, and monitoring strategies. Some states and territories have cleaning standards that are applied to healthcare facilities regardless of whether cleaning services are contracted or performed in-house.

Auditing of cleaning is mostly done through visual checking; however, this does not recognise that microorganisms are invisible to the naked eye (Dancer 2008). Currently, more objective methods of assessing surface cleanliness and benchmarking (such as black-spot auditing and detection of bacterial load with ATPase) are being investigated.

Routine microbiological sampling of the environment to determine the effectiveness of cleaning has considerable limitations, including detection of specific classes of organisms (with exclusion of others), inconsistency and unpredictability of 'patient shedding' and other causes of environmental contamination, variation of effects of residual detergent/ disinfectants, and variations in sampling techniques and testing. These limitations make interpreting the results very difficult (Button 2006; Mutters et al 2009; Rohr et al 2009) and routine environmental sampling is therefore not recommended. However, there may be a role for environmental sampling in the management of specific situations and as part of a holistic risk-management approach (e.g. an outbreak situation or unidentified cause of infections).

B1.4.3 Management of blood and body substance spills

Prompt removal of spots and spills of blood and body substance followed by cleaning and disinfection of the area contaminated is a sound infection control practice and meets occupational health and safety requirements (Schulster & Chinn 2003).

Process of spills management

Strategies for decontaminating spills of blood and other body substances (e.g. vomit, urine) differ based on the setting in which they occur and the volume of the spill:

- in patient-care areas, healthcare workers can manage small spills by cleaning with detergent solution
- for spills containing large amounts of blood or other body substances, workers should contain and confine the spill by:
 - removing visible organic matter with absorbent material (e.g. disposable paper towels)
 - removing any broken glass or sharp material with forceps
 - soaking up excess liquid using an absorbent clumping agent (e.g. absorbent granules).

The B1.12 table demonstrates appropriate processes when managing spills.

Appropriate PPE should be worn at all times.

If spillage has occurred on soft furnishings, a detergent solution can be used to clean the area thoroughly. Do not clean soft furnishings with a disinfectant such as sodium hypochlorite.

Soft furnishings can also be wet vacuumed. Following cleaning of soft furnishings, every effort must be made to air the room to allow drying of the furnishing before reuse.

Alcohol solutions should not be used to clean spillages (HPS 2006).

Table BI.12: Management of blood or body substance spills

Spot cleaning	<ul style="list-style-type: none"> • Select appropriate PPE • Wipe up spot immediately with a damp cloth, tissue or paper towel • Discard contaminated materials • Perform hand hygiene
Small spills (up to 10cm diameter)	<ul style="list-style-type: none"> • Select appropriate PPE • Wipe up spill immediately with absorbent material • Place contaminated absorbent material into impervious container or plastic bag for disposal • Clean the area with warm detergent solution, using disposable cloth or sponge • Wipe the area with sodium hypochlorite and allow to dry • Perform hand hygiene
Large spills (greater than 10cm diameter)	<ul style="list-style-type: none"> • Select appropriate PPE • Cover area of the spill with an absorbent clumping agent and allow to absorb • Use disposable scraper and pan to scoop up absorbent material and any unabsorbed blood or body substances • Place all contaminated items into impervious container or plastic bag for disposal • Discard contaminated materials • Mop the area with detergent solution • Wipe the area with sodium hypochlorite and allow to dry • Perform hand hygiene

The use of sodium hypochlorite is not necessary for routinely managing spills but it may be used in specific circumstances. There is evidence supporting the use of sodium hypochlorite to inactivate various bloodborne and gastrointestinal viruses, and bacteria such as *C. difficile* (HPS 2008). The consideration to use sodium hypochlorite should be based on risk assessment of the environment, the spill, risk of transmission of disease, and the surface area and potential hazards with using the product.

If a disinfectant is required, particularly during the implementation of transmission-based precautions, a TGA-registered hospital grade disinfectant must be used. The disinfectant chosen should have label claims against the organism of concern.

Recommendation

I4 Site decontamination after spills of blood or other potentially infectious materials **Grade**

Spills of blood or other potentially infectious materials should be promptly cleaned as follows: **C**

- wear utility gloves and other PPE appropriate to the task;
- confine and contain spill, clean visible matter with disposable absorbent material and discard the used cleaning materials in the appropriate waste container;
- clean the spill area with a cloth or paper towels using detergent solution.

Use of chemical disinfectants such as sodium hypochlorite should be based on assessment of risk of transmission of infectious agents from that spill.

Spill kit

A spill kit should be readily available in each clinical area and should include a scoop and scraper, single-use gloves, protective apron, surgical mask and eye protection, absorbent agent, clinical waste bags and ties, and detergent. All parts should be disposable to ensure that cross-contamination does not occur.

BI.4.4 Putting it into practice

Individual actions for reducing the risk

- Make sure you are familiar with facility policies on routine cleaning
- Familiarise yourself with the cleaning frequencies outlined in Section B5.1 (see page 161).
- Report any concerns you have about hygiene
- Consider ways to involve patients in monitoring the cleanliness of the patient-care area (e.g. through comments books on the ward, or a short questionnaire to be filled in before discharge)

Involving patients in their care

Patients are an integral part of the risk-management process. Following are points of advice to assist patients in becoming involved in identifying and reducing risks related to routine hospital hygiene.

- All surfaces and equipment in the patient-care environment are regularly cleaned to prevent transmission of infection—equipment is cleaned immediately after use (i.e. between patients)
- Surfaces that are touched often (such as doorknobs, bedrails, over-bed tables, light switches) and floors are cleaned daily, while surfaces that are touched less often (such as ceilings) are cleaned less frequently
- Blood or other body substances (such as urine or vomit) increase the risk of transmission of infection so they are cleaned away promptly
- You should notify staff if you think something needs to be cleaned

Risk-management case study

Spills management in a busy paediatric ward

A visitor to the paediatric ward in a small regional hospital notices that the child in the next bed is vomiting and has diarrhoea. The ward is extremely busy and the two nurses on duty are fully occupied. The child's mother has cleaned up any spills, but there are still traces of vomit on the bedside table. Later the visitor notices that equipment is being placed on this table. When there is a lull in activity in the ward, the visitor approaches one of the nurses and mentions what she has noticed. The nurse is grateful for the advice and the quiet period is used for more thorough cleaning of surfaces around the vomiting child. The nurse thanks the mother for her assistance and explains to her the importance of thorough cleaning and hand hygiene in the prevention of transmission of infection.

Eliminating risks	Ideally, this risk can be eliminated through immediate removal and cleaning of spills. However, in many situations it is more likely that the risk will be managed.
Identifying risks	The risk has been identified as potential cross-transmission of Norovirus through environmental contamination.
Analysing risks	One source of the risk has been identified as inadequate environmental cleaning by a visitor resulting in potential contamination of equipment placed on environmental surfaces (bedside table) or hands touching this surface. There is then potential for direct or indirect spread of infection to other patients, visitors and healthcare workers. There are likely to be other infectious agents that could be transmitted in the same way (e.g. Rotavirus).
Evaluating risks	The balance of likelihood and consequences identify this as a 'high risk' situation requiring immediate response.
Treating risks	Immediate measures may include raising patient and visitor awareness of hygiene measures (including hand hygiene as well as environmental cleaning). This could be done through posters and/or discussion with patients and carers on admission. Longer-term measures could include revision and implementation of environmental cleaning policies and involvement of patients/visitors in this review.
Monitoring	Changes in practice could be monitored through observation of patient/visitor behaviour.

BI.4.5 Resources

Standards

- Victorian Department of Human Services Cleaning standards for Victorian public hospitals
- AS/NZS:3733:1995
- AS/NZS:4849.1.2003 Upholstery Cleaning.

Legislation/codes of practice

- Therapeutic Goods Order No 54 - Standard for Disinfectants and Sterilants (TGO 54)
- Australian Register of Therapeutic Goods (ARTG) Class B for disinfectants
- National Occupational Health and Safety Commission. National Code of Practice for the preparation of material safety data sheets. [NOHSC: 2100(1994)]. Canberra: Australian Government Publishing Services.

Guidelines

- Centers for Disease Control and Prevention Guideline for Environmental Infection Control in Health-Care Facilities 2003 http://www.cdc.gov/ncidod/dhqp/gl_environmentinfection.html
- NHMRC (1996) *Infection Control in the Healthcare Setting. Guidelines for the Prevention of Transmission of Infectious Diseases*. National Health and Medical Research Council. Rescinded.
- VCSUG (2009) *Cleaning Standards for Victorian Health Facilities*. Victorian Cleaning Standards User Group, Department of Health, Victoria. <http://www.health.vic.gov.au/cleaningstandards/>

Tools and web-based resources

- *Little Yellow Infection Control Book*. Available at http://www.health.vic.gov.au/__data/assets/pdf_file/0018/37350/lyicb_original.pdf
- Health Protection Scotland *Control of the Environment - Standard Infection Control Precautions (SICP)* <http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=31229>
- *Revised Cleaning Manual*. National Learning and Reporting Service, National Patient Safety Agency, NHS <http://www.nrls.npsa.nhs.uk/resources/?EntryId45=61830>

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BI.5 Reprocessing of reusable instruments and equipment

This section gives core principles for reprocessing of reusable instruments and equipment in any healthcare setting. Healthcare facilities should develop local policies and procedures relevant to their setting and may also need to consult relevant Australian standards and discipline-specific guidelines for further advice on reprocessing requirements.

BI.5.1 What are the risks?

Any infectious agents introduced into the body can establish infection. In all healthcare settings, reusable instruments and equipment should be handled in a manner that will prevent patient, healthcare worker and environmental contact with potentially infectious material. Principles of reprocessing reusable instruments and equipment include (TGA 1998):

- all reusable medical devices and patient-care equipment used in the clinical environment should be reprocessed according to their intended use and manufacturer’s advice
- only TGA-registered reusable medical devices should be used; before purchase, healthcare facilities should ensure that manufacturer’s reprocessing instructions are provided and are able to be followed by the healthcare facility
- single-use medical devices should not be reprocessed
- if a healthcare facility takes a decision to reprocess single-use devices, the facility must be licensed by the TGA
- will be considered a manufacturer
- will be subject to audit for conformance.

BI.5.2 Assessing the degree of risk

Any instrument or piece of equipment that is to be reused requires reprocessing—cleaning, disinfection and/or sterilisation. The minimum level of reprocessing required for reusable instruments and equipment depends on the individual situation (i.e. the body site and the nature by which the instrument will be used).

The approach to disinfection and sterilisation of patient-care items and equipment devised by Spaulding over 30 years ago has been retained and refined and is still successfully used by infection control professionals and others when planning methods for disinfection or sterilisation (Rutala & Weber 2008). The system is based on instruments and items for patient care being categorised into critical, semi-critical and non-critical, according to the degree of risk for infection involved in use of the items.

Table BI.13: Categories of items for patient care

Critical	These items confer a high risk for infection if they are contaminated with any microorganism and must be sterile at the time of use. This includes any objects that enter sterile tissue or the vascular system, because any microbial contamination could transmit disease.
Semi-critical	These items come into contact with mucous membranes or non-intact skin, and should be single use or sterilised after each use. If this is not possible, high-level disinfection is the minimum level of reprocessing that is acceptable.
Non-critical	These items come into contact with intact skin but not mucous membranes. Thorough cleaning is sufficient for most non-critical items after each individual use, although either intermediate or low-level disinfection may be appropriate in specific circumstances.

Computers and personal digital assistants (PDAs) used in patient care should be included in policies for cleaning non-critical items. Although keyboard covers and washable keyboards that can

be easily cleaned are in use, the infection control benefit of these items and optimal management are yet to be determined.

BI.5.3 Cleaning

Cleaning is the removal of foreign material (e.g. soil and organic material) from objects and is normally accomplished using detergent solution.

Cleaning to remove organic material must always precede high-level disinfection and sterilisation of critical and semi-critical instruments and devices as residual proteinaceous material reduces the effectiveness of the disinfection and sterilisation processes. If an item cannot be cleaned, it cannot be disinfected or sterilised.

Instruments should be cleaned as soon as practical after use (e.g. preferably at the point of use) before soiled materials become dried onto the instruments. Dried or baked materials on the instrument make the removal process more difficult and the disinfection or sterilisation process less effective or ineffective.

Instruments that can be disassembled must be disassembled before the cleaning and the disinfection/sterilisation process.

Methods of cleaning

Automated

Automated cleaners (ultrasonic cleaners and washer-disinfectors) reduce the handling of instruments and are recommended for cleaning basic instruments that can withstand the process.

- Ultrasonic cleaners work by subjecting instruments to high frequency, high-energy sound waves, thereby loosening and dislodging dirt.
- Washer-disinfectors use detergent solutions at high temperatures to wash instruments. When a washer-disinfecter is used, care should be taken in loading instruments: hinged instruments should be opened fully to allow adequate contact with the detergent solution; stacking of instruments in washers should be avoided; and instruments should be disassembled as much as possible.

Manual

Cleaning is done manually for fragile or difficult-to-clean instruments and in areas without automatic units.

The two essential components of manual cleaning are:

- friction—rubbing/scrubbing the soiled area with a soft brush
- fluidics—use of fluids to remove soil and debris from internal channels after brushing and when the design does not allow passage of a brush through a channel.

Healthcare workers should wear appropriate PPE for the task—plastic apron, utility gloves and face protection (protective eyewear and mask or face shield). Care should be taken to prevent splashes to mucous membranes or penetration of the skin by sharp instruments.

Cleaning agents

The cleaning solution and style must be appropriate for each instrument and equipment. The manufacturer's instructions will guide the type of cleaning agent required. This is usually neutral pH or mildly alkaline as such solutions generally provide the best material compatibility profile and good soil removal and mildly acidic solutions may damage instruments.

Enzymes, usually proteases, are sometimes added to neutral pH solutions to assist in removing organic material such as blood and pus. Cleaning solutions can also contain lipases (enzymes

active on fats) and amylases (enzymes active on starches). Enzymatic cleaners are not disinfectants, and proteinaceous enzymes can be inactivated by germicides.

As with all chemicals, enzymes must be rinsed from the equipment or adverse reactions could result.

Checking effectiveness of cleaning

During the past few years, data have been published describing use of an artificial soil, protein, endotoxin, X-ray contrast medium, or blood, to verify manual or automated cleaning processes and adenosine triphosphate bioluminescence and microbiologic sampling to evaluate the effectiveness of environmental surface cleaning (Rutala & Weber 2008). However, these are not used routinely in most healthcare facilities.

Australian Standards (AS 2945:2002) outline specific test methods to check the effectiveness of cleaning to verify manual and automated processes. At a minimum, all instruments should be individually inspected (with magnification where possible) and be visibly clean.

BI.5.4 Disinfection

Disinfection is a process that inactivates non-spore-forming infectious agents, using either thermal (moist or dry heat) or chemical means. Items need to be cleaned before being disinfected.

Instruments should be removed from the disinfectant after reprocessing and stored dry.

To preserve the surfaces of the instruments, dissimilar metals should be separated before cleaning.

- *Thermal disinfection* uses heat and water, at temperatures that destroy infectious agents and is appropriate for items that are heat and moisture resistant and do not require sterilisation. Thermal disinfection, is the simplest, most efficient and cost-effective method of disinfection. It can be achieved in an automated thermal washer-disinfector by choosing the appropriate cycle.
- *Chemical disinfection* can be achieved with a compatible TGA-registered instrument-grade disinfectant, used alone or together with an automated washer-disinfector. Chemical disinfectants include alcohols, chlorine and chlorine compounds, formaldehyde, hydrogen peroxide, phenolics and quaternary ammonium compounds. Commercial formulations based on these chemicals are considered unique products and must be registered with the TGA. In most instances, each product is designed for a specific purpose; therefore, users should read labels carefully to ensure the correct product is selected for the intended use and applied efficiently.

There are three levels of disinfection, depending on the intended use of the instruments.

Disinfection is not a sterilising process. Wherever possible, sterilise items to be used in semi-critical sites, or employ single-use items.

BI.5.5 Sterilisation

Sterilisation destroys all microorganisms on the surface of an instrument or device, to prevent disease transmission associated with the use of that item. While the use of inadequately sterilised critical items represents a high risk of transmitting infectious agents, documented transmission associated with an inadequately sterilised critical item is rare. This is probably due to the wide safety margin associated with the sterilisation processes used in healthcare facilities.

- Reprocessing of heat resistant items is recommended by steam sterilisation due to the safety margin, reliability, validity and lethality.
- Reprocessing heat and moisture-sensitive items requires use of a low-temperature sterilisation technology (e.g. ethylene oxide, hydrogen peroxide plasma, peracetic acid, aldehyde).

Sterilisation methods are designed to give a sterility assurance level (SAL) of at least 10^{-6} , provided the sterilisation process is validated by the user. Records of sterilisation must also be kept to verify that an

appropriate reprocessing system is in place according to state and federal legislation. Details of the documentation required can be found in Australian Standards AS/NZS 4187 and AS/NZS 4815.

In this rapidly changing area, reprocessing standards should evolve to accommodate changes in equipment design and emerging technologies in sterilisation.

BI.5.6 Storage and maintenance

All items must be stored in a way that that maintains their level of reprocessing (e.g. sterile, high level disinfected). Dry, sterile, packaged instruments and equipment should be stored in a clean, dry environment and protected from sharp objects that may damage the packaging. This is essential for instruments and equipment that are sterile and intended for use on critical sites.

Equipment and instrument surfaces should be regularly examined for breaks in integrity that would impair either cleaning or disinfection/sterilisation. Equipment that no longer functions as intended or cannot be properly cleaned and disinfected or sterilised should be repaired or discarded.

Table BI.14: General criteria for reprocessing and storage of equipment and instruments in healthcare settings

Level of risk	Process	Examples	Storage
<p>*Critical</p> <p>Entry or penetration into sterile tissue, cavity or blood stream</p>	<ul style="list-style-type: none"> Clean thoroughly as soon as possible after using Sterilise after cleaning by steam under pressure If heat or moisture sensitive, sterilise through an automated low temperature chemical sterilant system, other liquid chemical sterilants or ethylene oxide sterilisation 	<ul style="list-style-type: none"> Invasive surgical and dental equipment e.g. surgical oral instruments, arthroscopes, laparoscopes, rigid and flexible bronchoscopes, heat stable scopes Cardiac and urinary catheters, implants and ultrasound probes used in sterile body cavities 	<p>Sterility must be maintained:</p> <ul style="list-style-type: none"> packaged items must go through a drying cycle and then be checked to ensure drying has taken place before use or storage the integrity of the wrap must be maintained wraps should act as an effective biobarrier during storage unpackaged sterile items must be used immediately (without contamination in transfer from steriliser to site of use) or resterilised
<p>Semi-critical</p> <p>Contact with intact mucous membranes or non- intact skin</p>	<ul style="list-style-type: none"> Clean thoroughly as soon as possible after using Steam sterilisation is preferable If the equipment will not tolerate steam use a high level chemical or thermal disinfectant 	<ul style="list-style-type: none"> Respiratory therapy and anaesthesia equipment, some endoscopes, vaginal speculae, laryngoscope blades, cystoscopes, anorectal manometry catheters, diaphragm fitting rings Probes including transoesophageal echocardiogram, transrectal ultrasound and transvaginal probes 	<p>Store to prevent environmental contamination</p>
<p>Non-critical</p> <p>Contact with intact skin</p>	<ul style="list-style-type: none"> Clean as necessary with detergent solution If decontamination necessary, disinfect with compatible low or intermediate level TGA-registered disinfectant after cleaning 	<ul style="list-style-type: none"> Stethoscopes, sphygmomanometers, blood pressure cuffs, mercury thermometers, non-invasive ultrasound probes Commodes, intravenous pumps and ventilators Noninvasive ultrasound probes 	<p>Store in a clean dry place to prevent environmental contamination</p>

Notes: Critical items, particularly endoscopes, must be sterilised between patient uses. An invasive procedure is defined as entry into tissues, cavities or organs or repair of traumatic injuries.

Source: Rutala & Weber (2008).

Further considerations

Steam sterilisation and the other methods listed above are not sufficient for reprocessing items potentially contaminated with certain types of infectious agents. This includes prions, such as vCJD, for which single-use items should be used wherever possible and subsequently destroyed by incineration.

This guideline does not provide detailed information on reprocessing of reusable instruments or disease-specific guidance. The Department of Health and Ageing provides further information on infection control issues relating to vCJD. Refer to <http://www.health.gov.au/internet/main/publishing.nsf/Content/icg-guidelines-index.htm>.

BI.5.7 Putting it into practice

Individual actions for reducing risk

- Become familiar with standards and facility protocols on cleaning, disinfecting and sterilising
 - Use the appropriate product for the situation and use it as directed
 - Participate in education sessions and professional development sessions on reprocessing instruments and equipment, particularly when new sterilising or disinfecting equipment is introduced
-

Involving patients in their care

The following information may be provided to patients to assist them in becoming involved in identifying and reducing risks related to reprocessing of instruments and equipment.

- Many instruments and equipment in the hospital are reusable
 - All reusable instruments and equipment are cleaned thoroughly and then either disinfected or sterilised before being used on the next patient
 - The system for cleaning, disinfecting and sterilising instruments and equipment protects patients and healthcare workers from contact with potentially infectious material
 - Any instrument that enters a part of the body (e.g. in surgery) is sterilised and completely free of all potentially harmful organisms
 - Any instrument that goes inside the nose, mouth or other orifice, or touches broken skin, is either sterilised or disinfected to a high level
 - Any equipment that touches the patient or is touched by the patient, is cleaned thoroughly and if necessary disinfected
 - It's okay to ask about the cleaning and sterilising practices in the hospital
-

Risk-management case study

Reprocessing of instruments in a dental practice

A patient attends a dental practice for a scaling and cleaning of his teeth. He has moderate periodontal disease with inflamed gingiva (gums). The dentist uses both an ultrasonic scaler (which creates aerosol) and very sharp hand scalers and curettes. Neither the dentist nor the assistant wears a mask. To protect the tongue and cheeks of the patient from being injured by the sharp instruments, a dental mirror is used to retract them. The mirror consists of a handle into which a mirror head is screwed. The handle of the mirror has a corrugated surface so that it doesn't slip. During this procedure the mirror gets covered in blood from the bleeding of the inflamed diseased gums.

Eliminating risks	Proper reprocessing of the instrument, operator and assistant care in the use of sharp instruments and protecting against possible aerosol exposure has the potential to eliminate the risk.
Identifying risks	There is a risk of exposure of other patients to bloodborne viruses if the mirror is not reprocessed properly (i.e. still has blood on it or if the mirror head was constantly loose during the procedure). There is also a risk of exposure of staff to aerosol infectious agents (influenza in particular) and a risk of staff exposure to bloodborne viruses through sharps injury (either during the treatment or during reprocessing).
Analysing risks	Sources of the risk are difficulties in reprocessing the mirror; the use of multiple sharp instruments in a bloody field and aerosolisation caused by the treatment.
Evaluating risks	The balance of likelihood and consequences identify this as a 'medium risk' situation requiring management by specific monitoring or audit procedures.
Treating risks	Immediate measures include making sure that mirror handles are clean before sterilisation, operator care in the use of sharp instruments, use of high volume evacuation to reduce aerosolisation caused by this treatment and wearing of masks by operator and assistant. Longer-term measures could include revising practice PPE and instrument cleaning and reprocessing policies.
Monitoring	Repeated checking of reprocessed instruments, audits of staff sharps injuries and monitoring of PPE use would assist in assessing of the level of risk on an ongoing basis.

BI.5.8 Resources

CDC (2008) *Guideline for the Disinfection and Sterilization in Healthcare Facilities 2008*.

Standards

- AS 1079.1-1993 Packaging of items (sterile) for patient care – selection of packaging materials for goods undergoing sterilisation
- AS 1410-2003 Sterilizers – Steam – Pre-vacuum
- AS 2182 Sterilizer Steam Benchtop
- AS 2192 – 1991 Sterilisers-Steam-downward displacement
- AS 2437-1987 Flusher/sterilizers for bedpans and urine bottles
- AS 2487: Dry heat sterilizers
- AS 2514-1999 Drying cabinets for medical equipment
- AS 2773.1-1998 Ultrasonic cleaners for health care facilities – Non-portable
- AS 2773.2-1999 Ultrasonic cleaners for healthcare facilities-Benchtop
- AS 2774-1985 Drying cabinets for respiratory apparatus
- AS 2945 (Int) – 2002 Batch-type washes/disinfectors for health care facilities
- AS3789.2-1991 Textiles for health care facilities and institutions – Theatre linen and pre-packs
- AS 3836-1998 Rack conveyor washes for health care facilities
- AS/NZ 4146: 2000 Laundry Practice
- AS/NZS 4187: Cleaning, Disinfecting and Sterilizing Reusable Medical and Surgical Instruments and Equipment, and Maintenance of Associated Environments in Health Care Facilities
- AS/NZS 4815: Office-based healthcare facilities-Reprocessing of reusable medical and surgical instruments and equipment, and maintenance of the associated environment
- Therapeutic Goods (Medical Devices) 2007 Regulations (see PD2005_399 Single Use Medical Devices (SUDs) Remanufacture)
- S16 Reprocessing of Reusable Items: Cleaning, Packaging, Sterilisation and Storage of Sterile Supplies <http://www.acorn.org.au/about-acorn-standards.html>

Guidelines

- Department of Health and Ageing Infection control guidelines (2007) Section 31 Creutzfeldt Jakob Disease <http://www.health.gov.au/internet/main/publishing.nsf/Content/icg-guidelines-index.htm>
- NSW Health, Health Procurement, Guidelines for Storage and Handling of Pre-Sterilized Consumables
- Centers for Disease Control and Prevention *Guideline for Disinfection and Sterilization in Healthcare Facilities*, 2008 <http://www.cdc.gov/ncidod/dhqp/guidelines.html>
- GESA/GENCA document: Infection Control in Endoscopy 2nd Edition. (2003) <http://www.gesa.org.au/professional/guidelines/infectioncontrol.cfm>

Tools and web-based resources

- Sterilizing Research Advisory Council of Australia <http://www.sraca.org.au/>
- The Australian College of Operating Room Nurses Standards <http://www.acorn.org.au/>
- Queensland Health Sterilizing Services resources available at: Endoscope Reprocessing, Queensland Health <http://www.health.qld.gov.au/EndoscopeReprocessing/default.asp>
- Prions and reprocessing <http://www.dh.gov.uk/ab/ACDP/TSEguidance/index.htm>

BI.5.9 References

Rutala WA & Weber DJ (HICPAC) (2008) *Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008*. United States Centers for Disease Control. http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf

TGA (1998) *Therapeutic Goods Order No 54 - Standard for Disinfectants and Sterilants (TGO 54)*. <http://www.tga.gov.au/docs/pdf/tgo/tgo54.pdf>

BI.6 Respiratory hygiene and cough etiquette

Respiratory hygiene and cough etiquette should be applied as a standard infection control precaution at all times. Covering sneezes and coughs prevents infected persons from dispersing respiratory secretions into the air. Hands should be washed with soap and water after coughing, sneezing, using tissues, or after contact with respiratory secretions or objects contaminated by these secretions.

Table BI.15: Steps in respiratory hygiene and cough etiquette

<p>Anyone with signs and symptoms of a respiratory infection, regardless of the cause, should follow or be instructed to follow respiratory hygiene and cough etiquette as follows:</p> <ul style="list-style-type: none"> • Cover the nose/mouth with disposable single-use tissues when coughing, sneezing, wiping and blowing noses • Use tissues to contain respiratory secretions • Dispose of tissues in the nearest waste receptacle or bin after use • If no tissues are available, cough or sneeze into the inner elbow rather than the hand • Practice hand hygiene after contact with respiratory secretions and contaminated objects/materials • Keep contaminated hands away from the mucous membranes of the eyes and nose

Health care/social workers should also assist patients (e.g. elderly, children) who need assistance with containment of respiratory secretions. Those who are immobile will need a receptacle (e.g. plastic bag) readily at hand for the immediate disposal of used tissues and will need to be offered hand hygiene facilities.

Respiratory hygiene and cough etiquette are particularly important for patients on droplet precautions (see Section B2.3).

BI.6.1 Resources

- Department of Health and Ageing
[http://www.healthemergency.gov.au/internet/healthemergency/publishing.nsf/Content/posters.htm/\\$File/cough_etiquette.pdf](http://www.healthemergency.gov.au/internet/healthemergency/publishing.nsf/Content/posters.htm/$File/cough_etiquette.pdf)
- US Centers for Disease Control and Prevention
<http://www.cdc.gov/flu/protect/covercough.htm>
- Health Protection Scotland (2009) Respiratory Hygiene and Cough Etiquette Standard Infection Control Policy (Accessed July 2009)
<http://www.hps.scot.nhs.uk/haic/ic/guidelinedetail.aspx?id=43001>
- WHO (2007) Infection Prevention and Control of Epidemic- and Pandemic-Prone Acute Respiratory Diseases in Health Care WHO Interim Guidelines, WHO, Geneva.

BI.7 Aseptic technique

Aseptic technique protects patients during invasive clinical procedures by employing infection control measures that minimise, as far as practicably possible, the presence of pathogenic microorganisms.

BI.7.1 Aseptic non-touch technique (ANTT)

ANTT is a framework for aseptic practice—the principles are intended for use in a range of settings from the operating theatre to the community. Since 1993, the ANTT project (www.antt.org.uk) has helped implement ANTT through clinical guidelines and a standard implementation process, into hundreds of hospitals and community health organisations in the UK and internationally. As a result, ANTT has become the first standardised method of aseptic technique to exist in multiple hospitals and community care organisations. Hospitals that have implemented ANTT robustly have reported significant improvements in practice that have helped reduce rates of healthcare-associated infection (Rowley & Clare 2009).

Terminology

Historically, the practice of protecting patients from contamination and infection during clinical procedures has generated an inaccurate and confusing paradigm based on the terminology of undefined sterile, aseptic and clean techniques.

The use of accurate terminology is important in order to promote clarity in practice.

Sterile ‘Free from microorganisms’ (Weller 1997)

Due to the natural multitude of organisms in the atmosphere it is not possible to achieve a sterile technique in a typical healthcare setting. Near sterile techniques can only be achieved in controlled environments such as a laminar air flow cabinet or a specially equipped theatre. The commonly used term, ‘sterile technique’ i.e. the instruction to maintain sterility of equipment exposed to air, is obviously not possible and is often applied inaccurately.

Asepsis '*Freedom from infection or infectious (pathogenic) material*' (Weller 1997)

An **aseptic technique** aims to prevent pathogenic organisms, in sufficient quantity to cause infection, from being introduced to susceptible sites by hands, surfaces and equipment. Therefore, unlike sterile techniques, aseptic techniques are possible and can be achieved in typical hospital and community settings.

Clean '*Free from dirt, marks or stains*' (McLeod 1991).

Although cleaning followed by drying of equipment and surfaces can be very effective it does not necessarily meet the quality standard of asepsis (Ayliffe 2000). However, the action of cleaning is an important component in helping render equipment and skin aseptic, especially when there are high levels of contamination that require removal or reduction. However, to be confident of achieving asepsis an application of a skin or hard surface disinfectant is required either during cleaning or afterwards.

Consequently, the aim of any aseptic technique including ANTT, is asepsis.

ANTT in practice

ANTT is a technique used to prevent contamination of key parts and key sites by microorganisms that could cause infection. In ANTT, asepsis is ensured by identifying and then protecting key parts and key sites by hand hygiene, non-touch technique, using new sterilised equipment and/or cleaning existing key parts to a standard that renders them aseptic prior to use (Rowley et al 2010).

Risk assessment

While the principles of ANTT remain constant for all clinical procedures, the level of practice will change depending upon a standard ANTT risk assessment. Taking into account the technical difficulty of the procedure and his or her own competence, the healthcare worker assesses whether procedures can be performed without touching key parts and key sites directly. Infective precautions are then selected to counter the risks identified. For example, if it were necessary to touch a key part directly, sterile gloves would be the gloves of choice. Otherwise non-sterile gloves would be used.

BI.7.2 Core infection control components of ANTT

Key part and key site identification and protection

Key parts must be identified and protected at all times. Aseptic key parts must only come into contact with other aseptic key parts and/or key sites.

Hand hygiene

Effective hand hygiene is an essential component of ANTT. In Standard ANTT, hand hygiene should be performed as outlined in Section B1.1. In Surgical ANTT, a surgical hand scrub is required (ICNA 2002) (see Section B4.3.2).

It is known that hand hygiene is not always correctly performed and that even correctly performed hand hygiene cannot always remove all pathogenic organisms. Therefore, a non-touch technique—identifying 'key parts' and not touching them directly or indirectly—is a vital component of achieving asepsis. In other words, the safest way to protect a key part is not to touch it, even when wearing sterile gloves, as even sterile gloves can become contaminated.

Glove use

Gloves are single-use items. In ANTT, if it is necessary to touch key parts or key sites directly, sterile gloves are used to minimise the risk of contamination. Otherwise, non-sterile gloves are typically the gloves of choice.

Aseptic fields

Even well cleaned hospitals can be said to be ‘dirty’—busy and dynamic environments resident with unusual antibiotic-resistant organisms. Consequently, aseptic fields are important in providing a controlled aseptic working space to help promote or ensure the integrity of asepsis during clinical procedures. It is also important that aseptic fields are fit for purpose. In ANTT, aseptic fields are increased in size and sterilised drapes added on the basis of procedure complexity; for example in IV therapy, ‘mobile’ aseptic fields such as plastic trays should be large enough and with high sides to provide an adequate working space to contain equipment, sharps and spillages.

ANTT employs two types of aseptic field that require different management depending on whether the primary purpose is to promote or ensure asepsis.

Critical aseptic fields; ensuring asepsis

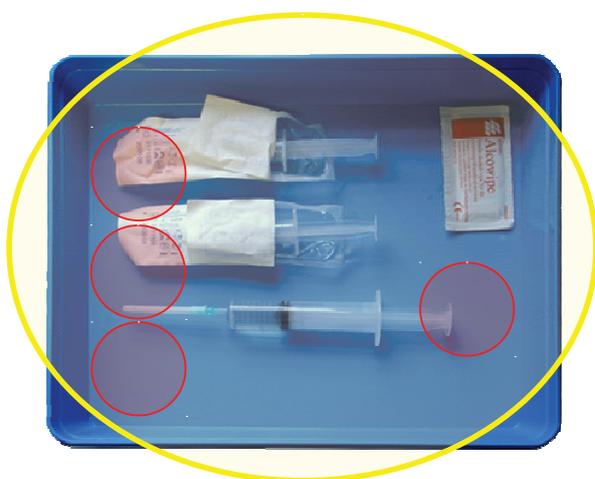
Critical aseptic fields are used when key parts and/or key sites, usually due to their size or number, cannot easily be protected at all times with covers and caps, or handled at all times by a non-touch technique (such as in PICC line, urinary catheter insertion, complex wound care etc), or when particularly open and invasive procedures demand large aseptic working areas for long durations, as in the operating room. In such cases, the critical aseptic field demands to be managed as a key part (i.e. only equipment that has been sterilised can come into contact with it). Such a critical aseptic field demands the use of sterilised gloves and, often, full barrier precautions (Pratt et al 2007). Large main critical aseptic fields are used in Surgical ANTT and as a result, technique is more complicated.

A sub-type of a main critical aseptic field is the **critical micro aseptic field**. Traditional non-touch/clean techniques have protected key parts by syringe caps, sheathed needles, covers or packaging etc. This often-understated approach is given new emphasis in ANTT, because the inside of such caps and covers have been sterilised and thus provide an optimum all-encompassing aseptic field for key parts.

General aseptic fields; promoting asepsis

General aseptic fields are used in Standard ANTT when key parts can easily and optimally be protected by critical micro aseptic fields and a non-touch technique. The main general aseptic field does not have to be managed as a key part and is essentially promoting rather than ensuring asepsis. Subsequently, aseptic technique is considerably simplified and typically involves non-sterile gloves.

Figure BI.4: Use of standard and surgical aseptic non-touch technique



Standard ANTT and the use of a general main aseptic field and critical



Surgical ANTT and the use of a main critical aseptic field

Environmental control

Prior to aseptic procedures, healthcare workers must ensure that there are no avoidable nearby environmental risk factors, such as bed making or patients using commodes.

Sequencing

ANTT practice is sequenced to ensure an efficient, logical and safe order of procedure events. Section B5.4 provides examples of how to perform ANTT for peripheral and central access intravenous therapy and for wound care.

BI.7.3 Surgical or Standard ANTT?

Differentiation between Standard and Surgical ANTT is intended to provide clarity and structure to aid understanding, but not polarise practice. ANTT guidelines help standardise practice, technique and equipment levels.

- **Standard ANTT**—Clinical procedures managed with Standard ANTT will characteristically be technically simple, short in duration (approximately less than 20 minutes), and involve relatively few and small key sites and key parts. Standard ANTT requires a main general aseptic field and non-sterile gloves. The use of critical micro aseptic fields and a non-touch technique is essential to protect key parts and key sites.
- **Surgical ANTT**—Surgical ANTT is demanded when procedures are technically complex, involve extended periods of time, large open key sites or large or numerous key parts. To counter these risks, a main critical aseptic field and sterile gloves are required and often full barrier precautions (Pratt et al, 2007). Surgical ANTT should still utilise critical micro aseptic fields and non-touch technique where practical to do so.

Table BI.16: Use of aseptic non-touch technique for specific procedures

Procedure	Standard /Surgical ANTT	Rationale/typical procedure
IV therapy	Standard ANTT	Key parts can typically be protected by optimal critical micro fields and non-touch technique. Key sites are small. Procedures are technically simple and <20 mins duration.
Simple wound dressings	Standard ANTT	Key parts and sites can be protected by optimal critical micro fields and non-touch technique. Procedures are technically simple and <20 mins duration.
Complex or large wound dressings	Surgical ANTT	The complexity, duration or number of key parts may demand a critical aseptic field.
Urinary catheterisation	Standard/ Surgical ANTT	An experienced healthcare worker can perform catheterisation with the use of a main general aseptic field, micro-aseptic-fields and a non-touch technique. However, less experienced healthcare workers may require a critical aseptic field.
Cannulation	Standard/ Surgical ANTT	Although technically quite simple the close proximity of healthcare worker hands to the puncture site and key parts may demand sterile gloves – dependant upon healthcare worker competency.
PICC/CVC insertion	Surgical ANTT	The size of the CVC or PICC line, invasiveness, numerous key parts and equipment and duration will demand a critical aseptic field and full barrier precautions.
Surgery	Surgical ANTT	Surgical access involves deep or large exposed wounds, numerous key parts and equipment and long procedures. Standard operating room precautions required.

BI.7.4 References

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BI.8 Waste management

As there is currently no national definition of clinical waste in Australia, healthcare facilities need to conform to relevant State or Territory legislation and regulations on the management of clinical and related wastes. Healthcare facilities should also refer to AS/NZS 3816.

When handling waste:

- apply standard precautions to protect against exposure to blood and body substances during handling of waste; wash hands following procedure
- segregation should occur at the point of generation
- waste should be contained in the appropriate receptacle (identified by colour and label) and disposed of according to the facility waste management plan
- healthcare workers should be trained in the correct procedures for waste handling.

Regardless of where waste is generated (e.g. isolation rooms/patient versus routine patient-care areas), the principles of determining whether it is to be treated as clinical or general waste remain the same.

BI.8.1 Resources

- http://www.epa.vic.gov.au/waste/clinical_waste.asp,
- <http://www.environment.nsw.gov.au/waste/clinicalwaste.htm>
- http://www.derm.qld.gov.au/environmental_management/waste/waste_management/waste_management_laws.html

Standards

- AS/NZ 3816 Management of Clinical and Related Wastes (under revision)

BI.9 Handling of linen

Healthcare facilities must have documented policies on the collection, transport and storage of linen. Healthcare facilities that process or launder linen must have documented operating policies consistent with AS/NZS 4146.

All used linen should be handled with care to avoid dispersal of microorganisms into the environment and to avoid contact with staff clothing. The following principles apply for linen used for all patients (i.e. whether or not transmission-based precautions are required):

- appropriate PPE is worn during handling of soiled linen to prevent skin and mucous membrane exposure to blood and body substances
- used linen is 'bagged' at the location of use into an appropriate laundry receptacle
- used linen must not be rinsed or sorted in patient-care areas or washed in domestic washing machines
- linen soiled with body substances should be placed into leak-proof laundry bags for safe transport
- hand hygiene is performed following the handling of used linen.

Clean linen must be stored in a clean dry place that prevents contamination by aerosols, dust, moisture and vermin and is separate from used linen.

Patient items

Domestic-type washing machines must only be used for a patient's personal items (not other linen). Washing must involve the use of an appropriate detergent and hot water. If hot water is not available, only individual patient loads can be washed at one time. Clothes dryers should be used for drying.

BI.9.1 Resources

Standards

- AS/NZS 4146: Laundry Practice
- AS/NZS 4480.1: Textiles for healthcare facilities and institutions – Medical sheepskins – Product specification and testing.

B2 Transmission-based precautions

Summary

- Transmission-based precautions are applied in addition to standard precautions.
- The aim of instituting early transmission-based precautions is to reduce further transmission opportunities that may arise due to the specific route of transmission of a particular pathogen.
- While it is not possible to prospectively identify all patients needing transmission-based precautions, in certain settings, recognising an increased risk warrants their use while confirmatory tests are pending.
- Section B5.2 (see page 165) outlines recommended precautions for specific infectious agents.

Patient-care tip

When transmission-based precautions are applied during the care of an individual patient, there is potential for adverse effects such as anxiety, mood disturbances, perceptions of stigma and reduced contact with clinical staff. Clearly explaining to patients why these precautions are necessary may help to alleviate these effects.

Evidence supporting practice

The majority of the recommendations in this section have been adapted from:¹¹

- Siegel JD, Rhinehart E, Jackson M et al (Health Care Infection Control Practices Advisory Committee) (2007) *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, June 2007*. United States Centers for Disease Control and Prevention. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>
- Pratt et al (2007) *Epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England*.

Further review of the evidence concerning certain aspects of implementation of transmission-based precautions allowed the development of recommendations and good practice points specific to the Australian context. Literature reviews conducted as part of the development of these guidelines or that were released during the guideline development process identified the following:¹²

- good quality evidence on the use of alcohol-based hand rubs in reducing transmission of infectious agents
- a lack of human clinical trials into the benefit of P2 respirators in reducing the risk of transmission of influenza
- a paucity of studies evaluating the effectiveness of negative pressure rooms in reducing the transmission of infectious agents in health care settings.

¹¹ These guidelines were selected based on analysis using the AGREE tool, which ensures that guidelines have been developed in a rigorous, transparent and robust manner. This process is discussed in detail in Appendix 2.

¹² Due to a paucity of evidence or low quality evidence some systematic reviews were not used to draft recommendations. The reports of those reviews that were used are available from the NHMRC upon request.

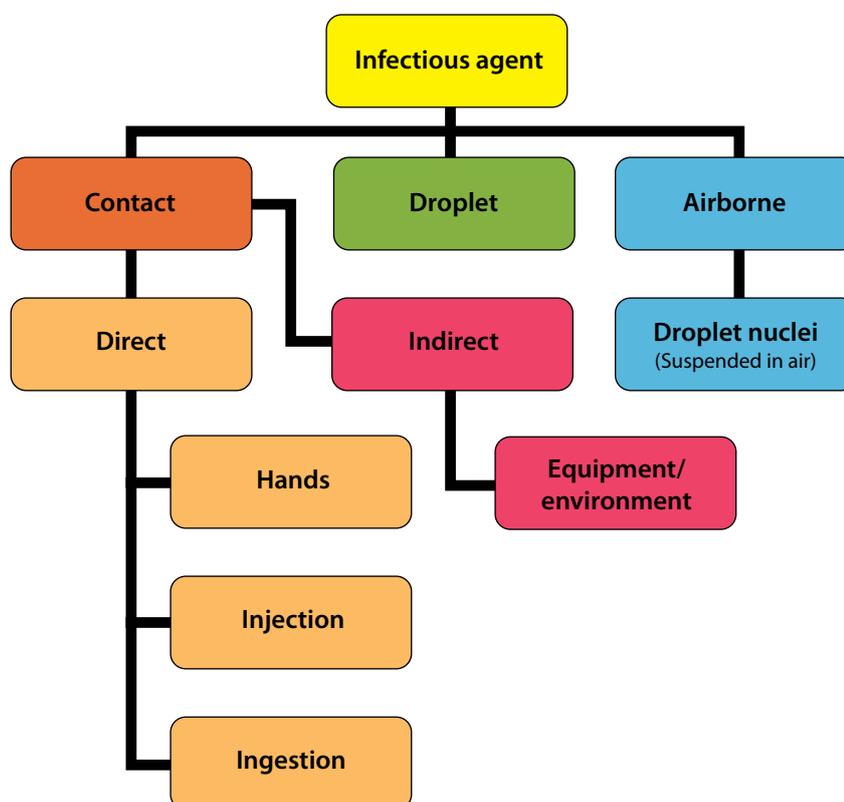
B2.1 Application of transmission-based precautions

B2.1.1 What are the risks?

Transmission of infectious agents can occur in a number of ways.

- Indirect or direct *contact transmission*—when healthcare worker hands or clothing become contaminated, patient-care devices are shared between patients, infectious patients have contact with other patients, or environmental surfaces are not regularly decontaminated.
- *Droplet transmission*—when healthcare workers' hands become contaminated with respiratory droplets and are transferred to susceptible mucosal surfaces such as the eyes, when infectious respiratory droplets are expelled by coughing, sneezing or talking, and come into contact with another's mucosa (eyes, nose or mouth), either directly into or via contaminated hands.
- *Airborne transmission*—when attending healthcare workers or others inhale small particles that contain infectious agents.

Figure B2.1: Transmission of infectious agents



Source: Courtesy of Northern Ireland region infection prevention manual, Department of Health, Social Services and Public Safety.

B2.1.2 When are transmission-based precautions applied?

Transmission-based precautions are applied to patients suspected or confirmed to be infected with agents transmitted by the contact, droplet or airborne routes.

The combination of measures used in transmission-based precautions depends on the route(s) of transmission of the infectious agent involved, as outlined in Sections B2.2, B2.3 and B2.4 below. In the acute-care setting, this will involve a combination of the following measures:

- continued implementation of standard precautions
- appropriate use of PPE (including gloves, apron or gowns, surgical masks or P2 respirators, and protective eyewear)
- patient-dedicated equipment
- allocation of single rooms or cohorting of patients
- appropriate air handling requirements
- enhanced cleaning and disinfecting of the patient environment
- restricted transfer of patients within and between facilities.

For diseases that have multiple routes of transmission, more than one transmission-based precaution category is applied. Whether used singly or in combination, transmission-based precautions are always applied in addition to standard precautions. Transmission-based precautions remain in effect for limited periods of time until signs and symptoms of the infection have resolved or according to recommendations from infection control professionals specific to the infectious agent (see Section B5.2, page 165).

The mode of transmission of infectious agents is the same in primary care or office-based practice as it is in the acute-care setting. However, the risk of transmission may differ due to the population groups and the nature of care provided.

Considering the following will help to establish the risk of infection in primary care and office-based practice:

- patient population—this will influence the nature of care required and the type of potential infectious agents (i.e. some populations have a higher incidence of tuberculosis)
- the profile of care—this includes the level of training of staff, what forms of invasive procedures are performed, whether equipment is reprocessed or single use
- local infrastructure—this influences water quality, food availability, access to other health services (i.e. rural vs urban).

In developing policies and procedures for a healthcare facility it is useful to refer to discipline-specific guidelines to inform practice on specialised areas.

An overview of risk-management principles and processes is given in Section A2.

B2.1.3 Environmental cleaning

In acute-care areas where the presence of infectious agents requiring transmission-based precautions is suspected or known, surfaces should be physically cleaned with a detergent solution. A TGA-registered hospital-grade disinfectant should then be used (e.g. 2-step clean or 2-in-1 clean) as outlined in Section B1.4.2). In office-based practice and non-acute-care areas (e.g. long-term care facilities), the risk of contamination, mode of transmission and risk to others should be used to determine whether disinfectants are required.

Crockery and utensils used by patients on transmission-based precautions do not require containment and should be treated in the same manner as those used for non-infectious patients (i.e. washed in a dishwasher). Disposable crockery and utensils are not necessary.

This section does not provide specific guidance on cleaning. Section B5.1 provides guidance on frequency of cleaning of specific items in low, medium and high-risk settings. Further information on the considerations required when developing cleaning schedules is provided in Section B1.4.2.

B2.2 Contact precautions

B2.2.1 What are the risks?

There is clear evidence that certain infectious agents are transmitted by direct or indirect contact during patient care.

Direct transmission occurs when infectious agents are transferred from one person to another person without a contaminated intermediate object or person. For example, blood or other body substances from an infectious person may come into contact with a mucous membrane or breaks in the skin of another person (Rosen 1997; Beltrami et al 2003).

Indirect transmission involves the transfer of an infectious agent through a contaminated intermediate object (fomite) or person. Contaminated hands of healthcare workers have been shown to be important contributors to indirect contact transmission (Boyce & Pittet 2002; Bhalla et al 2004; Duckro et al 2005). Other opportunities for indirect contact transmission include:

- when clothing becomes contaminated after care of a patient colonised or infected with an infectious agent, which can then be transmitted to subsequent patients (Perry et al 2001; Zachary et al 2001)
- when contaminated patient-care devices are shared between patients without cleaning and disinfection between patients (Brooks et al 1992; Desenclos et al 2001; Siegel et al 2008)
- when environmental surfaces become contaminated (see Section B1.4 on routine environmental cleaning and Section B5.1 on frequency of cleaning of specific items).

Direct or indirect contact transmission of microorganisms during patient care is responsible for the majority of healthcare-associated infections in patients and healthcare staff.

B2.2.2 When should contact precautions be implemented?

Contact precautions are used when there is a risk of direct or indirect contact transmission of infectious agents (e.g. MRSA, *C. difficile*, or highly contagious skin infections/infestations) that are not effectively contained by standard precautions alone (see Section B1).

The requirements for contact precautions are summarised on page 110. Information about which precautions to apply for specific conditions is given in Section B5.2 (see page 165).

Recommendation

I5 Implementation of contact precautions

In addition to standard precautions, implement contact precautions in the presence of known or suspected infectious agents that are spread by direct or indirect contact with the patient or the patient's environment.

Grade

GPP

B2.2.3 How should contact precautions be applied?

The key aspects of applying contact precautions relate to:

- standard precautions
- use of appropriate PPE
- special handling of equipment
- patient placement
- minimising patient transfer or transport.

Hand hygiene and PPE

Effective hand hygiene is particularly important in preventing contact transmission and the 5 moments for hand hygiene outlined in Section B1.1.2 should be followed at all times. When the presence of *C. difficile* or non-enveloped viruses is known or suspected, use of alcohol-based hand rubs alone may not be sufficient to reduce transmission of these organisms (see Section B1.1.3).

Putting on both gloves and gown upon entering the patient-care area helps to contain infectious agents, especially those that have been implicated in transmission through environmental contamination (e.g. VRE, MRSA, *C. difficile*, norovirus and other intestinal tract pathogens, respiratory syncytial virus) (Hall & Douglas 1981; CDC 1995; Evans et al 2002; Bhalla et al 2004; Donskey 2004; Duckro et al 2005; Wu et al 2005). Considerations in selecting a gown appropriate to the situation are outlined in Section B1.2.

A surgical mask and protective eyewear must be worn if there is the potential for generation of splashes or sprays of blood and body substances into the face and eyes.

Recommendation

I6 Hand hygiene and personal protective equipment to prevent contact transmission	Grade
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When working with patients who require contact precautions:

- perform hand hygiene;
- put on gloves and gown upon entry to the patient-care area;
- ensure that clothing and skin do not contact potentially contaminated environmental surfaces; and
- remove gown and gloves and perform hand hygiene before leaving the patient-care area.

C

Single-use or patient-dedicated equipment

Standard precautions concerning patient-care equipment (see Section B1.5) are very important in the care of patients on contact precautions. If patient-care devices (e.g. blood pressure cuffs, nebulisers, mobility aids) are shared between patients without being reprocessed between uses, they may transmit infectious agents (Brooks et al 1992; Desenclos et al 2001; Rutala & Weber 2008).

Recommendation

I7 Patient-care equipment for patients on contact precautions	Grade
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Use patient-dedicated equipment or single-use non-critical patient-care equipment.

If common use of equipment for multiple patients is unavoidable, clean the equipment and allow it to dry before use on another patient.

C

Patient placement

A single-patient room is recommended for patients who require contact precautions. Rooms with ensembles and anterooms are preferred (see also C6). Other points relevant to patient placement include the following:

- keep patient notes outside the room
- keep patient bedside charts outside the room
- disinfect hands upon leaving room and after writing in the chart
- keep doors closed
- make sure rooms are clearly signed.

When a single-patient room is not available, consultation with infection control professionals is recommended to assess the various risks associated with other patient placement options (e.g. cohorting).

If it is necessary to place a patient who requires contact precautions in a room with a patient who is not infected or colonised:

- avoid placing these patients with patients who are at increased risk of an adverse outcome from infection (e.g. patients who are immunocompromised, have open wounds or have anticipated prolonged lengths of stay)
- change protective attire and perform hand hygiene between contact with patients in the same room, regardless of whether one or both patients are on contact precautions.

Transfer of patients

Limiting transfer of a patient on contact precautions reduces the risk of environmental contamination. If transfer within or between facilities is necessary, it is important to ensure that infected or colonised areas of the patient's body are contained and covered. Contaminated PPE should be removed and disposed of and hand hygiene performed before the patient is moved. Clean PPE should be put on before the patient is handled at the destination.

Risk-management case study

***Klebsiella pneumoniae* sepsis in a neonatal unit**

*During a 7-month period, seven infants in a neonatal unit developed septicaemia from multi-resistant extended spectrum β lactamase producing *Klebsiella pneumoniae*, and two babies died. Molecular typing revealed that four of the strains were identical; not all isolates were available for typing. Screening of all babies was not carried out, as it was expected that many would already be colonised, and that babies whose gut was colonised by the bacteria would be the source of infection through the hands of healthcare workers. The outbreak was brought under control by in-service education and improvement of hand hygiene compliance, and wearing of single-use gloves when babies' nappies were being changed. Nurses were declared to be the advocates for the babies, and the nurse caring for each baby was responsible for ensuring that all attending personnel perform hand hygiene before and after handling the baby, with non-compliance being reported to the infection control team.*

Source: Based on Royle et al (1999).

Eliminating risks	In this situation it is not possible to eliminate the risk entirely, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of <i>Klebsiella pneumoniae</i> .
Analysing risks	The major source of the risk is transmission between neonates by healthcare workers' hands, with failure to wear gloves when changing nappies, and lack of appropriate hand hygiene practices by some staff members.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	Immediate measures include implementation of contact precautions, with strict enforcement of hand hygiene, wearing of PPE (e.g. gloves), and provision of in-service education on hand hygiene. Longer-term measures might include increased frequency of environmental cleaning, performance of surveillance cultures, and cohorting of colonised babies, if the outbreak could not be brought under control by immediate measures.
Monitoring	Changes in rates of infection could be monitored through ongoing surveillance.

B2.3 Droplet precautions

B2.3.1 What are the risks?

A number of infectious agents are transmitted through respiratory droplets (i.e. large-particle droplets >5 microns in size) that are generated by a patient who is coughing, sneezing or talking. Transmission via large droplets requires close contact as the droplets do not remain suspended in the air and generally only travel short distances. There is also the potential for infectious agents transmitted by the droplet route to be transmitted by contact.

Droplet precautions are based on evidence that shows that:

- hand hygiene is effective in preventing transmission of viruses and reducing the incidence of respiratory infections both within and outside healthcare settings (Pittet & Boyce 2001; Aiello & Larson 2002; Boyce & Pittet 2002)
- physical interventions are highly effective against the spread of a broad range of respiratory viruses (Jefferson et al 2009; Gralton and McLaws 2009)
- surgical masks protect the wearer from droplet contamination of the nasal or oral mucosa (DoHA 2006)
- physical proximity of less than one metre has long been associated with an increased risk for transmission of infections via the droplet route (e.g. *N. meningitidis* and group A streptococcus (Hamburger & Robertson 1948; Feigin et al 1982)
- placing masks on coughing patients can also prevent infected patients from dispersing respiratory secretions into the air (Siegel et al 2007).

B2.3.2 When should droplet precautions be implemented?

Droplet precautions are intended to prevent transmission of infectious agents spread through close respiratory or mucous membrane contact with respiratory secretions. Because these microorganisms do not travel over long distances, special air handling and ventilation are not required. Infectious agents for which droplet precautions are indicated include respiratory syncytial virus (RSV) and meningococcus.

The requirements for droplet precautions are summarised on page 110. Information about which precautions to apply for specific conditions is given in Section B5.2 (see page 165).

Recommendation	
I8 Implementation of droplet precautions	Grade
In addition to standard precautions, implement droplet precautions for patients known or suspected to be infected with agents transmitted by respiratory droplets that are generated by a patient when coughing, sneezing or talking.	C

B2.3.3 How should droplet precautions be applied?

The key aspects of applying droplet precautions relate to:

- standard precautions
- use of appropriate PPE
- special handling of equipment
- patient placement
- minimising patient transfer or transport.

Hand hygiene and personal protective equipment

Droplet transmission is, technically, a form of contact transmission and some infectious agents transmitted by the droplet route may also be transmitted by contact (Siegel et al 2007). Hand hygiene is therefore an important aspect of droplet precautions and the 5 moments for hand hygiene outlined in Section B1.1.2 should be followed.

There is insufficient evidence to support the use of P2 respirators for reducing the risk of infections transmitted by the droplet route. Although surgical masks do not protect the wearer from infectious agents that are transmitted via the airborne route, surgical masks that meet Australian Standards are fluid resistant and protect the wearer from droplet contamination of the nasal or oral mucosa (DoHA 2006). The mask is generally put on upon room entry, with hand hygiene practiced before putting on the mask and after taking off the mask.

More studies are needed to improve understanding of droplet transmission under various circumstances. The CDC isolation guidelines (Siegel et al 2007) specify that masks should be put on when the healthcare worker is ‘a short distance from a patient’, giving a distance of 1 metre around the patient as an example of what is meant by this, but also stating that it may be prudent to put on a mask upon entry into the patient’s room, especially when the patient has violent, frequent coughing and sneezing or when exposure to emerging or highly virulent pathogens is likely.

There is insufficient evidence to recommend the routine use of protective eyewear with individuals on droplet precautions, unless there is a risk of splashes or spray to the mucosa (see Section B1.2). Goggles provide reliable eye protection from respiratory droplets from multiple angles.

Emerging evidence on droplet transmission will be monitored as a part of the ongoing review process.

Recommendation	
I9 Personal protective equipment to prevent droplet transmission	Grade
When entering the patient-care environment, put on a surgical mask.	C

Placement of patients on droplet precautions

Placing patients on droplet precautions in a single-patient room reduces the risk of patient-to-patient transmission. When single-patient rooms are in short supply, the following principles apply in decision-making on patient placement:

- prioritise patients who have excessive cough and sputum production for single-patient room placement
- place together in the same room (cohort) patients who are infected with the same pathogen and are suitable roommates.

If it becomes necessary to place patients who require droplet precautions in a room with a patient who does not have the same infection:

- avoid placing patients on droplet precautions in the same room with patients who have conditions that may increase the risk of adverse outcomes from infection or that may facilitate transmission (e.g. those who are immunocompromised, have anticipated prolonged lengths of stay, have cystic fibrosis, cardiac conditions or muscular dystrophy)
- ensure that patients are physically separated (> 1 metre apart) from each other and draw the privacy curtain between beds to minimise opportunities for close contact.

In all cases, the importance of respiratory hygiene and cough etiquette should be explained to patients on droplet precautions (see Section B1.6).

In primary care and other office-based practice, examples of appropriate implementation of droplet precautions include segregation in waiting rooms for patients with violent or frequent coughing, and the availability of tissues, alcohol-based handrub and a waste bin so that patients can practice respiratory hygiene and cough etiquette.

Recommendation

20 Placement of patients requiring droplet precautions

Place patients who require droplet precautions in a single-patient room.

Grade

GPP

Transfer of patients on droplet precautions

When transfer of a patient on droplet precautions within or between facilities is necessary, there is the potential for other patients and healthcare workers to come in contact with infectious agents when the patient coughs or sneezes. This can be addressed by asking the patient to wear a mask while they are being transferred and to follow respiratory hygiene and cough etiquette. Children should wear a correctly fitting mask when they are outside an isolation room. The child's oxygen saturation should be monitored.

Risk-management case study

Influenza in a long-term care facility

A cluster of cases of influenza occurred in a long-term care facility, which were observed after a group activity involving dancing was held in the dining room prior to the midday meal. It was observed that a number of residents who had been unwell had attended the group activity and had sat at the dining tables. Due to the lack of waste receptacles in the dining room, used tissues were placed on the dining room tables. It was also noticed that a number of residents remained in the vicinity of the dining room post activity as their rooms were a short distance from the dining room. The shared bathrooms were at the other end of the corridor so it was not known whether hand hygiene was performed prior to meals or the event. Residents reported signs and symptoms consistent with influenza at least 2 days following the event, which was later confirmed by rapid diagnostic test from four patients and two staff members. The vaccination coverage of the staff was 41.7%. None of the staff members with influenza symptoms who had assisted in the group activities had been immunised.

Eliminating risks	In this situation, it is not possible to eliminate the risk immediately, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of influenza.
Analysing risks	One source of transmission is the assembling of large numbers of residents in a confined area in which close contact droplet transmission occurred such as sneezing, coughing or talking. In addition the lack of waste receptacles available would have hindered immediate disposal of infectious waste material. Healthcare workers or other residents may have had indirect contact with influenza droplets from the dirty tissues lying on the table, particularly if any of the other people disposed of the tissues later. The lack of hand hygiene facilities in the immediate vicinity could have resulted in poor hand hygiene compliance, with staff or residents not decontaminating their hands prior to eating or after sneezing or coughing. Low levels of staff immunisation also contributed to the spread of the infection.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	<p>Immediate measures may include:</p> <ul style="list-style-type: none"> • waste receptacles being made available in a common area, so people can dispose of tissues immediately after use • the provision of ABHR so residents (and staff) can decontaminate their hands prior to eating, handling food or coughing and sneezing. <p>Other measures may include:</p> <ul style="list-style-type: none"> • education of staff and residents on the importance of hand hygiene, respiratory hygiene and cough etiquette • immunisation of residents and staff and asking sick staff members to stay at home; • education of residents, that if they feel unwell, to avoid participating in group activities until they feel better • displaying posters and signage on hand hygiene and respiratory hygiene around the facility on an ongoing basis.
Monitoring	Immunisation rates among staff and residents could be monitored, as well as monitoring the difference in case numbers from previous influenza outbreaks and outbreaks after the measures have been put in place.

B2.4 Airborne precautions

B2.4.1 Why are airborne precautions important?

Certain infectious agents are disseminated through airborne droplet nuclei or small particles in the respirable size range that remain infective over time and distance.

Airborne precautions are based on evidence that shows that:

- the use of P2 respirators prevents the inhalation by healthcare workers of small particles that may contain infectious agents transmitted via the airborne route (DoHA 2006)
- the use of negative pressure rooms may also reduce the transmission of infection
- wearing of correctly-fitted surgical masks by coughing patients prevents dispersal of respiratory secretions into the air (Siegel et al 2007).

B2.4.2 When should airborne precautions be implemented?

Airborne precautions prevent transmission of microorganisms that remain infectious over time and distance when suspended in the air. These agents may be inhaled by susceptible individuals who have not had face-to-face contact with (or been in the same room as) the infectious individual.

Infectious agents for which airborne precautions are indicated include measles (rubeola), chickenpox (varicella) and *M. tuberculosis*.

The requirements for airborne precautions are summarised on page 110. Information about which precautions to apply for specific conditions is given in Section B5.2 (see page 165).

Recommendation

21 Implementation of airborne precautions

Grade

In addition to standard precautions, implement airborne precautions for patients known or suspected to be infected with infectious agents transmitted person-to-person by the airborne route.

B

B2.4.3 How should airborne precautions be applied?

The key aspects of applying airborne precautions relate to:

- standard precautions, including respiratory hygiene and cough etiquette (see Section B1.6)
- use of appropriate PPE (particularly correctly-fitted respirators)
- minimising exposure of other patients and staff members to the infectious agent.

Specialist procedural areas should refer to their discipline-specific guidelines for detailed advice on applying airborne precautions relevant to the field of practice.

Personal protective equipment

When there is a high probability of airborne transmission due to the infectious agent or procedure, sound scientific principles support the use of P2 respirators to prevent transmission (see also Table B1.6; page 52). Respirators are designed to help reduce the wearer’s respiratory exposure to airborne contaminants such as particles, gases or vapours. P2 respirators are appropriate for the majority of airborne precautions encountered in healthcare facilities. There is a range of respiratory protective equipment outlined in AS 1715:2009, which provide differing levels of protection dependant upon the nature of the microorganism, the mode of transmission and procedure being undertaken.

The need for PPE varies with the condition in question and the immune status of the healthcare worker. For example, staff members known to be immune to the relevant infectious agent are not required to wear a P2 respirator. For high-risk procedures such as bronchoscopy where the risk of droplet and airborne infection is high, a P2 respirator should be worn if the infectious status of the patient is unknown or unconfirmed.

P2 respirators – fit testing and checking

In order for a P2 respirator to offer the maximum desired protection it is essential that the wearer is properly fitted and trained in its safe use. A risk-management approach should be applied to ensure that staff working in high-risk areas are fit tested and are aware of how to perform a fit check.

Fit testing

The purpose of fit testing is to identify which size and style of P2 respirator is suitable for an individual, and to ensure that it is worn correctly. It also provides an opportunity to ensure healthcare workers are properly trained in the correct use of the mask.

Fit testing should be performed:

- at the commencement of employment for employees who will be working in clinical areas where there is a significant risk of exposure to infectious agents transmitted via the airborne route—assessment of the significance of risk will involve consideration of the location (e.g. risk is higher in an intensive care unit) and activities to be undertaken (e.g. a physiotherapist performing induced sputum is at risk of exposure to infectious aerosols);
- when there is a significant change in the wearer's facial characteristics that could alter the facial seal of the respirator (e.g. significant change in body weight, facial surgery); and
- at regular intervals—AS1715:2009 recommends annual fit testing. Healthcare facilities should ensure that they have a respiratory protection program that regularly evaluates the risk to which healthcare workers are exposed and determines which employees are required to undertake fit testing.

Employers must ensure that their employees have the medical ability to wear a respirator. Medical evaluations are required for both positive pressure and negative pressure respirators.

There are two types of facial fit test—qualitative and quantitative. Qualitative fit tests are fast and simple but can be influenced by the wearer. Quantitative fit tests require the use of specialised equipment used by a trained operator. AS/NZS 1715:2009 outlines the method by which fit testing is conducted.

Fit checking

Healthcare workers must perform fit checks every time they put on a P2 respirator to ensure it is properly applied. No clinical activity should be undertaken until a satisfactory fit has been achieved. Fit checks ensure the respirator is sealed over the bridge of the nose and mouth and that there are no gaps between the respirator and face. Healthcare workers must be informed about how to perform a fit check.

The procedure for fit checking includes (see Figure B2.2):

- placement of the respirator on the face
- placement of the headband or ties over the head and at the base of the neck
- compressing the respirator to ensure a seal across the face, cheeks and the bridge of the nose
- checking the positive pressure seal of the respirator by gently exhaling. If air escapes, the respirator needs to be adjusted
- checking the negative pressure seal of the respirator by gently inhaling. If the respirator is not drawn in towards the face, or air leaks around the face seal, readjust the respirator and repeat process, or check for defects in the respirator.

The manufacturer's instructions for fit checking of individual brands and types of P2 respirator should be referred to at all times.

Healthcare workers who have facial hair (including a 1–2 day beard growth) must be aware that an adequate seal cannot be guaranteed between the P2 respirator and the wearer's face.

Figure B2.2: Process for putting on a P2 respirator



Source: Courtesy of DHS Victoria www.health.vic.gov.au/environment/downloads/fitting_mask.pdf.

Wearing a P2 respirator

Considerations when using a P2 respirator include (DoHA 2006):

- if a good facial seal cannot be achieved (e.g. the intended wearer has a beard or long moustache), an alternative respirator such as a powered air-purifying respirator (PAPR) should be used
- respirators should not be touched while being worn
- respirators should be changed when they become moist
- respirators should never be reapplied after they have been removed
- respirators should not be left dangling around the neck
- hand hygiene should be performed upon touching or disposing of a used respirator.

Respirators should be removed outside the patient-care area and disposed of in a closed receptacle (Siegel et al 2007).

Recommendation	
22 Personal protective equipment to prevent airborne transmission	Grade
Wear a correctly fitted P2 respirator when entering the patient-care area when an airborne-transmissible infectious agent is known or suspected to be present.	D

Patient placement

When patients have a confirmed or suspected airborne-transmissible condition or if nebulisation is to be performed, it is important to place them in an area that can be contained (e.g. placing them in a single room and, providing it is tolerated, asking them to wear a surgical mask while not in a single room, until advised to remove it by attending staff). It is important that the door to the room remains closed and that, where possible, only staff or visitors who are immune to the specific infectious agent enter the room. Non-immune staff should be provided with appropriate PPE. While there is a paucity of evidence to confirm their effectiveness, the use of correctly serviced/maintained negative pressure rooms may reduce the transmission of airborne infection within healthcare settings (Siegel et al 2007).

Visitors should be restricted and screened by nursing staff, with visitors' names recorded either in a log book or in the case notes.

Recommendation	
23 Placement of patients requiring airborne precautions	Grade
Patients on airborne precautions should be placed in a negative pressure room or in a room from which the air does not circulate to other areas. Exceptions to this should be justified by risk assessment.	GPP

Transfer of patients

If transfer of the patient outside the negative pressure room is necessary, asking the patient to wear a correctly fitted surgical mask while they are being transferred and to follow respiratory hygiene and cough etiquette, as well as covering any skin lesions associated with the condition (e.g. chickenpox [varicella]) will reduce the risk of cross-transmission. Children should wear a correctly fitting mask when they are outside an isolation room. The child's oxygen saturation should be monitored.

Risk-management case study

M. tuberculosis among immunocompromised patients attending outpatient services

An investigation into the healthcare-associated transmission of M. tuberculosis followed reports of two epidemiologically linked patients (Patient 1 and Patient 2) with haematologic malignancies and active pulmonary TB. Subsequently it was found that four oncology patients had spent more than an hour in the same room as Patient 1. Patient 1's pulmonary TB was not diagnosed for 3 months as clinical findings were attributed to lower respiratory tract infection from other infectious agents or adverse effects of oncology treatments. Patient 1 was not placed on airborne precautions during this period. The investigation found that delayed TB diagnosis in Patients 1 and 2 ultimately resulted in the transmission of M. tuberculosis to 19 patients and staff at three hospitals and a residential facility.

Source: Based on Malone et al (2004).

Eliminating risks	In this situation, it is not possible to eliminate risk, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of <i>M. tuberculosis</i> from a single patient attending a number of outpatient facilities.
Analysing risks	The sources of risk are a failure to consider the possibility of tuberculosis and delays in screening and diagnostic tests. These resulted in a lack of transmission-based precautions applied to Patient 1, a source of risk to subsequent patients.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	Immediate measures may include avoidance of potential exposures in outpatient settings, implementation of airborne precautions and treatment of febrile, coughing patients with pulmonary TB. State/territory TB services would also need to be notified, as they would assist in the development of a management plan. Longer-term measures could include implementation of baseline TB screening for immunocompromised patients and protocols to assist with earlier diagnosis of active disease. Further measures would include increasing awareness of tuberculosis generally, educating staff about identifying the high-risk patients for a particular facility, and development of specific protocols, such as 'cough protocols'.
Monitoring	Ongoing surveillance would assist in reducing the risk of subsequent outbreaks. Retrospective review and screening of other contacts and laboratory typing of <i>M. tuberculosis</i> isolates to identify unrecognised, linked transmission could also inform future actions.

Measles (rubeola) control in general practice

The case study in Section A2.2 (see page 30) outlines a risk assessment approach to airborne precautions in the primary care setting.

B2.5 Putting it into practice

Individual actions for reducing risk

- Consult with infection control professionals to ensure that appropriate transmission-based precautions are applied and that they remain in place until the risk of transmission of the infectious agent has passed
- Remember that transmission-based precautions are applied AS WELL as standard precautions
- Advise patients why particular measures are needed to control infection (see above)
- Become familiar with local policy on appropriate PPE, and when it should be put on and taken off, when attending patients on transmission-based precautions
- Make sure you know which type of mask is needed in different situations and how to check that they are properly fitted
- Always contain or cover the infected or colonised areas of a patient on contact precautions before moving them from one patient-care area to another
- Explain the purpose and process of respiratory hygiene and cough etiquette to patients on droplet precautions
- Ask patients on droplet or airborne precautions to wear a surgical mask if they are being moved from one patient-care area to another
- If patients are moved to a single-patient room (contact or droplet precautions) or negative pressure room (airborne precautions) explain why this is necessary to prevent transmission of infection
- Make sure you are fully immunised against vaccine-preventable diseases as recommended in the Australian Immunisation Handbook

Involving patients in their care

The following information may be provided to patients to assist them in becoming involved in identifying and reducing risks.

- When a patient has a condition that can easily be transmitted to others, extra measures beyond normal practices to prevent and control infection are needed—these are for everybody's safety
 - Hand hygiene is the most important aspect of preventing the spread of infection. This means everyone, including visitors, should perform hand hygiene after any contact with the patient or environment that could lead to contamination
 - Hand hygiene is also important for the patient, especially after activities when hands come in contact with possible sources of infection (such as blowing your nose, going to the toilet, touching infected wounds)
 - 'Respiratory hygiene and cough etiquette' is an important part of reducing the risk of infection to others. This includes covering the mouth with a tissue when coughing or sneezing, disposing of the tissue in the nearest waste receptacle and performing hand hygiene
 - Healthcare workers wear gloves and gowns to limit the spread of infection
 - For some infections, the patient needs to wear a mask so that they do not infect others (for example when they are sneezing or coughing), especially if they are moving between patient-care areas
 - Regular cleaning of the patient's room and objects around them helps to prevent the spread of infection
 - If a healthcare worker might be splashed by the patient's body substances, he or she should wear face protection
 - Any piece of equipment that might come in contact with infectious agents is thrown away or cleaned and disinfected before it is used again
 - For some types of infection, it is necessary to place patients in a single room or to keep them more than a metre away from other patients. Sometimes patients with the same infection are placed in a room together
 - It's okay to question a healthcare worker about whether they have taken measures to prevent infection (like performing hand hygiene, wearing a gown or mask or using clean equipment)
-

Table B2.1: Application of standard and transmission-based precautions

Type of precautions	Examples of infectious agents	Single room or cohort	Gloves	Gown	Mask	Eye protection	Handling of equipment	Visitors*
Standard	Standard precautions apply for all work practices to prevent the likelihood of transmission of infection.							Hand hygiene Respiratory hygiene and cough etiquette
Contact	MROs, <i>C. difficile</i> , intestinal tract pathogens (e.g. norovirus), highly contagious skin infections	✓	✓	✓	♣	☆	Single use or reprocess before reuse on next patient	Same precautions as staff
Droplet	Influenza, RSV, norovirus, pertussis (whooping cough), meningococcus	✓	☆	☆	✓ Surgical mask	☆	Single use or reprocess before reuse on next patient	Restrict visitor numbers and precautions as for staff
Airborne	Pulmonary TB, chickenpox (varicella) [#] , measles (rubeola) [#] , SARS,	✓ Negative pressure	☆	☆	✓ P2 (N95) respirator	☆	Single use or reprocess before reuse on next patient	Restrict visitor numbers and precautions as for staff

Notes:

- ✓ Essential component of transmission-based precautions
 - ♣ surgical mask required if infectious agent isolated in sputum
 - ☆ As required — Gloves to be worn whenever there is the potential of direct or indirect contact with blood or body substances
- Gowns to be worn for procedures when there is the potential of direct or indirect contact to body substances
- Face and eye protection to be worn when there is the potential of exposure to splashes or sprays to mucosa (including during aerosol-generating procedures)
- * Visitors should be given instruction about correct procedures when transmission-based precautions are applied and given appropriate resources to support them in meeting these requirements.
- # If staff or visitor HAVE HAD chickenpox / measles in the past or vaccination for these diseases, mask, gown and gloves are not required

Environmental cleaning has not been addressed in this table but it is an essential component of infection prevention and control. For further guidance please refer to section **B1.4** For more detail on specific diseases please refer to Section B5.2.

Source: Adapted from The Canberra Hospital *Inpatient Isolation Guidelines*

B2.6 Resources

Standards

- AS/NZS 1715:2009 Selection, use and maintenance of respiratory protective equipment outlines the method by which fit testing is conducted
- AS/NZS 2243.3:2002 Safety in laboratories Part 3: Microbiological aspects and containment facilities

Guidelines

- Siegel JD, Rhinehart E, Jackson M et al (Health Care Infection Control Practices Advisory Committee) (2007) *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, June 2007*. United States Centers for Disease Control and Prevention. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>
- Pandemic Influenza Preparedness and Response Guidance for Healthcare Workers and Healthcare Employers OSHA 3328-05R2009
- WHO strategic action plan for pandemic influenza 2006
- State/territory infection control policies provide guidance on the implementation of transmission-based precautions

Tools and web based resources

- Department of Health and Ageing *Safe use of Personal Protective Equipment for Pandemic Influenza* DVD available on the DOHA website pandemic influenza resource page <http://www.health.gov.au/internet/panflu/publishing.nsf/Content/safeuse-transcript-1>
- CDC Influenza website www.cdc.gov/flu/
- Fit testing and fit checking
 - NSW infection control policy2007. PD2007_036
 - SA Dept Health Appendix 4 Infection Control Service, CDCB, May2004
 - Department of Human Services- Tasmania. Tasmanian pandemic (H1N1) 2009 information http://www.pandemic.tas.gov.au/information_for/health_sector

B2.7 References

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B3 Management of multi-resistant organisms and outbreak situations

Summary

- Effective hand hygiene is the most important measure to prevent and control the spread of multi-resistant organisms (MROs). Rigorous adherence to hand hygiene is also integral to any outbreak control and management program.
- The application of transmission-based precautions is particularly important in containing MROs such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), and multi-resistant Gram-negative bacteria (MRGN) (see Section B3.1).
- Transmission-based precautions are also an integral part of outbreak management (see Section B3.2).
- Specific precautions required for each infectious agent are listed in Section B5.2 (see page 165).

Patient-care tip

When a patient is infected or colonised with an MRO or involved in an outbreak, there is potential for adverse effects such as anxiety, mood disturbances, perceptions of stigma and reduced contact with clinical staff. Clearly explaining to patients the measures being undertaken and why they are necessary may help to alleviate these effects.

Evidence supporting practice

The majority of the recommendations in this section have been adapted from United States Centers for Disease Control and Prevention (CDC) *Management of Multidrug-Resistant Organisms in Healthcare Settings* (2006).¹³

Further review of the evidence concerning the management of MROs allowed the development of recommendations and good practice points specific to the Australian context. Literature reviews conducted as part of the development of these guidelines or that were released during the guideline development process identified the following:

- good quality evidence on the use of alcohol-based hand rubs in reducing transmission of MROs
- a paucity of evidence regarding the use of PPE for preventing the transmission of MRSA and VRE
- a paucity of prospectively designed experimental studies into the effectiveness of patient isolation in reducing transmission of MROs
- lack of evidence regarding the value of screening for MROs in the absence of implementation of other infection control measures
- a paucity of evidence concerning routine screening of healthcare workers for MRSA colonisation.

¹³ These guidelines were selected based on analysis using the AGREE tool, which ensures that guidelines have been developed in a rigorous, transparent and robust manner. This process is discussed in detail in Appendix 2.

B3.1 Management of multi-resistant organisms

B3.1.1 What are the risks?

MROs, which are predominantly bacteria, are resistant to multiple classes of antimicrobial agents. Antibiotic resistance increases the morbidity and mortality associated with infections, and contributes to increased costs of care due to prolonged hospital stays and other factors, including the need for more expensive drugs (Struelens 1998). A major cause of antibiotic resistance is the exposure of a high-density, high-acuity patient population in frequent contact with healthcare workers to extensive antibiotic use, along with the attendant risk of cross-infection (Gold & Moellering 1996; Christiansen et al 2008).

For the purpose of these guidelines, MROs are taken to include:

- **all methicillin-resistant *Staphylococcus aureus***—MRSA cause up to a third of hospital-acquired bloodstream infections (Christiansen et al 2008), with mortality from BSI ranging from 10% to 50% according to the setting (Herwaldt 1999)
- **all vancomycin-resistant enterococci** with mobile resistance determinants (e.g. VanA, VanB)—the ratio of invasive VRE infection to colonisation appears to be proportionately lower than that of MRSA (Christiansen et al 2008)
- **a range of Gram-negative bacteria** with multiple classes of drug resistance or resistant mechanisms to critically important antibiotics—highly transmissible resistance is a particular feature of antibiotic resistance among the Gram-negative bacteria, especially the Enterobacteriaceae. Multi-drug resistance is also common and increasing among non-fermenting Gram-negative bacteria (e.g. *Pseudomonas aeruginosa* and *Acinetobacter baumannii*) and a number of strains have now been identified that exhibit resistance to essentially all commonly used antibiotics. These organisms are associated with treatment failure and increased morbidity (Christiansen et al 2008).

A two-level approach is necessary for the prevention and control of MROs. This involves implementation of:

- core strategies for MRO prevention and control in any situation where MRO infection or colonisation is suspected or identified (see Section B3.1.2)
- organism-based or resistance mechanism-based approaches if incidence or prevalence of MROs are not decreasing despite implementation of the core strategies (see Section B3.1.3).

In the event of an MRO outbreak, investigation and control/containment should be conducted as outlined in Section B3.2.

The best practices in these guidelines are based on the assumption that healthcare settings already have basic infection prevention and control systems in place. If this is not the case, healthcare settings will find it challenging to implement the practices recommended for the management of MRSA and VRE. These settings must work with organisations that have infection prevention and control expertise, such as academic health science centres, regional infection control networks, public health units that have professional staff certified in infection prevention and control and local infection prevention and control associations to develop evidence-based programs (PIDAC 2007).

B3.1.2 Core strategies for MRO prevention and control

Successful control of MROs is based on a combination of interventions. These involve continued rigorous adherence to hand hygiene, appropriate use of PPE and implementation of specific transmission-based precautions (isolation of infected or colonised patients, increased environmental cleaning and patient-dedicated equipment) until patients are culture-negative for a target MRO or have been discharged from the facility.

In non-acute healthcare settings, general measures of infection control (particularly hand hygiene by both patients and healthcare workers) may be enough to prevent transmission. However, contact precautions, such as gowns and gloves, may be necessary if the patient is heavily colonised or there is known continuing transmission. Local guidelines and circumstances should determine practice in settings where the patient population is vulnerable (Matlow & Morris 2009).

Organisational measures—such as staff education on prevention and management of MRO transmission, antibiotic stewardship program, and appropriate response to active surveillance cultures—are discussed in Part C.

Hand hygiene

MROs can be carried from one person to another via the hands of a healthcare worker. Contamination can occur during patient care or from contact with environmental surfaces in close proximity to the patient, particularly when patients have diarrhoea and the reservoir of the MRO is the gastrointestinal tract. Effective hand hygiene is therefore the most important measure to prevent and control the spread of MROs. Alcohol-based hand rub of at least 70% v/v ethanol or equivalent has been shown to be effective against MRSA and VRE (Picheansathian 2004).

Personal protective equipment

Both direct patient contact (e.g. routine patient care) and indirect contact (e.g. involving environmental contamination) can lead to contamination of the healthcare worker's hands and clothing. Appropriate use of gloves has been found to be as effective a strategy as patient isolation in containing MROs, particularly when isolation may not be feasible (Trick et al 2004; Bearman et al 2007). Glove use is more effective when combined with wearing of gowns (Puzniak et al 2002; Srinivasan et al 2002; Hayden et al 2008). Section B1.2.3 provides guidance on the selection of an appropriate gown and Section B1.2.5 on selection of gloves.

Isolation

Placing colonised or infected patients in single rooms, cohort rooms or cohort areas as a component of a multifaceted infection control policy can reduce acquisition rate and infection with MROs in acute-care settings. Cohorting patients with the same strain of MRO has been used extensively for managing outbreaks of specific MROs, including MRSA, VRE, extended spectrum beta-lactamase (ESBL)-producing bacteria, and *Pseudomonas aeruginosa*. However, it is not always appropriate to cohort patients with the same MRO species if they have a different resistance mechanism or phenotype (e.g. if one has a community-acquired strain of likely panton-valentine leukocidin (PVL)-positive MRSA and the other has a hospital-acquired strain of MRSA).

In long-term care facilities, isolation and cohorting may not be possible, so hand hygiene with appropriate routine use of gloves for individual resident and environmental contact is preferred (Trick et al 2004).

Due to the varying nature of healthcare facilities, it is not feasible to provide a generic policy on the movement of patients with MROs. This needs to occur at a local level and be relevant to the patient's treatment plan. These policies should not limit access to treatment and should consider the social implications of managing a patient with an MRO.

Environmental cleaning

In acute-care areas where the risk of patient vulnerability and risk of cross infection due to the presence of an MRO is high, contact precautions should be followed. This will require all patient surrounds and frequently touched objects (e.g. bedrails, trolleys, bedside commodes, doorknobs, light switches or tap handles, ensuite facilities) to be cleaned with a suitable detergent and disinfected with a TGA-registered hospital grade disinfectant.

As outlined in Section B1.4 this process must involve either:

- a 2-step clean, which involves a physical clean using detergent solution followed by use of a chemical disinfectant
- a 2-in-1 clean in which a combined detergent/disinfectant wipe or solution is used and mechanical/manual cleaning action is involved.

Sole reliance on a disinfectant without mechanical/manual cleaning is not recommended.

Patient equipment

Standard precautions concerning patient-care equipment are very important in the care of patients with MROs. Patient-care devices (e.g. electronic thermometers) may transmit infectious agents if devices are shared between patients. To reduce the risk of transmission, disposable or patient-dedicated equipment is preferred. Section B1.5 provides more detailed information on reusable instruments and equipment.

Monitoring

Monitoring of the incidence of target MRO infection and colonisation should continue after these interventions are implemented. If rates do not decrease, more interventions may be needed to reduce MRO transmission as outlined in Section B3.1.3.

Recommendation

24 Implementation of core strategies in the control of MROs (MRSA, MRGN, VRE)	Grade
Implement transmission-based precautions for all patients colonised or infected with an MRO, including: <ul style="list-style-type: none"> • performing hand hygiene and putting on gloves and gowns before entering the patient-care area; • using patient-dedicated or single-use non-critical patient-care equipment • using a single-patient room or, if unavailable, cohorting patients with the same strain of MRO in designated patient-care areas • ensuring consistent cleaning and disinfection of surfaces in close proximity to the patient and those likely to be touched by the patient and healthcare workers. 	C

Patient-care tip

When patients are placed on transmission-based precautions due to infection or colonisation with an MRO, efforts should be made to ensure patients continue to receive adequate medical care, and to counteract potential psychological adverse effects of isolation such as anxiety and depression, and feeling of stigmatisation.

B3.1.3 Organism-specific approach

When the incidence or prevalence of MROs is not decreasing despite implementation of the core strategies outlined above, further measures to control transmission need to be considered.

A risk management approach focuses on:

- the type of MRO (e.g. prioritisation of available isolation facilities according to MRO)
- the healthcare area (e.g. intensive care or haematology/oncology units have higher risks of transmission)
- patient factors (e.g. whether the consequences of infection are severe)
- available resources (e.g. whether screening a certain patient population is feasible)
- whether interventions to interrupt transmission are available (e.g. decolonisation for MRSA).

Further measures may include:

- *targeted screening*—timely active screening to identify colonised patients combined with the use of contact precautions for the care of colonised patients has been followed by a significant reduction in the rates of both colonisation and infection of patients with MRSA (Calfee & Farr 2002; Pop-Vicas & D-Agata 2005). Screening involves collecting specimens from the patient and subsequent laboratory analysis of these samples. In a risk assessment approach to screening, considerations include the endemicity of the MRO, the prevalence of MRO infection, and the likelihood of MRO carriage. Clinicians and the infection control professional should be informed of both negative and positive screening results promptly. If screening returns a positive sample, contact precautions should be applied and appropriate use of isolation and cohorting facilities should be implemented.
- *decolonisation*—interventions may be topical—whole body washes (using chlorhexidine) and topically applied antimicrobial agents (e.g. mupirocin); systemic—orally administered antibiotics (tetracyclines, fusidic acid, ciprofloxacin, rifampin and trimethoprim-sulfamethoxazole); and combinations of systemic and topical therapy.
- *surveillance and timely feedback*—increased surveillance may be appropriate to monitor the effect of interventions designed to control particular MROs. Surveillance information should be fed back to health care workers and facility management promptly.

Screening

Currently there is no consensus nationally or internationally about the most appropriate manner to conduct screening for MROs. Control measures specific to local factors should be determined and endorsed by the healthcare facility management structure, and the screening protocols for MROs should be influenced by the:

- local prevalence of the MRO
- the reason for admission of the patient
- the risk status of the unit to which they are admitted
- the likelihood that the patient is carrying an MRO.

As a minimum standard to reduce the risk of transmission of MROs, it is recommended that the following approaches to screening be implemented. Expert direction and resources allocation is required for effective MRO screening.

The decision to screen for VRE and MRGN is optional and should be made on the basis of local epidemiology, necessity for screening and resource factors. The following tables provide guidance for screening based on patient risk factors for these organisms. Other risk groups may be defined by local experience, based on screening initiatives or outbreak epidemiology.

For example some facilities have found that screening patients who are recent hospital admissions from international facilities into Australian facilities have increasingly been shown to be positive for MRGN. While this is an area for future research, currently, healthcare facilities could consider screening these patients on admission, particularly in areas where MROs are found to be prevalent in transferred patients.

Table B3.1: Suggested approach to screening for MRSA

Organism	Screen who	Screen when	Sample collection
MRSA	<ul style="list-style-type: none"> Patients at high risk of carriage: <ul style="list-style-type: none"> those who are known to have been previously infected or colonised with MRSA frequent re-admissions to any healthcare facility transfers from other acute care facility residence in long term care facilities patients with chronic wounds recent inpatients at hospitals known or likely to have a high prevalence of MRSA locales or populations where community-acquired strains of MRSA are prevalent 	<ul style="list-style-type: none"> Screened routinely at the time of admission unless they are being admitted directly to isolation facilities and it is not planned to attempt to clear them of MRSA carriage 	<ul style="list-style-type: none"> Multiple sites including one from the nose and a mucosal surface Reasonable sites to swab include nares, skin lesions and wounds, sites of catheters, catheter urine, groin/perineum, tracheostomy and other skin break in all patients, and sputum from patients with a productive cough Where maximum sensitivity is required, consideration should be given to adding a throat swab. The umbilicus should be sampled in all neonates
	<ul style="list-style-type: none"> Healthcare workers epidemiologically linked to single-strain outbreak in health care facility 	<ul style="list-style-type: none"> After confirmation of epidemiological evidence 2 weeks after decolonisation therapy 	
	<ul style="list-style-type: none"> Patients in high-risk units <ul style="list-style-type: none"> ICU/high dependency unit (admission and discharge) Spinal unit Burns unit Pre-operative clinics Patients with planned prosthetic surgery (joint replacement, cardio-thoracic surgery) 	<ul style="list-style-type: none"> All patients on admission, discharge and once weekly 	

Management

Apply stringent hand hygiene, contact precautions (gloves and gown) and core strategies outlined in B.3.1.2 including isolating and cohorting patients, increased environmental cleaning and dedicated patient equipment.

Patients positive for MRSA have an electronic alert placed on their case record for easy identification on readmission.

Consider topical plus/minus systemic decolonisation for:

- Healthcare workers epidemiologically linked to transmission
- Patients having prolonged hospitalisation
- Patients with chronic conditions likely to be readmitted (e.g. haemodialysis).
- Patients before undergoing high-risk elective surgery such as cardiac and implant surgery

Table B3.2: Suggested approach to screening for VRE and MRGN dependent on local acquisition rates

Organism	Suggested targeted screening dependent on local acquisition rates and risk factors	Frequency of screening	Sample collection
VRE	<p>High risk units</p> <ul style="list-style-type: none"> – Intensive care unit – Nephrology – Haematology – Solid organ transplant unit • Patients epidemiologically linked to single-strain outbreak in health care facility <p>Patients at high risk of carriage</p> <ul style="list-style-type: none"> • Dialysis patients • Recent hospitalisation in any health care facility • Critical illness in intensive care units • Long duration of stay and severity of illness • Chronic disease and impaired functional status • Patients with urinary catheters • Prolonged or broad-spectrum antibiotic use, particularly vancomycin 	<ul style="list-style-type: none"> • For endemic VRE screen on admission to intensive care unit, discharge and once weekly • For VRE in ambulatory haemodialysis unit, or an haematology/ oncology facility screen periodically every 3-6 months 	<ul style="list-style-type: none"> • Multiple sites including rectal or perianal swabs, • Reasonable sites include groin, wounds and respiratory secretions or tracheal aspirates depending on the infectious agent
MRGN ESBLs, plasmid AmpC, MR-Pa, MR-Ab, transferable- carbapenemase- producing organisms	<p>High risk units</p> <ul style="list-style-type: none"> – Intensive care unit – Solid-organ transplant unit – Speciality centres (e.g. burns, neurosurgery) • Patients epidemiologically linked to single-strain outbreak in health care facility <p>Patients at high risk of carriage</p> <ul style="list-style-type: none"> • Those with recent broad spectrum antibiotic therapy (carbapenem, quinolones, and 3rd and 4th generation cephalosporins) • Long duration of stay and severity of illness • Chronic disease and impaired functional status • Presence of invasive medical devices 		<ul style="list-style-type: none"> • Multiple sites including rectal or perianal swabs, • Reasonable sites to include nares, groin, wounds and respiratory secretions or tracheal aspirates depending on the infectious agent
<p>Management</p> <p>Staff screening and decolonisation is not recommended for VRE and MRGN</p> <p>Apply stringent hand hygiene, contact precautions (gloves and gown) and core strategies outlined in B.3.1.2 including isolating, cohorting, increased environmental cleaning and dedicated patient equipment. Patients positive for VRE or MRGN should have an electronic alert placed on their case record for easy identification on readmission.</p>			

MRO clearance

Based on the 2005 Multi-Resistant Organism Screening and Clearance Recommendations¹⁴ the following criteria should be satisfied prior to certifying that a patient has cleared a particular MRO:

- more than 3 months elapsed time from the last positive specimen
- all wounds healed, no indwelling medical devices present
- no exposure to any antibiotic or antiseptic body wash for at least 2 weeks prior to screening
- in the case of MRSA, no exposure to specific anti-MRSA antibiotic therapy in the past three months
- consecutive negative screens from above screening sites on two separate occasions OR evaluation of a single set of screening swabs with a broth amplification technique.

Some patients with VRE may appear to ‘clear’ with time but relapse with antibiotic therapy. Where VRE or MRGN are prevalent, admission and interval screening in specialised units is an important way to detect new or relapsed VRE or MRGN colonisation.

These criteria are based on evidence related to MRSA. It is recognised that there is variation in clearance methods between jurisdictions, but currently there is insufficient evidence to recommend the most effective method of demonstrating clearance of a particular MRO. This is an area that warrants further research. The important issue appears to be sampling the patient on more than two occasions separated in time. This period should not be less than 3 weeks but is typically months.

Examples of successful approaches

With an incidence rate of 1.09 per 100,000 population in 2006, Western Australia (WA) has consistently reported low rates of acquisition of MRSA compared to other states in Australia (Ferguson 2007). Tables B3.3 and B3.4 provide examples of approaches that have been successful in reducing rates of cross-transmission in hospitals in WA. It is acknowledged that approaches will vary across jurisdictions, depending on the setting (e.g. available resources and access to laboratory techniques).

Table B3.3: Example of a successful strategy to prevent endemicity of MRSA in a tertiary hospital in WA

Patient screening	Infection control precautions	Decolonisation	Sample collection
<ul style="list-style-type: none"> • Patients hospitalised or in long-term care facility outside WA in previous 12 months • Healthcare workers who have worked outside WA in 12 months prior to commencing employment in WA • Patients / healthcare workers epidemiologically linked to single-strain outbreak in healthcare facility • Patients from WA long-term care facilities • Patients in high-risk units: <ul style="list-style-type: none"> – ICU/high dependency unit (admission and discharge) – Spinal unit – Burns unit – Pre-operative clinics 	<ul style="list-style-type: none"> • Core strategies plus • Contact precautions: <ul style="list-style-type: none"> – Single room or cohort – Gown and gloves 	<ul style="list-style-type: none"> • Topical plus/minus systemic • Healthcare workers • Patients having prolonged hospitalisation • Patients with chronic conditions likely to be readmitted • Clearance only after negative screening swabs on at least three occasions over a ten week period 	<ul style="list-style-type: none"> • Multiple sites including the nose and a mucosal surface • Reasonable sites to swab include noses, throat and wounds
<p>Patients positive for MRSA have an electronic alert placed on case record for easy identification on readmission</p>			

¹⁴ [http://www.health.gov.au/internet/safety/publishing.nsf/content/a4114b5692d8a24fca2571d8000978d0/\\$file/mroscreen-jun05.pdf](http://www.health.gov.au/internet/safety/publishing.nsf/content/a4114b5692d8a24fca2571d8000978d0/$file/mroscreen-jun05.pdf)

Table B3.4: Example of a successful strategy to prevent endemicity of VRE in a tertiary hospital in WA

Patient screening	Infection control precautions	Sample collection	Laboratory surveillance
<ul style="list-style-type: none"> • Patients epidemiologically linked to single-strain outbreak in health care facility • Dialysis patients monthly • High risk units (admission and discharge) <ul style="list-style-type: none"> – Intensive care unit – Nephrology – Haematology – Solid organ transplant unit – Transfers from hospitals outside WA 	<ul style="list-style-type: none"> • Core strategies plus • Contact precautions: <ul style="list-style-type: none"> – Single room or cohort – Gown and gloves 	<ul style="list-style-type: none"> • Rectal swab 	<ul style="list-style-type: none"> • All faeces specimens submitted to laboratory are screened • All enterococcal isolates are screened
Patients positive for VRE have electronic alert placed on case record for easy identification on readmission. Decolonisation not possible Healthcare workers not screened			

B3.1.4 Antibiotic stewardship¹⁵

Over the last 40 years, the prevalence of MROs such as MRSA has risen alarmingly, initially mainly in hospitals but now increasingly in the community. There is good evidence that overall rates of antibiotic resistance correlate with the total quantity of antibiotics used, as determined by the number of individuals treated, prior exposure and the average duration of each treatment course. Some antibiotics promote the development of resistance more readily than others, depending in part on the breadth of their antibacterial spectrum. In individuals, the risk of colonisation and infection with MROs correlates strongly with previous antibiotic therapy.

Unnecessary antibiotic use for self-limiting or non-infective illness and inappropriate antibiotic choice, dose or duration of therapy drives the selection of resistant bacteria, disrupts normal bacterial flora and increase the risk of colonisation with resistant organisms. There is a lag period between acquisition of an MRO and its detection; during this period, the infection may spread between patients if risk factors for acquisition are not considered carefully. Clinicians may be under pressure to prescribe broad-spectrum agents against likely pathogens in an environment where MROs are common, thereby further increasing the development of resistant organisms.

As many as 25–50% of antibiotic regimens prescribed in hospitals may be inappropriate. The reasons for the continued unnecessary and/or inappropriate use of antibiotics, in the face of increasing antibiotic resistance and availability of well-established evidence-based treatment guidelines, are varied.

Antibiotic stewardship programs involve a systematic approach to optimising the use of antibiotics (see Section C5). Effective hospital antibiotic stewardship programs have been shown to decrease antibiotic use and improve patient care. Along with infection control, hand hygiene and surveillance, antibiotic stewardship is considered a key strategy in local and national programs to decrease MROs and HAIs.

¹⁵ This section is drawn from ACSQHC (2009) National Report on Antibiotic Stewardship.

B3.1.5 Risk-management case study

VRE outbreak in a large tertiary-care referral hospital

Two months after the first index case of VRE was detected in the intensive care unit of a large teaching hospital, 68 patients had become either infected or colonised with an epidemic strain of vanB vancomycin-resistant Enterococcus faecium, despite standard infection control procedures. Subsequently, 169 patients in 23 wards were found to be colonised with a single strain of vanB vancomycin-resistant E. faecium. Introducing additional control measures rapidly brought the outbreak under control. Hospital-wide screening found 39 previously unidentified colonised patients, with only 7 more non-segregated patients being detected in the next 2 months. The outbreak was terminated within 3 months due to a well-resourced, multifaceted approach.

Source: Based on Christiansen et al (2004).

Eliminating risks	In this situation, it is not possible to eliminate risk immediately, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of VRE.
Analysing risks	The source of the risk is multidrug resistance coupled with a vulnerable patient population (intensive care unit). Each time there is contact with an infected patient there is potential for cross-transmission to the healthcare worker and/or other patients.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	<p>Immediate measures to control the outbreak may include;</p> <ul style="list-style-type: none"> • formation of a VRE executive group • rapid laboratory identification (30 to 48 hours) using culture and polymerase chain reaction detection of vanA and vanB resistance genes • screening of hospitalised patients with isolation of patients and cohorting of contacts • increased cleaning • electronic flagging of medical records of contacts • antibiotic restrictions (third-generation cephalosporins and vancomycin). <p>In the longer term, hospital policies may be changed to restrict antibiotic use, institute targeted screening and increase environmental cleaning efficiency and frequency.</p> <p>These measures are relevant to a recent outbreak in an area of low endemicity. Some of these approaches may also be relevant in an area of high endemicity.</p>
Monitoring	Repeated screening would identify whether the outbreak recurred.

B3.2 Outbreak investigation and management

When there are more cases of infection with the same organism than would normally be expected in one area or period of time, this constitutes an outbreak.

An outbreak may be defined as:

- occurrence of more cases of disease than expected in a given area among a specific group of people over a particular period of time
- two or more linked cases of the same illness.

Commonly detected outbreaks involve:

- MRSA (see Section B3.1.3);
- aminoglycoside or multi-resistant enterobacteriaceae or pseudomonads
- diarrhoeal pathogens (e.g. *Salmonella*, *Campylobacter*, norovirus)
- respiratory pathogens (e.g. influenza, RSV)
- measles (rubeola), chickenpox (varicella)
- hepatitis A
- *C. difficile* enterocolitis
- Legionnaires' disease.

This section gives principles and overall guidance for managing an outbreak. For specific guidance on particular infections, please refer to national guidelines related to management of that infection.

B3.2.1 Outbreak investigation and management

A suspected outbreak may be identified by a healthcare worker, by laboratory personnel, or by state/territory health authorities conducting routine surveillance or investigating reports of illness and from reportable disease notifications. When an outbreak is detected, the healthcare facility's infection control management system should be notified and an outbreak control team formed relevant to the size and seriousness of the outbreak and the healthcare facility involved. There may also be a requirement to notify the state/territory public health unit.

The responsibility for investigation and the extent of investigations will vary according to the outbreak type and circumstances. It is important to investigate an outbreak immediately, as the availability and quality of microbiological evidence and epidemiological data diminishes rapidly with time between illness and investigation.

An outbreak management plan should be developed based on local policy and consultation between the infection control professional, healthcare workers, patients, facility management and state/territory health authorities as appropriate. Such a plan is multifactorial and its implementation is typically overseen by a person with designated responsibility for infection control, such as an infection control professional, clinical microbiologist or infectious diseases physician.

The outbreak response may differ according to the nature of disease, the virulence of the organism and the vulnerability of the patients concerned, however the principles that underlie an outbreak investigation are similar: identification of the aetiological agent; the route(s) of transmission; exposure factors and the population at risk.

Table B3.5 outlines the process of outbreak investigation and corresponding management. In practice many steps are taken more or less simultaneously, while the results of investigations and implementation of strategies to contain and control will vary with the availability and timeliness of information and seriousness of the outbreak. In primary care there may be a limited ability to investigate an outbreak, which will be generally conducted by public health authorities once they have been notified. All outbreaks, however minor, should be investigated promptly and thoroughly and the outcomes of the investigations documented.

Table B3.5: Steps in an outbreak investigation

Steps	Suggested approach	Responsibilities (dependent on facility and type of outbreak)
Step 1. Recognise outbreak and prepare to investigate		
Determine existence of the outbreak	<ul style="list-style-type: none"> Establish background rate of disease Consider if observed number of cases is in excess of the usual number and cases are typical Examine surveillance data 	<ul style="list-style-type: none"> Healthcare workers Laboratory personnel
Determine if immediate control measures are needed (refer to B3.2.2)	<ul style="list-style-type: none"> Reinforce standard precautions Apply appropriate transmission-based precautions 	<ul style="list-style-type: none"> Healthcare workers—as soon as outbreak is suspected
Notify and communicate	<ul style="list-style-type: none"> Healthcare workers and ancillary staff in immediate area Infection control professional Executive Laboratory Public health unit (if notifiable disease or required pursuant to public health legislation) 	<ul style="list-style-type: none"> Healthcare workers—as soon as outbreak is suspected Laboratory personnel (e.g. routine screening can identify outbreak)—as soon as outbreak is suspected
Formation of an outbreak investigation/management team (OMT) – this will vary according to location/resources, made up of one or more people with designated responsibility	Membership may include but is not limited to: <ul style="list-style-type: none"> Administrators (medical and nursing) Managers of implicated areas Infection control professional or designated person with infection control experience Clinical Microbiologist Infectious diseases physician/epidemiologist/statistician Lead investigator or ‘chair’ nominated Others as defined by circumstances 	<ul style="list-style-type: none"> Management—as soon as notified
Step 2. Verify the diagnosis and confirm that an outbreak exists		
Confirm that there are more than expected number of cases meeting the surveillance case definition of the disease of interest in the period under review	<ul style="list-style-type: none"> Confirm clinical diagnoses (symptoms and features of illness) Review laboratory data and request additional laboratory tests if necessary, e.g. molecular typing of organisms to confirm clonality 	<ul style="list-style-type: none"> Laboratory personnel to report results Clinicians to verify clinical diagnosis
Consider likely outbreak definition and whether criteria are met	<ul style="list-style-type: none"> – Are there more cases than expected compared to previous weeks / months? – Review scientific literature – Consider epidemiology of cases - are there two or more linked cases of the same illness? 	<ul style="list-style-type: none"> OMT representatives (clinical microbiologist, senior clinicians)

Steps	Suggested approach	Responsibilities (dependent on facility and type of outbreak)
Step 3. Establish case definition and find cases		
Establish a set of standard criteria to decide whether or not a person has the disease of concern.	<ul style="list-style-type: none"> Case definition should be based on: <ul style="list-style-type: none"> Clinical information about the disease Characteristics of the people who are affected Information about the location Specification of time period for the outbreak Case definition can be refined later after collection of primary data Cases can be classified as <ul style="list-style-type: none"> 'Confirmed' (usually laboratory verification); 'Probable' (usually has typical clinical features); 'Suspect' (usually has fewer typical clinical features) 	<ul style="list-style-type: none"> OMT representatives (clinical microbiologist, senior clinicians)
Find cases	Gather critical information by: <ul style="list-style-type: none"> Interview Follow-up of disease notification Health alerts 	<ul style="list-style-type: none"> Healthcare workers OMT representatives Healthcare facility management
Identify and count cases	Collect the following types of information <ul style="list-style-type: none"> Identifying information Demographic information Clinical information Risk factor information (including environmental tests) 	<ul style="list-style-type: none"> OMT representative
Tabulate this information in a line list, that is updated as new cases appear	<ul style="list-style-type: none"> Time – date of onset of illness Person – age, sex Place – where did the exposure occur? Other relevant information 	<ul style="list-style-type: none"> OMT representative
Step 4. Characterise outbreak by person, place, and time		
Review descriptive epidemiology of all cases	<ul style="list-style-type: none"> Person: sex, age, occupation, residence Place: information that provides information on possible source of agent and nature of exposure Time: date and time of onset; record relevant events in a timeline 	<ul style="list-style-type: none"> OMT representative
Create epidemic curve to determine hypotheses	<ul style="list-style-type: none"> Number of cases on y-axis Time on x-axis 	<ul style="list-style-type: none"> OMT representative
Step 5. Determine who is at risk		
Identify groups at risk	<ul style="list-style-type: none"> Number of people ill Time and place of onset Personal characteristics 	<ul style="list-style-type: none"> OMT representative

Steps	Suggested approach	Responsibilities (dependent on facility and type of outbreak)
Initiate precautionary measures	<ul style="list-style-type: none"> • Use of standard precautions and appropriate transmission-based precautions • Increase frequency and efficiency of environmental cleaning using appropriate products; • Prophylactic treatment/immunisation • Antibiotic restrictions • Exclusion of cases from high risk activities • Isolation and/or cohorting of patients • Restricting movement of patients, staff and visitors • Screening of patients with isolation of patients and cohorting of contacts; • Provision of health information and advice 	<ul style="list-style-type: none"> • Healthcare workers • Infection control professional
Step 6. Develop hypothesis – the ‘how’ and ‘why’		
Develop hypotheses from the factual information gathered to date on potential source, vector, pathogen, route of transmission	<ul style="list-style-type: none"> • Data collected by interview • Common links • Plausible exposures • Environmental test results where appropriate • Review literature 	<ul style="list-style-type: none"> • OMT representative
Step 7. Test hypothesis with established facts		
Perform epidemiologic study	<ul style="list-style-type: none"> • Cohort • Case-control 	<ul style="list-style-type: none"> • OMT representative
Analyse the data	<ul style="list-style-type: none"> • Compare risk factors among ill (cases) vs. not ill (controls) • Attack rates • Relative risk 	<ul style="list-style-type: none"> • OMT representative or outsourced to consultant with knowledge of statistical methods
Step 8. Carry out further studies if necessary		
To support the hypothesis or if analytic studies do not confirm the hypothesis	<ul style="list-style-type: none"> • Further study to refine case definition • May involve testing of environmental samples, food samples or environmental screening in some situations (e.g. Legionella, Pseudomonas) 	<ul style="list-style-type: none"> • OMT
Step 9. Implement ongoing control / prevention measures (This can be done at any time during the outbreak as deemed necessary).		
Review measures initiated for immediate control (Step 1 and Step 5)	<ul style="list-style-type: none"> • Are infection control measures adequate to reduce risk of transmission? 	<ul style="list-style-type: none"> • Healthcare workers • OMT • Healthcare facility management
Implement appropriate ongoing control measures and strategies to prevent further illness (see B.3.2.2)	<ul style="list-style-type: none"> • Restrict spread from the case • Interrupt chain of infection • Interrupt transmission or reduce exposure • Reduce susceptibility to infection • Assessment of policy, regulations, standards 	<ul style="list-style-type: none"> • Healthcare workers • OMT • Healthcare facility management

Steps	Suggested approach	Responsibilities (dependent on facility and type of outbreak)
Communicate and coordinate with all stakeholders	<ul style="list-style-type: none"> Electronic flagging of medical records of contacts; Reinforcement of infection control precautions to staff, patients and visitors 	<ul style="list-style-type: none"> Healthcare workers OMT Infection control professional
Make plans to evaluate their effectiveness	<ul style="list-style-type: none"> Document type and time of implementation of infection control measures Monitor factors contributing or affected by outbreak and any associated changes 	<ul style="list-style-type: none"> Healthcare workers OMT Infection control professional
Step 10. Communicate findings		
Prepare written report that evaluates methods used for the control of the outbreak	<ul style="list-style-type: none"> Include discussion of factors leading to outbreak, comprehensive timelines, summary of investigation and documented actions Short and long term recommendations for prevention of similar outbreak Disseminate to appropriate stakeholders including publication 	<ul style="list-style-type: none"> OMT Healthcare facility management

B3.2.2 Infection control strategies to control/contain an outbreak

Good governance and administrative or managerial support are crucial to support outbreak management (see Section C1). The healthcare worker's role in outbreak management will include:

- reinforcement of standard precautions*, including rigorous adherence to the 5 moments for hand hygiene and environmental cleaning protocols and appropriate use of PPE
- implementation of relevant transmission-based precautions*, including isolation and cohorting.

The specific precautions required for each infectious agent are listed in Section B5.2 (see page 165).

Environmental cleaning

Frequency and efficiency of environmental cleaning should be increased above the standard for the area to ensure any contaminants are removed (see Section B5.1 on page 161 for guidance on cleaning in high-risk situations). A targeted cleaning regime may be introduced and continued for the duration of the outbreak dependent on the mode of transmission of the infectious agent. Consideration should be given to whether the surrounding environment will need to be disinfected in addition to being cleaned.

Patient isolation

The isolation of infected patients—through allocation of single rooms or cohorting of patients—is important when managing an outbreak. Infected patients should be isolated using single rooms, cohorting and negative-pressure rooms if available and as advised by an infection control professional or person with designated responsibility for infection control. Standardised transmission-based precautions signage should identify the isolation room and include the necessary precautions to be adopted. The door should be kept closed for patients on airborne precautions.

Single room

Single-patient rooms are always indicated for patients placed on airborne precautions and are preferred for patients who require contact or droplet precautions. In the event of an outbreak, single-patient rooms are preferred for all modes of transmission.

When there is only a limited number of single-patient rooms, they should be prioritised for patients

who have conditions that facilitate transmission of infectious material to other patients (e.g. draining wounds, stool incontinence, uncontained secretions) and for those who are at increased risk of acquisition and adverse outcomes resulting from infection (e.g. immunosuppression, open wounds, indwelling catheters, anticipated prolonged length of stay, total dependence on healthcare workers for activities of daily living).

Cohorting

Cohorting patients who are colonised or infected with the same strain confines their care to one area and prevents contact with other patients. Cohorts are created based on clinical diagnosis, microbiologic confirmation when available, epidemiology, and mode of transmission of the infectious agent. It is generally preferred not to place severely immunosuppressed patients in patient-care areas with other patients.

Cohorting allows more efficient use of staff. Cohorting has been used for managing outbreaks of MROs and pandemic influenza, and modelling studies provide additional support for cohorting patients to control outbreaks.

Placement of large numbers of patients

In the event of an outbreak or exposure involving large numbers of patients who require airborne precautions, an infection control professional should be consulted before patient placement. Appropriate measures may include:

- cohorting of patients in areas of the facility that are away from other patients
- using temporary portable solutions (e.g. exhaust fan) to create a negative pressure environment in the converted area of the facility.

Restricting movement within the facility

Restricting movement of patients during an outbreak reduces the risk of further transmission. If transfer within the facility or transport to another facility is necessary, advice should be sought from an infection control professional. If an infected or colonised patient must be moved the transport service and/or receiving area or facility should be notified of the nature of the patient's infection or colonisation.

It is important to:

- ensure that infected or colonised areas of the patient's body are covered if relevant
- if the target infection is transmitted by the droplet or airborne route, ask the patient to wear a mask while being moved.

Contaminated PPE should be removed and disposed of and hand hygiene performed before the patient is moved. Clean PPE should be put on before the patient is handled at the destination.

Exclusion policies

Exclusion policies may also be implemented to restrict the spread of disease throughout a healthcare facility. This could include:

- excluding patients from participating in specific activities
- restricting or cancelling visiting hours for patients in outbreak areas
- excluding staff from work until well if they are implicated in the transmission of infection (e.g. food handlers).

In an outbreak of viral gastroenteritis, healthcare workers should not return to work until diarrhoea and vomiting have ceased for 2 days. It is extremely important that healthcare workers comply with appropriate hand hygiene methods and stringent infection control practices upon return to work, given that some studies have shown prolonged viral shedding.

Notifications and contact tracing

All healthcare facilities should have systems in place to ensure timely reporting of notifiable diseases to the relevant state/territory health department. As patients may present to a healthcare facility and be later confirmed to have a transmissible disease state/territory health authorities need to be notified to enable tracing of contacts of the infected patient in order to initiate appropriate counselling, quarantine and post-exposure prophylaxis. Healthcare facilities may need to identify staff on duty and other patients present who may have been exposed to the infectious patient and be at risk.

Communication

One of the important aspects of the outbreak management process is the written and oral communication of findings to the appropriate authorities, the appropriate health professionals and the public. This communication is based on the type and severity of the outbreak. During an outbreak it is important to provide education to the key stakeholders and clinicians about the organism, its mode of transmission and its behaviour in disease.

Within a healthcare facility, effective communication could consist of:

- appropriate signage to limit access to a room or a clinical unit
- electronic alerts on the medical record to manage cases and contacts
- emails and multimedia to target all stakeholders within the healthcare facility
- provision of education and written materials to visitors to inform them of the situation and the infection control measures with which they should comply.

Patient-care tip

Patients, their families, and visitors may experience concern or fear or may feel they are not being given enough information in an outbreak situation. Clearly explaining the process of outbreak management and the importance of infection control measures may assist them in understanding the situation and improve compliance with infection control directives.

B3.2.3 Applying transmission-based precautions during an outbreak

Successful outbreak management is based on a combination of transmission-based precautions. Specific interventions will be determined by the infection control professional, based on the mode of transmission of the infectious agent. These include:

- rigorous adherence to the 5 moments for hand hygiene (see Section B1.1.2);
- use of appropriate PPE (including gloves, apron or gowns, and surgical mask or P2 respirator);
- implementing patient-dedicated or single-use non-critical equipment (e.g. blood pressure cuff, stethoscope) and instruments and devices;
- following standard procedures for containment, cleaning and decontamination of spills; and
- increasing the frequency of environmental cleaning over the standard for that area, using appropriate products (see Section B5.1).

B3.2.4 Risk-management case study

Norovirus in a long-term care facility

A patient from a self-contained unit within a long-term care facility is transferred to a hospital unit with dehydration resulting from diarrhoea. The infectious agent involved is identified as norovirus. The facility is contacted and advised to implement contact and droplet precautions, but these can only be implemented in the main facility and the following day the patient's neighbour is also admitted with diarrhoea. When he and a third patient within the hospital unit are also confirmed as having norovirus, the three patients are isolated in single rooms with ensuites. Healthcare workers caring for the patients pay particular attention to hand hygiene and appropriate use of PPE. No further cases are identified. Investigation reveals low levels of hand hygiene among residents in the units. An education program is developed and provided to assist in preventing further infections.

Eliminating risks	In this situation, it is not possible to eliminate risk, so it must be managed.
Identifying risks	In this case, the risk has been identified as cross-transmission of norovirus by contact (faecal-oral) or droplet route.
Analysing risks	One source of the risk is the lack of appropriate hand hygiene practices by some residents. Each time there is social contact between these and other residents there is potential for cross-transmission. Depending upon hand hygiene practices among residents more broadly, there is potential for the infection to spread through the facility. There is also potential for residents with comorbidities who use the hospital to become reservoirs for transmission of the virus. Healthcare workers and visitors are also at risk of cross-contamination.
Evaluating risks	The balance of likelihood and consequences identify this as a 'very high risk' situation requiring immediate response.
Treating risks	Immediate measures may include increasing availability of soap and water as well as alcohol-based hand rub across the facility and raising residents' awareness of the highly transmissible nature of norovirus infection, its modes of transmission and the particular need for hand hygiene practices. Frequency of environmental cleaning across the facility should also be increased. Longer-term measures could include providing education to residents and visitors on hand hygiene and other infection control measures. Education for healthcare workers could also be used to raise awareness of the high transmissibility of norovirus, and its capacity to spread very rapidly within units where there are poor or inadequate hygiene practices among residents and staff. Visitors should be requested not to enter the facility if they have any symptoms.
Monitoring	Changes in practice could be evaluated by surveying residents/patients on hand hygiene practice.

B3.3 Putting it into practice

Individual actions for reducing the risk

- Become familiar with local policy on the implementation of transmission-based precautions in the event of an outbreak
- If an outbreak is suspected or identified, implement core strategies for prevention and control and seek advice from an infection control professional or person with designated responsibility for this task regarding intensified strategies appropriate to the specific organism
- Practice hand hygiene assiduously and wear appropriate PPE when caring for patients who may be colonised or infected
- Become familiar with local policy on antibiotic stewardship.

Involving patients in their care

The following information may be provided to patients to assist them in understanding outbreak management.

- Hand hygiene is the most important part of preventing transmission of an infection—this applies to everyone including healthcare workers, patients, visitors and families
- If infected patients are transferred, they may be asked to wear a mask
- Infected patients should avoid unnecessary movement around other parts of the healthcare facility
- To minimise transmission of infection In hospitals, visitors should perform hand hygiene using alcohol-based hand rub before entering or exiting the patient-care area; they may also be asked to wear gloves and gowns while they are with the patient
- In hospitals, staff must respond quickly to an outbreak of an infection to contain the infection and stop it spreading any further. Actions may include testing patients to see who may be carrying the infection, placing patients in single rooms or with other patients who have the same infection, and limiting movement of people around the facility.

B3.4 Resources

B3.4.1 Multi-resistant organisms

Guidelines

- South Australian *Guidelines For The Management Of Patients With Vancomycin Resistant Enterococci (VRE) Colonisation/Infection* www.health.sa.gov.au/infectioncontrol/ – State Infection Control guidelines
- DHS Victoria - *Guidelines for the Management of Patients with Vancomycin-Resistant Enterococci (VRE) Colonisation/Infection* (1996)
- NSW Health Department Policy Directive 2007_084. *Infection Control Policy: Prevention & Management of Multi-Resistant Organisms (MRO)* http://www.health.nsw.gov.au/policies/pd/2007/PD2007_084.html
- Queensland Health *Infection Control Guidelines* <http://www.health.qld.gov.au/chrisp/>
- Centers for Disease Control and Prevention- *Management of Multidrug-Resistant Organisms in Healthcare Settings, 2006*. <http://www.cdc.gov/ncidod/dhqp/guidelines.html>
- SHEA *Guidelines for Preventing Nosocomial Transmission of Multi-resistant Strains of Staphylococcus aureus and Enterococci* 2003
- APIC *Guide to the Elimination of Methicillin Resistant Staphylococcus aureus (MRSA) Transmission in Hospital Settings*, March 2007

B3.4.2 Outbreak management

Guidelines

- CDNA (2000) *Guidelines for the Control of Measles Outbreaks in Australia and New Zealand*
- CDNA (2001) *Guidelines for the Early Clinical and Public Health Management of Meningococcal Disease in Australia*
- Queensland Health *Outbreak Management Guidelines* http://www.health.qld.gov.au/chrispic_guidelines/contents.asp

B3.5 References

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B4 Applying standard and transmission-based precautions during procedures

Summary

Medical and dental procedures increase the risk of transmission of infectious agents between patients and healthcare workers.

- 'Procedure' includes any situation in which there is a potential for contact between the skin of the healthcare worker and the patient's tissues, body cavities or organs, either directly or via surgical instruments or therapeutic devices.
- The more invasive the procedure, the greater the risk of transmission of infection. Before a procedure is undertaken, consideration should be given to whether there is a safer, less invasive alternative.
- The level of perceived infection risk depends on a range of factors including the site and complexity of the procedure and patient characteristics (e.g. age, underlying illness).
- Healthcare workers should be trained and competent in safe procedural techniques and participate in regular education sessions about minimising the infection risk of procedures. If there is any uncertainty, healthcare workers should contact the person with designated responsibility for infection control.

Patient-care tip

Patients and their carers should be offered clear, consistent information and advice through all stages of their care. This should include the risks of procedure-related infections, what is being done to reduce them and how they are managed.

This section outlines processes for risk identification and the application of standard and transmission-based precautions for certain procedures. It is not intended to provide guidance on performing procedures, but outlines the principles involved in the delivery of care that reduce the risk of transmission of infection during the insertion and maintenance of therapeutic devices and for surgery.

Evidence supporting practice

The advice in this section has been adapted from:¹⁶

- the Institute for Healthcare Improvement (www.ihl.org)
- Pratt et al (2007) *epic2: Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals* (Sections B4.2.1 and 4.2.2)
- Tenke et al (2008) *European and Asian guidelines on management and prevention of catheter-associated urinary tract infections* (Section B4.2.1)
- O'Grady et al (2002) Guidelines for the Prevention of Intravascular Catheter-Related Infections. United States Centers for Disease Control and Prevention. *MMWR* 51(RR10): 1–26 (Section B4.2.2)
- Muscedere J et al for the VAP Guidelines Committee and the Canadian Critical Care Trials Group (2008) Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: Prevention. *J Critical Care* 23: 126–37 (Section B4.2.3)
- Asterton et al (2008) *Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for Antimicrobial Chemotherapy* (Section B4.2.3)
- NICE (2003) *Prevention of Healthcare-associated Infection in Primary and Community Care* (Section B4.2.4)
- NICE (2008) *Prevention and Treatment of Surgical Site Infection* (Section 4.3).

¹⁶ These guidelines were selected based on analysis using the AGREE tool, which ensures that guidelines have been developed in a rigorous, transparent and robust manner. This process is discussed in detail in Appendix 2.

Further review of the literature conducted for these guidelines provided additional evidence on infection control measures required in the use of intravascular devices.¹⁷

B4.1 Taking a risk-management approach to procedures

All procedures involve some risk of infection. Minimising the infection risk associated with a procedure should be an integral part of considering the overall risks and benefits of that procedure to the patient. The aim should be to perform the procedure with the lowest level of perceived infection risk that will meet the treatment goals for that patient. When performing the procedure, associated infection risks should be identified and minimised.

In developing local policies for a healthcare facility, it is useful to refer to guidelines developed to inform practice in performing specialised procedures.

B4.1.1 Classifying procedures

Procedures can be classified according to the level of perceived risk, by applying the principles of Spaulding’s criteria for assessing the risk of medical instruments and equipment according to their intended use (see Section B1.5).

Table B4.1: Level of risk to patients from different types of procedures

Level of risk	Criteria	Example
High risk (critical site)	Any surgical entry into tissue, body cavities or organs, or repair of traumatic injury.	Abdominal surgery Dental surgery
Medium risk (semi-critical site)	Contact with mucous membranes or non-intact skin	Respiratory procedure Internal/instrument examination (e.g. ultrasound, endoscopy) Minor skin surgery Minor dental procedures
Low risk (non-critical site)	Contact with intact skin	Non-invasive examinations or procedures (e.g. abdominal ultrasound) Blood pressure measurement, ECG, injection through intact skin Extra-oral dental examination

B4.1.2 Appropriate use of devices

Appropriate use of devices is integral to reducing the risk of procedures. Single-use or single-patient items should be used wherever practical, and items designed for single use must not be used for multiple patients. Healthcare workers should be aware of situations where cross-contamination may occur during routine procedures.

Healthcare workers must adhere to infection control principles, including safe injection practices and aseptic technique for the preparation and administration of parenteral medications.

¹⁷ The report of this review is available from the NHMRC upon request.

Single-dose vials

Medications or solutions that come into contact with normally sterile tissue should be sterile. The most effective way to avoid cross-infection via injection of medication is through the use of single-dose vials or ampoules and single-use sterile injecting equipment. Single-dose vials or ampoules, or prefilled syringes, should be used wherever these are available. These include the use of a sterile, single-use needle and syringe for each injection given, and adherence to practices that prevent contamination of injection equipment and medication.

Multi-dose vials

The Australian Drug Evaluation Committee (ADEC) has advised that injectable products packaged in multi-dose vials should not be used except where products such as insulin are intended solely for the exclusive use of an individual patient (ADEC 2005). In these particular cases, specific protocols should be in place to ensure the products are used for those individuals only, and there is adherence to practices that prevent contamination of injection equipment and medication.

Currently some injectable products (e.g. Bacillus Calmette-Guérin [BCG] and botulinum toxin) are only available in multi-dose vials. When single-dose vials or ampoules are not available, there is a high risk of cross-contamination if injectable products are used on multiple patients. Steps should be taken to ensure these become available in single dose vials, however the risk of infectious disease transmission may be mitigated by (Siegel et al 2007):

- compliance with manufacturer's recommendations (adhere to instructions for refrigeration, storage, use within a specified time, expiry date)
- establishing a separate area designated for the placement of these medications away from any work area
- having only the current patient's medication in the immediate working environment
- using a sterile needle and syringe to draw up the required dose from the vial or ampoule on every occasion
- using a sterile needle to draw up all the contents of the container into individual syringes before administering to patients
- discarding any open ampoule(s) at the end of each procedure
- discarding product if sterility is compromised or questionable.

The use of multi-dose vials has been associated with the transmission of infectious diseases including HIV (Katzenstein et al 1999), hepatitis B (Hutin et al 1999; Dumpis et al 2003; Samandari et al 2005), hepatitis C (Widell et al 1999; Massari et al 2001; Trasancos et al 2001; Kokubo et al 2002; Silini et al 2002; Dumpis et al 2003; Germain et al 2005; Verbaan et al 2008), *Staphylococcus aureus* (Kellaway et al 1928), and *Streptococcus pyogenes* (Stetler et al 1985; Olson et al 1999). International agencies such as the CDC and WHO recommend that single-dose vials be used for parenteral additives or medications whenever possible, especially when medications will be administered to multiple patients (Hutin et al 2003; Siegel et al 2007).

There may be some exceptional circumstances where for short periods (e.g. a few months) multi-dose vials may be the only way to deliver vaccines or drugs to a large proportion of the population in a timely fashion. An example would be when a health emergency is declared because of an infection that has a high associated mortality and rapid spread (e.g. smallpox outbreak) and when there may be a delay in single-dose vaccines or drugs becoming available for a period of time.

Table B4.2: Summary of processes for appropriate use of devices

Injection equipment	<ul style="list-style-type: none"> • Avoid contamination of the needle
Single-use items	<ul style="list-style-type: none"> • Do not use the same needle, cannula or syringe for more than one patient nor to access a medication or solution that might be used for a subsequent patient • Do not administer medications from a single syringe to multiple patients, even if the needle or cannula on the syringe is changed.
Single-patient items	<ul style="list-style-type: none"> • Use single-patient items for one patient only and dispose of them appropriately.
Single-use medications	<ul style="list-style-type: none"> • Only use single-dose vials when administering drugs, therapeutic agents and vaccines to multiple patients • Do not administer medications from single-dose vials or ampoules to multiple patients or combine leftover contents for later use
Multi-dose vials	<ul style="list-style-type: none"> • Multi dose vials should not be used except where they are intended solely for the exclusive use of an individual patient (e.g. insulin)
Fluid infusion and administration sets (i.e. intravenous bags, tubing and connectors)	<ul style="list-style-type: none"> • Use for one patient only and dispose of appropriately after use • Do not use bags or bottles of intravenous solution as a common source of supply for multiple patients • Consider syringes or needles/cannulae as contaminated once they have been used to enter or connect to a patient's intravenous infusion bag or administration set • Use closed intravenous delivery devices as standard practice • Use premixed intravenous bags of medication wherever possible, in order to reduce the risk of contamination or infection during mixing, dilution or preparation • Avoid disconnection of administration sets if possible to minimise the potential of contamination of IV lines • Should be changed on a regular basis, depending on their use (see Section B4.2.2)

B4.1.3 The care bundle approach

The Institute for Healthcare Improvement (IHI) in the US developed a structured ‘care bundle’ approach to help healthcare workers consistently deliver the safest possible care for patients undergoing treatments with inherent risks. A bundle is a set of evidence-based practices that, when performed collectively and reliably, improve patient outcomes.

Many bundle elements are well-established practices, combined in a structured protocol that is agreed upon and is the responsibility of the whole clinical team. Bundle characteristics include the following.

- A bundle is a cohesive unit of steps that must all be completed to succeed.
- The elements are all based on randomised controlled trial evidence.
- The elements involve all-or-nothing measurement, making implementation clear-cut.
- Bundle elements occur at a specific time and in a specific place (e.g. during morning rounds every day).

Examples of care bundles are given in each section of this chapter. These can be used to monitor, assess and improve performance as well as to increase consistency of care.

Existing care bundles can be used as a tool and be developed by each facility to meet its needs. For more information, refer to the IHI website at www.ihl.org.

B4.2 Therapeutic devices

Therapeutic devices include catheters inserted for drainage (e.g. urinary catheter), for intravascular access (e.g. central venous line), for mechanical ventilation (e.g. intubation) and for feeding (e.g. enteral feeding tube).

Indwelling devices provide a route for infectious agents to enter the body. Aseptic insertion and careful maintenance of devices is critical to reducing infection risk.

Therapeutic medical devices are a common source of HAIs in intensive care units. Pneumonia, urinary tract infections and bloodstream infection account for around 70% of intensive care unit HAIs, and most of these are associated with invasive devices (Cruickshank & Ferguson 2008).

Table B4.3: Key concepts in minimising the risk of infection related to the use of invasive devices

-
- Consider the infection risk during decision-making about whether or not to perform the procedure, ensuring that a therapeutic device is absolutely necessary for the patient
 - Ensure you are adequately trained and competent in the skills required for safe insertion and maintenance of the device
 - Choose the most appropriate device for the patient
 - Minimise the period of time a device remains in a patient
 - Use processes identified as those that minimise the risk of infection (see summary tables in this section)
 - Regularly monitor patients for any signs and symptoms of infection
 - Provide patient education on the infection risk associated with the insertion of devices and the importance of proper maintenance
-

Information on use of aseptic non-touch technique (ANTT) for specific procedures (including therapeutic devices) can be found in Sections B1.7 and B5.4.

B4.2.1 Indwelling urinary devices¹⁸

An indwelling urinary catheter is a flexible tubular instrument passed into the bladder either through the urethra or through the abdominal wall above the symphysis pubis. They are used to empty the contents of the bladder in patients with acute urine retention or peri-operatively, and for urinary measurements in critically ill patients.

What are the risks?

Bacterial infections associated with urinary catheterisation gain access to the urinary tract either through:

- *extraluminal contamination*—this can occur if there is a break in aseptic technique during insertion of the catheter or servicing the drainage system, from the healthcare worker’s hands or from the patient’s own colonic or perineal flora
- *intraluminal contamination*—this can occur through reflux of bacteria from a contaminated urine drainage bag.

Catheterising patients places them at significant risk of acquiring a urinary tract infection. The risk of infection is associated with the method and duration of catheterisation, the quality of catheter care and host susceptibility. The longer a urinary catheter is in place, the greater the risk of infection.

¹⁸ Unless otherwise specified, this section is drawn from Pratt et al (2007) epic2: Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals and Tenke et al (2008) European and Asian Guidelines on Management and Prevention of Catheter-Associated Urinary Tract Infections.

Between 15 and 25% of patients in hospital may receive short-term indwelling urinary catheters, and about 5% of residents in long-term care facilities (O'Grady et al 2002; draft 2009). Around 20% of HAIs are urinary tract infections, and a large proportion of these are catheter-associated urinary tract infections (CAUTIs) (Smyth et al 2008). Up to 97% of urinary tract infections in intensive care units have been associated with indwelling catheters (Cruickshank & Ferguson 2008).

Minimising the risk from indwelling urinary devices

Limiting catheter use and minimising duration are primary strategies in reducing the risk of CAUTI. Healthcare facilities should have documented policies regarding insertion, maintenance and surveillance of indwelling urinary catheters. Facilities should clearly outline the indications for catheter insertion.

Healthcare workers performing catheterisation should be trained and competent in the technique and familiar with policies and procedures for insertion, maintenance and changing regimes of indwelling urinary devices.

Insertion

- The need for insertion of an indwelling urinary device should be reviewed before the procedure is performed.
- Principles of good practice, clinical guidance and expert opinion, together with findings from a systematic review agree that urinary catheters should be inserted using sterilised equipment (including a sterile drape) and an aseptic technique, using the smallest bore catheter possible that will not be associated with leakage. Staff performing the procedure must be trained and competent in the technique.
- Expert opinion indicates that there is no advantage in using antiseptic preparations over sterile saline for cleansing the urethral meatus prior to catheter insertion. The use of lubricant or anaesthetic gel minimises urethral trauma and discomfort.

Maintaining the system

- Maintaining an aseptic, continuously closed urinary drainage system is central to the prevention of CAUTI. Breaches in the closed system, such as unnecessary emptying of the urinary drainage bag or taking a urine sample, increase the risk of catheter-related infection. Reflux of urine from the drainage bag is also associated with infection.
- Studies investigating the addition of disinfectants and antimicrobials to drainage bags as a way of preventing CAUTI show no reduction in the incidence of bacteriuria following the addition of hydrogen peroxide or chlorhexidine.
- The device should be removed immediately it is no longer needed.

Patient care

- No reduction in bacteriuria has been demonstrated when antiseptic/antimicrobial agents are used for meatal care compared with routine bathing or showering. Expert opinion and a systematic review support the view that vigorous meatal cleansing is not necessary and may increase the risk of infection and that daily routine bathing or showering is all that is needed to maintain meatal hygiene.
- Evidence indicates that bladder irrigation, instillation and washout may have local toxic effects and contribute to the development of resistant microorganisms. However, continuous or intermittent bladder irrigation may be indicated during urological surgery or to manage catheter obstruction.

Documentation and surveillance

- The literature emphasises the importance of documenting all procedures involving the catheter or drainage system in the patient’s records and providing patients with adequate information in relation to the need for catheterisation and details of the insertion, maintenance and removal of their catheter.
- Surveillance relating to indwelling catheters is recommended in the literature and can include monitoring compliance with indications for insertion and documentation.

Patient-care tip

Given the risk of urinary tract infection associated with urinary catheterisation, it is important that patients and relatives understand about infection prevention, are aware of the signs and symptoms of urinary tract infection and know how to access expert help if difficulties arise.

Table B4.4: Summary of processes for urethral catheter insertion and maintenance

<p>Insertion</p>	<ul style="list-style-type: none"> • Ensure documented facility policy on urethral catheter insertion is being followed and that staff members performing the procedure are trained in the specific technique. • Use sterile equipment (including a sterile drape) and aseptic technique when inserting urinary catheters and connecting to the sterile system • Clean the urethral meatus with sterile normal saline before insertion of the catheter • Use an appropriate sterile, single-use lubricant or anaesthetic gel • Properly secure catheter after insertion to prevent movement and urethral traction
<p>Maintenance</p>	<ul style="list-style-type: none"> • Use an aseptic closed system and avoid breaches to this system (e.g. unnecessary emptying of the urinary drainage bag) • Before manipulation, perform hand hygiene and put on non-sterile gloves • Position drainage bag to prevent back-flow of urine or contact of bag with the floor • Do not add antiseptic or antimicrobial solutions into drainage bags • Empty the drainage bag frequently enough to maintain urine flow and prevent reflux • Use a separate urine collection container for each patient, avoiding contact between the drainage bag and container. Following use, the container should be discarded if single use, or cleaned and sterilised if reusable • Change drainage bags only when necessary (i.e. according to either manufacturers’ recommendations of the patient’s clinical needs) • Clamping is unnecessary • Daily meatal hygiene can be maintained through routine bathing or showering • Avoid use of bladder irrigation, instillation or washouts as routine measures to prevent catheter-associated infection • Document all procedures involving the catheter or drainage system

Table B4.5: CAUTI maintenance bundle

An example of a bundle procedure for maintenance of urinary catheters is to:

- Perform a daily review of the need for the urinary catheter
- Check the catheter has been continuously connected to the drainage system
- Ensure patients are aware of their role in preventing urinary tract infection, or if the patient is unable to be made aware, perform routine daily meatal hygiene
- Empty urinary drainage bags frequently enough to maintain urine flow and prevent reflux. Use a separate urine collection container for each patient, avoiding contact between the drainage bag and container
- Perform hand hygiene and put on gloves and apron before each catheter care procedure; on procedure completion, remove gloves and apron and perform hand hygiene again

These practices can be measured and used to monitor performance by the clinical team.

B4.2.2 Intravascular access devices¹⁹

Indwelling intravascular access devices (catheters) provide a route for:

- administering fluids, blood products, nutrients and intravenous medications
- monitoring haemodynamic function
- maintaining emergency vascular access
- obtaining blood specimens.

Intravascular devices (IVDs) are catheters that are usually inserted into peripheral veins (e.g. small veins in the arms). Peripheral arterial devices are also used for some patients.

Central venous catheters are inserted into larger veins within the chest and abdomen. They generally remain in place for longer than peripheral vein catheters.

Some central venous catheters are inserted through a peripheral vein site (peripherally inserted central catheters [PICC or PIC lines]). They can be used for a prolonged period of time (e.g. for long **chemotherapy** regimens, extended antibiotic therapy, or total parenteral nutrition).

IVD insertion is the most commonly performed invasive healthcare procedure with approximately 14 million IVDs used in Australia each year (Collignon 1994; ABS 2008).

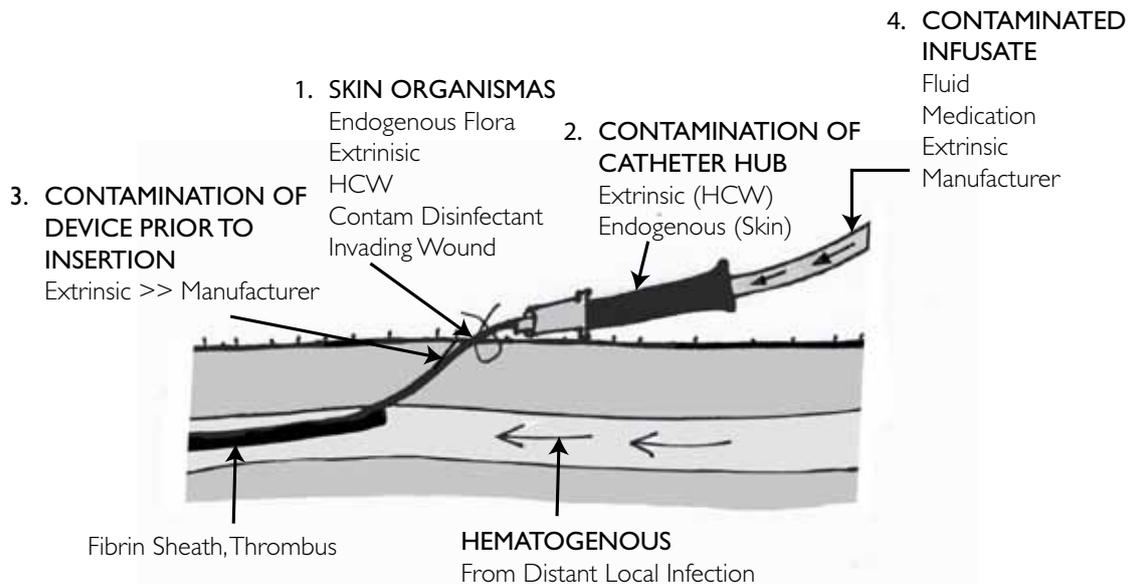
What are the risks?

IVDs provide potential routes for infectious agents to cause local infection or to enter the bloodstream. As a result, despite their important role in diagnostic and therapeutic care, IVDs are a potential source of HAIs, the most severe form being bloodstream infections (BSI) associated with the insertion and maintenance of central venous access devices. There are about 5,000 cases of IVD-related BSI a year in Australia (Collignon 1994; ABS 2008). IVD-related BSIs are associated with significant mortality, worsen the severity of the patient's underlying ill health, prolong the period of hospitalisation and increase the cost of care.

There is risk of infection when the device is inserted and while it remains *in situ*. The risks inherent in insertion of IVDs include bypassing the skin, which is such an important barrier against microorganisms gaining entry to sterile sites such as the bloodstream, and leaving a foreign body in the patient for several days or longer which is likely to become colonised by microorganisms.

¹⁹ Unless otherwise specified, this section is drawn from: O'Grady et al (2002) Guidelines for the Prevention of Intravascular Catheter-Related Infections. United States Centers for Disease Control and Prevention. MMWR 51(RR10): 1–26; Pratt et al (2007) *epic2: Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals*; and a literature review conducted to inform the development of these guidelines.

Figure B4.1: Potential sources for indwelling device contamination



1. Skin organisms: Colonisation of the external surfaces of the IVD by microorganisms from the patient's skin around the insertion site. This can occur through contamination of the catheter tip at the time of insertion or migration of skin organisms at the insertion site into the cutaneous catheter tract after insertion.
2. Contamination of the catheter hub with distal spread of the organisms down the intraluminal surface. This is largely thought to occur during handling of the connections at catheter junctions.
3. Occasionally, the catheter might become haematogenously seeded from another focus of infection.
4. Contamination of the fluid infusate occurs on rare occasions.

Source: Illustration used with permission from Professor Dennis Maki.

Table B4.6: Risk factors for IVD-related BSI

- Prolonged hospitalisation before the IVD is inserted
- Prolonged placement of the device
- Heavy microbial colonisation of the insertion site that contaminate the catheter during insertion and migrate along the cutaneous catheter track
- Heavy microbial colonisation of the cannula/catheter hub, usually secondary to contamination from healthcare workers' hands during care interventions such as injections
- Antibiotic use during catheterisation.

The microorganisms that colonise catheter hubs and the skin adjacent to the insertion site are the source of most IVD-related BSI. Coagulase-negative staphylococci, particularly *Staphylococcus epidermidis*, are the most frequently implicated microorganisms. Other microorganisms commonly involved include *Staphylococcus aureus*, *Candida* species and enterococci.

Prolonged duration of peripheral IV catheters greatly increases the risk of infection—while only 1–2% of peripheral catheters remain in place for longer than 2 days, these are associated with 90% of IVD-related BSIs (Collignon P, unpublished study).

Minimising the risk from intravascular access devices

To minimise the risk to patients, IVDs should only be used when absolutely necessary. They must be removed as soon as they are no longer needed or alternative means are available to deliver appropriate care (e.g. oral drugs instead of IV delivery). Prevention of catheter-related BSI requires a set of infection control measures (see care bundles box below).

Decision-making about IVDs

Decision-making about IVDs should involve the consideration of:

- whether oral administration is possible
- which device poses the lowest risk to the patient
- the reduced risk of sepsis associated with permanent access devices (e.g. fistula) if long-term administration is required (e.g. for haemodialysis)
- the importance of removing the IVD when it is no longer needed or a safer alternative can be used.

If a central venous access catheter is necessary, it must be inserted under maximal barrier precautions (i.e. similar to surgical procedures). The femoral site of insertion should be avoided (Hamilton & Foxcraft 2008).

Table B4.7: Central venous catheter decision tree for adults

-
- Assess the physical status and vascular access history of the patient
 - Base a decision on the type and duration of therapy required
 - Carefully consider the need for central v peripheral vascular access
 - Do not lose sight of the patient as the focus for your decision
 - Ensure clear documentation of all key events in the clinical record
-

Source: The Canberra Hospital.

Evidence supporting practice²⁰

Site preparation

- Alcohols are the most effective and most rapid-acting skin antiseptics. Alcohol-based preparations that have 70% isopropyl alcohol v/v and at least 0.5% chlorhexidine are recommended for procedures penetrating skin (including subcutaneous infusions). Typically available solutions range from 0.5% to 4% and there is strong evidence (Grade A) that skin preparations with at least 0.5% chlorhexidine-gluconate solution reduce intravascular device colonisation.

Insertion of IVDs

- There is Grade B evidence that maximum barrier precautions (insertor wears mask, cap, sterile gown, sterile gloves, uses large sterile drape; assistant wears cap and mask) reduce immediate post-insertion skin colonisation in short-term central venous devices.
- Maximum barrier precautions are not necessary for insertion of short peripheral venous or arterial devices; device colonisation or IVD-related BSI was not reduced compared to when standard good practice care was used (insertor wears sterile gloves and uses sterile equipment).

²⁰ Based also on evidence identified through Richard C, Ray-Barruel G (2009). Systematic literature review of infection control literature relating to intravascular devices conducted to inform the development of these guidelines.

Maintenance

- The safe maintenance of an IVD includes good practice in caring for the patient's catheter hub and connection port to avoid contamination by staff hands, the use of an appropriate site dressing regimen, and using flush solutions to maintain the patency of the line.
- For patients who require long-term venous access (e.g. renal dialysis), permanent access devices (e.g. fistulas) reduce the risk of infection compared to other forms of IV access.

Choice of dressings

- There is strong evidence (Grade B) that the use of chlorhexidine-impregnated (CHG) sponges at the catheter insertion site significantly reduces IVD-related bloodstream infection and device colonisation rates compared to other types of dressings for peripheral arterial devices, short-term and long-term central venous devices. The safety of these sponges has not been established in low birth-weight neonates who may be at risk of skin or systemic toxicity.
- There is insufficient evidence to determine a significant difference in the use of sterile gauze over other dressings (tape, transparent polyurethane, or highly moisture permeable transparent dressings) to reduce phlebitis incidence in peripheral IVDs and tunnelled central venous catheters (used for haemodialysis and oncology); or in preventing infectious complications in short and long-term central venous devices (including those used for haemodialysis).
- Patient preference, clinician preference and costs are currently acceptable factors when choosing between sterile gauze and transparent polyurethane dressings.
- There is Grade B evidence that the use of an antimicrobial or antibiotic ointment (calcium mupirocin, or Polysporin) on long-term tunnelled central venous devices used for haemodialysis access, significantly reduces IVD-associated BSIs and exit site infections.
- Povidone iodine antiseptic ointment or bacitracin/neomycin/polymyxin B ointment should only be used at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session if this ointment does not interact with the material of the hemodialysis catheter (as per manufacturer's recommendations)(O'Grady et al 2002).

Changing dressings

- The evidence (Grade C) supports daily examination of short-term vascular catheter dressings to assess whether they require changing. Dressing change is indicated where the dressing is loose or soiled.
- There is strong evidence that scheduled seven-day replacement of transparent dressings for short-term central venous and peripheral arterial devices (with or without CHG sponges) is equally as effective in preventing device colonisation and IVD-related BSI as scheduled three-day replacement.
- There is some evidence that eight-day replacement of transparent dressings for tunnelled central venous devices significantly reduces skin toxicity, and does not change IVD-related BSI rates, compared with four-day replacement.
- Evidence regarding paediatric central venous device dressings (Grade C) suggests that these should be changed at least every seven days.

Device replacement

- In adults, most studies use phlebitis (which may have a chemical or traumatic basis) as an endpoint and find little or no benefits for routinely changing short peripheral vein catheters. Evidence suggests that bacteraemia is disproportionately associated with catheters in place for more than 2 days. Removing a catheter eliminates the risk for associated sepsis.
- There is some evidence that routine replacement of short-term central venous devices compared with replacement on clinical indication has no effect on IVD-related BSI rates per adult patient.

Replacement of administration sets

- There is strong evidence (Grade B) that administration sets that do not contain lipids, blood or blood products may be left in place for intervals of up to 4 days.

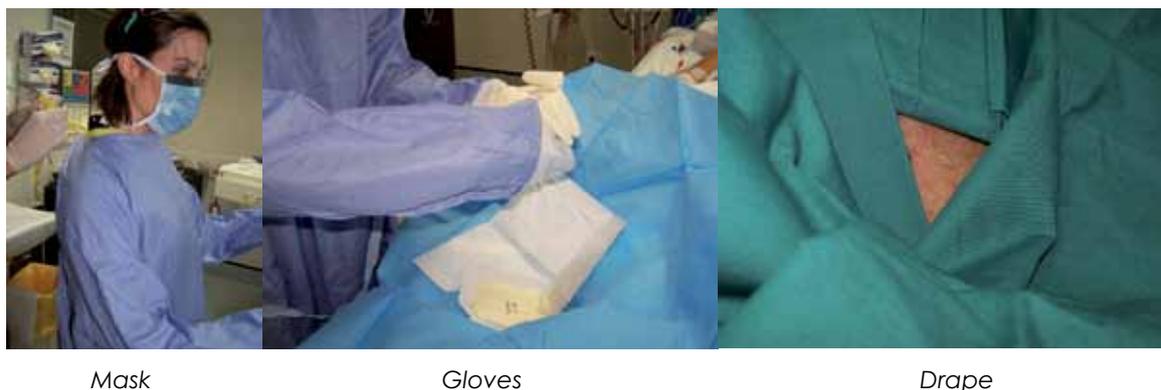
Patient-care tip

Before discharge from hospital, patients and their carers should be provided with education, supported by written instructions, on the management and care of an indwelling device, including the prevention of infection..

Table B4.8: Summary of processes for insertion, maintenance and replacement of intravascular access devices

<p>Site preparation</p>	<ul style="list-style-type: none"> • In selecting the best insertion site, consider patient-specific factors and the relative risk of mechanical complications • Allow sufficient contact time for site preparation—clean a site large enough for insertion before applying antiseptics and allow to dry completely • Before device insertion, decontaminate the site using a single-use application of alcohol-based chlorhexidine gluconate solution (0.5% chlorhexidine gluconate in 70% isopropyl alcohol) • If insertion through or close to mucous membranes is necessary, use aqueous solution supplemented with 2% chlorhexidine • For patients with a history of chlorhexidine sensitivity, use 5% alcohol-based povidone-iodine solution or 10% aqueous povidone-iodine if insertion is through or close to mucous membranes
<p>Insertion</p>	<ul style="list-style-type: none"> • Use maximum barrier precautions for insertion of all central venous catheters, including PICC lines • Use aseptic non-touch technique for insertion of peripheral venous, arterial or subcutaneous devices (see Section B5.4.1) • If an intravascular device is inserted in an emergency, remove within 24 hours and insert a new device under appropriate conditions • When PICC insertion is done at the bedside (i.e. in the patient’s room), establish a suitable aseptic field and maintain this throughout the procedure
<p>Maintenance</p>	<ul style="list-style-type: none"> • Use hand antiseptics and aseptic non-touch technique for catheter site care and for accessing the system <p><i>Dressings</i></p> <ul style="list-style-type: none"> • Use CHG sponge dressings for peripheral arterial devices, short-term and long-term central venous devices • Use sterile gauze or sterile, transparent, semi-permeable dressings to cover the catheter site • If the patient is diaphoretic, or if the site is bleeding or oozing, use a gauze dressing • For long-term tunnelled central venous devices used for haemodialysis, use an antimicrobial or antibiotic ointment at the exit site after catheter insertion and at the end of each dialysis session unless the ointment interacts with the material of the catheter <p><i>Changing dressings</i></p> <ul style="list-style-type: none"> • Examine short-term vascular catheter dressings daily and change if soiled or loosened • Examine dressings for short-term central venous and peripheral arterial devices daily and replace: when soiled or loose; if the patient’s clinical presentation indicates a BSI; and after seven days for paediatric patients • Monitor dressings for tunnelled central venous devices and replace when soiled or loose, or after 8 days
<p>Device replacement</p>	<ul style="list-style-type: none"> • Assess all devices daily and remove if no longer needed or if complications occur • Routinely replace peripheral intravenous devices every 2 to 3 days or sooner if clinically indicated • Do not routinely replace central venous catheters and PICC lines in neonates, children or adults • Do not routinely replace pulmonary artery catheters in neonates and children • In paediatrics, replace all catheters once IV therapy is complete unless there are indications of a BSI
<p>Replacement of administration sets</p>	<ul style="list-style-type: none"> • Leave administration sets that do not contain lipids, blood or blood products in place for intervals of up to 4 days • Change administration sets used for intermittent infusion of blood, blood products or lipid emulsions (including 3-1 parenteral nutrition solutions) when the infusion is complete or at least every 24 hours • Change administration sets used to infuse propofol at a minimum of 12 hours or as per manufacturer’s guidelines

Figure B4.2: PPE and maximal barrier precautions for IVD insertion



IVD care bundles

There are numerous care bundles in use on the management of central and peripheral vascular devices. Information on bundles and their implementation is discussed in Section B4.1.3.

Before implementing a care bundle it is important to identify current practice in the particular area. Gaps in service provision need to be identified, analysed and systematically addressed through the implementation of the bundle.

Examples available bundles include:

- i-CARE <http://www.health.qld.gov.au/chrisp/icare/about.asp>
- Health Protection Scotland <http://www.hps.scot.nhs.uk/haic/ic/bundles.aspx>

B4.2.3 Ventilation²¹

Certain patients require mechanical ventilatory support by endotracheal tube or tracheostomy. Common medical indications include acute lung injury, chronic obstructive lung disease and acute respiratory acidosis.

What are the risks?

Ventilator-associated pneumonia (VAP) is a type of hospital-acquired pneumonia that can occur in up to 25% of all people who require mechanical ventilation. VAP is a common cause of morbidity and mortality with crude death rates of 5 to 65% as well as increased healthcare costs. VAP can develop at any time during ventilation, but occurs more often in the first few days after intubation, because the intubation process itself contributes to the development of VAP.

VAP primarily occurs because microorganisms colonise the endotracheal or tracheostomy tube and are embolised into the lungs, often in patients who may have underlying lung or immune problems. Bacteria may enter the lungs with procedures such as bronchoscopy.

Minimising the risks of VAP

Many practices have been demonstrated to reduce the incidence of VAP and its associated burden of illness. The first consideration should always be whether intubation is necessary.

21 Unless otherwise specified, this section is drawn from Muscedere J et al for the VAP Guidelines Committee and the Canadian Critical Care Trials Group (2008) Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: Prevention. *Journal of Critical Care* 23: 126–37 and Asterton et al (2008) *Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for Antimicrobial Chemotherapy*.

Physical strategies

- Oral endotracheal intubation is associated with a trend toward a reduction in VAP compared to nasotracheal intubation and with a decreased incidence of sinusitis (the incidence of VAP is lower in patients who do not develop sinusitis). Reintubation should be avoided if possible.
- The frequency of ventilator circuit changes does not influence the incidence of VAP. Circuits should be changed if they become soiled or damaged. New ventilator circuit tubing should be provided for each patient.
- There is no difference in the incidence of VAP between patients whose airways are humidified using a heat and moisture exchanger and those whose airways are humidified using a heated humidifier. The decision should be made for each patient, with the aim to ensure adequate moisture output to minimise the risk of airway obstruction.
- Less frequent heat and moisture exchanger changes may be associated with a slightly decreased incidence of VAP. Reducing the frequency of humidifier changes might be considered as a cost-reduction measure.
- The type of suctioning system has no effect on the incidence of VAP. Safety considerations (patient and healthcare worker exposure to aerosolised secretions) favour the use of closed systems. The number of disconnections of suction equipment should be minimised to reduce the risk of exposure to staff to potentially infected secretions
- Scheduled daily changes and unscheduled changes of closed systems have no effect on VAP.
- Subglottic secretion drainage is associated with a decreased incidence of VAP. To increase their utility and cost-effectiveness, these tubes should only be placed in patients expected to require prolonged mechanical ventilation.

Positional strategies

- The use of rotating beds is associated with a decreased incidence of VAP.
- Semi-recumbent positioning may be associated with a decreased incidence of VAP. However, semi-recumbent positioning may be unsafe for some patients.

Pharmacologic strategies

- The use of the oral antiseptic chlorhexidine may decrease the incidence of VAP. Safety, feasibility, and cost considerations for this intervention are all very favorable.
- The use of the oral antiseptic povidone-iodine decreases the incidence of VAP in patients with severe head injuries. Safety, feasibility, and cost considerations for this intervention are all very favorable. There are insufficient data to make a recommendation in critically ill patients other than those who have severe head injury.

Table B4.9: Summary of strategies for preventing VAP

<p>Physical strategies</p>	<ul style="list-style-type: none"> • When intubation is necessary, use the oro-tracheal route • Use new circuits for each patient and change these if they become soiled or damaged • Change heat and moisture exchangers for each patient every 5–7 days and as clinically indicated • Use a closed endotracheal suctioning system • Change the endotracheal system for each patient and as clinically indicated • Use subglottic secretion drainage in patients expected to be mechanically ventilated for more than 3 days • Assess patients for sedation, weaning and extubation each day
<p>Positional strategies</p>	<ul style="list-style-type: none"> • Elevate the head of the bed to 45°. Where this is not possible, raise the head of the bed as much as possible
<p>Pharmacological strategies</p>	<ul style="list-style-type: none"> • Consider the use of the oral antiseptic chlorhexidine • For patients with severe head injury, consider the use of the oral antiseptic povidone-iodone

VAP care bundles

There are numerous care bundles in use on the management and prevention of VAP. Information on bundles and their implementation is discussed in Section B4.1.3. Before implementing a care bundle it is important to identify current practice in the particular area. Gaps in service provision need to be identified, analysed and systematically addressed through the implementation of the bundle.

Examples of available bundles include:

- Scottish Infection Care Society Audit Group VAP Prevention Bundle http://www.sicsag.scot.nhs.uk/SubGroup/VAP_Prevention_Bundle_Bedside_Aide_Memoire.pdf
- IHI Ventilator Bundle <http://www.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheVentilatorBundle.htm>

B4.2.4 Enteral feeding tubes²²

Enteral feeding is usually prescribed for patients in hospital requiring artificial nutrition support for 7–10 days and long-term feeding / home enteral tube feeding may be considered for patients needing artificial nutrition support for more than 30 days.

What are the risks?

Contamination of feeds is a key concern in both the hospital and community setting, with contamination largely occurring during the preparation or administration of feeds and being linked to serious clinical infection.

Minimising the risks of enteral feeding tubes

Most evidence concerning enteral feeding relates to gastrostomy or percutaneous endoscopic gastrostomies (PEG feeds). However, the principles outlined here are also applicable to nasogastric and jejunostomy feeding.

- Standard principles stress the importance of hand hygiene and expert opinion stresses the need to prepare the work surface and, where necessary the equipment for reconstituting or diluting the feed. Even closed systems can become contaminated if hand hygiene is not adequate.
- Closed systems (i.e. sterilised prefilled ready-to-use feeds that do not expose feed to the air during assembly) as available from all major manufacturers, have lower contamination rates than open systems. The design of the system is also important in order to minimise handling.
- Bacterial contamination has been associated with the re-use of feed bags and administration sets. As evidence suggests re-use is not advisable, the administration system should be considered single use only and discarded after each session.
- There is some evidence related to infection immediately after insertion of the first tube, but no evidence relating to infections in a healed stoma.
- To help minimise the potential risk of microbial colonisation of the internal and external surfaces of enteral feeding tubes, expert opinion suggests that the tube should be flushed with fresh tap water before and after each change of feed, aspiration or medication administration. Cooled boiled water or freshly opened sterilised water should be used for flushing enteral feeding tubes in immunocompetent patients.

Patient-care tip

Patients and carers should be educated in techniques of hand hygiene, enteral feeding and the management of the administration system before being discharged from hospital.

²² Unless otherwise specified, this section is drawn from NICE (2003) *Prevention of Healthcare-associated Infection in Primary and Community Care*.

Table B4.10: Summary of processes for using enteral feeding tubes

Preparation	<ul style="list-style-type: none"> • Perform hand hygiene before starting feed preparation • Wherever possible, use pre-packaged, ready-to-use feeds • If decanting, reconstitution or dilution is required, use a clean working area and equipment dedicated for enteral feed use • Mix feeds with cooled boiled water or freshly opened sterilised water using an aseptic non-touch technique
Administration	<ul style="list-style-type: none"> • Perform hand hygiene immediately before administration • Use minimal handling and aseptic non-touch technique to connect the administration system to the enteral feeding tube • Use aseptic technique for administration of medications • Discard administration sets and feed containers after each feeding session
Care of insertion site and enteral feeding tube	<ul style="list-style-type: none"> • Perform hand hygiene immediately before commencing • Wash the stoma daily with water and dry thoroughly • Flush the enteral feeding tube with fresh tap water before and after feeding or administering medications (use cooled boiled water or sterilised water for patients who are immunosuppressed)

B4.3 Surgical procedures²³

The discussion in this section applies to all surgical procedures regardless of setting. While there is less evidence for surgical procedures in office-based practice than in hospitals, the same principles apply.

B4.3.1 What are the risks?

The microorganisms that cause surgical-site infections are usually derived from patients (endogenous infection), being present on their skin or from a surgical opening in the body. Exogenous infection occurs when microorganisms from instruments or the operating environment contaminate the site at operation, when microorganisms from the environment contaminate a traumatic wound, or when microorganisms gain access to the wound after surgery, before the skin has sealed.

The risk of surgery-related infection is increased by factors that:

- increase the risk of endogenous contamination (e.g. procedures that involve parts of the body with a high concentration of normal flora such as the bowel)
- increase the risk of exogenous contamination (e.g. prolonged operations that increase the length of time that tissues are exposed)
- diminish the efficacy of the general immune response (e.g. diabetes, malnutrition, or immunosuppressive therapy with radiotherapy, chemotherapy or steroids) or local immune response (e.g. foreign bodies, damaged tissue or formation of a haematoma).

²³ Unless otherwise specified, this section is drawn from NICE (2008) Prevention and Treatment of Surgical Site Infection.

B4.3.2 Minimising the risk of surgical procedures

Practices to prevent surgical-site infections are aimed at minimising the number of microorganisms introduced into the operative site, for example by:

- removing microorganisms that normally colonise the skin
- preventing the multiplication of microorganisms at the operative site, for example by using prophylactic antimicrobial therapy
- enhancing the patient's defences against infection, for example by minimising tissue damage and maintaining normothermia
- preventing access of microorganisms into the incision postoperatively by use of a wound dressings.

This section gives general guidance on preventing surgical infection. More detailed information can be found in the NICE surgical-site infection guidelines (NICE 2008).

Patient-care tip

Patients and carers require clear, consistent information and advice throughout all stages of their care, including:

- the risks of surgical-site infections, what is being done to reduce them and how they are managed
- how to care for their wound after discharge
- how to recognise a surgical-site infection and who to contact if they are concerned.

An integrated care pathway helps to communicate this information to both patients and all those involved in their care after discharge.

Patients should always be informed if they have been given antibiotics.

Hand hygiene for surgery

Surgical hand preparation should reduce the release of skin bacteria from the hands of the surgical team for the duration of the procedure in case of an unnoticed puncture of the surgical glove that releases bacteria to the open wound. Surgical hand preparation must eliminate the transient and reduce the resident flora. There are special surgical scrub formulations available for use, although any product used within Australia should preferably be approved by the TGA. Current WHO guidelines recommend the use of an alcohol-based formulation for preoperative surgical hand preparation given its superior antimicrobial efficacy compared to other methods (WHO 2009; Widmer 2010). Specific policies and procedures on products and methods of surgical hand preparation should be developed locally.

PPE for surgical and dental procedures

For surgical procedures and dentistry, the sequence for putting on PPE differs from that outlined in Section B1.2. In these situations, masks and protective eyewear are applied first prior to hand preparation. Gown and gloves are then put on.

Double-gloving (wearing two sets of gloves) is becoming more common, especially for surgery where sharp surfaces are formed (such as orthopaedic or dental surgery). A second pair of gloves protects the inner pair, without apparently affecting surgical performance (Tanner & Parkinson 2006). A glove liner between the two pairs of gloves reduces breaks to the inner glove even further, and extra-thick gloves seem to be as good as two pairs (Tanner & Parkinson 2006).

Information on use of Surgical aseptic non-touch technique (ANTT), and on Standard ANTT for wound care, can be found in Sections B1.7 and B5.4.

B4.3.3 Considerations pre-procedure

- Artificial nails, nail polish and jewellery may conceal underlying soiling and impair hand decontamination, and should not be worn by healthcare workers performing or assisting in surgical procedures.
- In carrying out procedures, there is a need to minimise the risk of microbial contamination of the operating site from the environment. Although there is limited evidence concerning the use of dedicated non-sterile operating attire (scrub suits, masks, hats and overshoes) by general staff in the operating environment, it may contribute to minimising operating environment contamination and reduce the risk of surgical-site infection.
- While there is evidence to support the efficacy of preoperative showering of patients in the hospital setting as a measure to reduce the rate of surgical-site infection, there is no evidence of a difference on surgical-site infection rate between chlorhexidine as a cleansing agent and plain detergent or soap. In addition, chlorhexidine has been found not to be cost-effective for this application (NICE 2008).
- There is no evidence that hair removal from patients decreases the incidence of surgical-site infection, but it might be appropriate in some clinical circumstances.
- Antibiotic prophylaxis has been used effectively to prevent surgical-site infections for appropriate operative procedures since 1969. Prophylaxis usually involves a single dose of antibiotic often given to the patient intravenously, close to the time of surgery and differs from treatment that entails a course of antibiotics over a period of time. In common with therapeutic use, the use of antibiotics for prophylaxis carries a risk of adverse drug reactions (including *C. difficile*-associated diarrhoea) and increased prevalence of antibiotic-resistant bacteria. The choice of antibiotic prophylaxis should be based on the *Australian Therapeutic Guidelines*.
- There is evidence for the efficacy of screening for MRSA carriage and decolonisation with nasal mupirocin ointment and chlorhexidine body washes before elective surgery such as cardiac and implant surgery (Lonneke 2010).

Table B4.11: Summary of processes pre surgical procedure

<p>Hand preparation</p>	<ul style="list-style-type: none"> • Operating team members should remove hand jewellery before operations • Operating team members should not wear artificial nails or nail polish during operations • If hands are visibly soiled, perform hand hygiene with liquid soap prior to scrubbing. • Remove debris from underneath fingernails using a nail cleaner, preferably under running water • Using a suitable antimicrobial soap, preferably with a product ensuring sustained activity, scrub hands and forearms for the length of time recommended by the manufacturer
<p>Operating suite/ room or procedure attire</p>	<ul style="list-style-type: none"> • Operating team members must wear sterile operation or procedure attire. • All operating suite/room staff who are not operating within the critical aseptic field must wear dedicated non-sterile attire in all areas where operations are undertaken. • Movements in and out of the operating area should be kept to a minimum.
<p>Patient preparation</p>	<ul style="list-style-type: none"> • Advise patients to shower or have a bath (or help patients to shower, bath or bed bath) using soap, either the day before, or on the day of, surgery • Avoid routine removal of hair—if clinical circumstances require hair removal, it should be clipped on the day of surgery or as close as possible to the time of operation. Hair must never be shaved • Provide antibiotic prophylaxis where appropriate, in accordance with the Australian Therapeutic Guidelines • Consider screening for MRSA carriage and decolonisation with nasal mupirocin ointment and chlorhexidine body washes before elective surgery such as cardiac and implant surgery.

B4.3.4 Considerations during a surgical procedure

- Surgical hand preparation is required to minimise the risk that resident or transient microorganisms contaminate the surgical wound. While transient microorganisms are readily removed by soap and water, antiseptics are required to eliminate resident microorganisms that reside in deep crevices and hair follicles.
- In the hospital setting, sterile gowns should be used when entering the critical aseptic field, to prevent patients from being exposed to the risk of contamination.
- There is no available evidence that double-gloving reduces the risk of surgical-site infection or that glove perforation increases the risk of surgical-site infection. However, current practice involves double-gloving in circumstances when the risk of glove perforation and its consequences for contamination of the operative field (in prosthetic surgery for example) is high.
- There is a need for safe operating suite/room practice when using alcohol-based antiseptic skin preparations prior to incision with diathermy. The evidence suggests that there is no difference between rates of surgical-site infection where diathermy is used to make an incision compared with conventional techniques. It is important to avoid pooling and wetting of drapes with the antiseptic and to let them dry before connecting the diathermy (Maiwald et al 2006).
- Although the use of non-iodophor-impregnated incise drapes is routine in some operations (such as prosthetic joint or graft surgery), they may marginally increase the risk of surgical-site infection. However, adhesive drapes may have a role in maintaining the integrity of the operative site/field.
- Evidence from small surgery-specific studies up to 20–30 years old suggest that intraoperative subcutaneous wound irrigation with povidone-iodine or with saline under pressure reduces the incidence of surgical-site infection. Although this was considered to be an adjunct to antibiotic prophylaxis in contaminated surgery, current practice has improved to make this approach unnecessary for the prevention of surgical-site infection.
- There is no evidence that intracavity lavage with antibiotics, other than a single small study of tetracycline lavage after contaminated surgery, reduces the incidence of surgical-site infection. There is some evidence that postoperative lavage of the perineal space with povidone-iodine reduces surgical-site infection.
- There is evidence that re-disinfection of the skin adjacent to the wound with iodine in alcohol solution prior to incisional closure has no effect on the incidence of surgical-site infection.
- The instillation of cefotaxime into wounds prior to closure appears to have no effect on surgical-site infection incidence after surgery for peritonitis.
- There is no robust evidence to support the use of a dressing in the immediate postoperative period for the prevention of surgical-site infection. However, it is generally accepted good clinical practice to cover the wound with an appropriate interactive dressing for a period of 2 days unless otherwise clinically indicated, for example, if there is excess wound leakage or haemorrhage.
- There is no robust evidence to support the use of one dressing over another. However, in the majority of clinical situations a semi-permeable film membrane with or without an absorbent island is preferable.

Table B4.12: Summary of processes during a surgical procedure

Hand hygiene	<ul style="list-style-type: none"> • Perform hand hygiene before the first operation on the list using an antiseptic surgical solution, according to the manufacturer’s instructions for the product that is being used. Use a single-use brush or pick for the nails, and ensure that hands and nails are visibly clean • Before subsequent operations, perform hand hygiene using an antiseptic surgical solution. If hands are soiled during a procedure, hand hygiene should be performed again with an antiseptic surgical solution
Operating suite/ room attire	<ul style="list-style-type: none"> • In hospital settings, wear sterile gowns during the procedure • Consider wearing two pairs of sterile gloves when there is a high risk of glove perforation
Patient preparation	<ul style="list-style-type: none"> • Prepare the skin at the surgical site immediately before incision using an antiseptic preparation, preferably chlorhexidine • If diathermy is to be used, ensure that antiseptic skin preparations are dried by evaporation and there is no pooling of alcohol-based preparations • If an incise drape is required, use an iodophor-impregnated drape unless the patient has an iodine allergy. Do not use non-iodophor-impregnated incise drapes routinely for surgery as they may increase the risk of surgical-site infection. Ensure skin preparation is dry before draping the patient.
Wound management	<ul style="list-style-type: none"> • Avoid routine use of wound irrigation or intracavity antibiotic lavage as measures to reduce surgical-site infection • Avoid routine use of intraoperative skin re-disinfection or topical cefotaxime as measures to reduce the risk of surgical-site infection in abdominal surgery • It is recommended that at the end of the operation, surgical incisions are covered with an appropriate dressing such as semi-permeable film membrane with or without an absorbent island

B4.3.5 Considerations post-procedure

- There is no high-quality evidence available that supports a change to the current clinical practice of using an aseptic technique. However, the use of aseptic technique when removing or changing surgical wound dressings can minimise the risk of contaminating the site with additional microorganisms.
- There was no evidence available that examined the effects of wound cleansing solutions for the prevention of surgical-site infection.
- Not all surgical-site infections require antibiotic treatment: minor infections may respond to drainage of pus (for example, by removal of sutures) and topical antiseptics. Antibiotic therapy carries with it the risk of adverse drug reactions and the development of antimicrobial-resistant bacteria as well as the associated risk of *C. difficile* diarrhoea.
- It is good practice to discard all used operating suite/room attire prior to leaving the operating area to prevent healthcare workers, patients and visitors from being exposed to the risk of contamination.

Table B4.13: Summary of processes following a surgical procedure

Dressings	<ul style="list-style-type: none"> • Use aseptic technique for changing or removing surgical wound dressings (see Section B5.4.2) • Avoid the routine use of topical antimicrobial agents for surgical wounds that are healing by primary intention as measures to reduce the risk of surgical-site infection • Avoid the use of Eusol and gauze, or moist cotton gauze or mercuric antiseptic solutions to manage surgical wounds that are healing by secondary intention • Use an appropriate dressing (such as semi-permeable film membrane with or without an absorbent island) to manage surgical wounds that are healing by secondary intention
Cleansing	<ul style="list-style-type: none"> • Use sterile saline for wound cleansing up to 2 days after surgery • Advise patients that they may shower safely 2 days after surgery
Management of surgical-site infection	<ul style="list-style-type: none"> • When surgical-site infection is suspected, take a specimen for culture and then give the patient an antibiotic that covers the likely causative organisms. Consider local resistance patterns in choosing an antibiotic and review the selection in light of results of microbiological tests • Avoid the use of Eusol and gauze, or dextranomer or enzymatic treatments for debridement in the management of surgical-site infection

B4.4 Putting it into practice

B4.4.1 Checklist of standard precautions for procedures

This table outlines the use of standard precautions for a range of procedures. It is assumed that there is no known or suspected infection. Decision-making about the level of protection required involves a risk assessment of the procedure to be performed; for example, usual wound irrigation is unlikely to require surgical mask and eye protection in primary care, but may be required more often in the hospital setting.

Table B4.14: Checklist of standard precautions for procedures

Procedure	Hand hygiene	Gloves	Sterile gloves	Surgical mask	Eye protection	Gown
Activities of daily living (washing, toilet etc)	✓	—	—	—	—	—
Routine observations (e.g. blood pressure measurement)	✓	—	—	—	—	—
General medical examination	✓	✓ For contact with broken skin/ rash/ mucous membrane	—	✓ If splash risk likely	✓ If splash risk likely	✓ If splash risk likely
Wound examination/ dressing	✓	✓ For contact with body substances	✓ For direct contact with wound	✓ For wound irrigation if splash likely	✓ For wound irrigation if splash likely	✓ For grossly infected wounds

Procedure	Hand hygiene	Gloves	Sterile gloves	Surgical mask	Eye protection	Gown
Blood glucose and haemoglobin monitoring	✓	✓	—	—	—	—
Vaginal delivery	✓	—	✓	—	✓	✓
Intravenous cannula insertion	✓	✓	—	—	✓ If splash risk likely	—
Intravascular access device insertion	✓	—	✓	✓	✓	✓ (Where max. barrier precautions are used)
Intravascular access device care	✓	—	✓	—	—	—
Surgical aseptic technique procedure (e.g. lumbar puncture)	✓	—	✓	✓	✓	✓
Insertion of urinary catheter	✓	—	✓	✓ If exposure risk likely	✓ If exposure risk likely	✓ If exposure risk likely
Urinary catheter care	✓	✓	—	—	✓ When emptying drainage bag	✓ If exposure risk likely
Suctioning: endotracheal tube, tracheostomy	✓	—	✓ Dominant hand (open suction system)	✓	✓	✓ If exposure risk likely
Major dental procedures*	✓	—	✓	✓	✓	✓
Routine intra-oral dental procedures	✓	✓	—	✓	✓	✓ If exposure risk likely

* Including most dental implants, surgical removal or exposure of completely impacted teeth or tooth fragments, vital endodontics, surgical periodontics, maxillo-facial surgery.

B4.5 Resources

B4.5.1 Intravascular devices

Guidelines

- Institute for Healthcare Improvement 'CVC Bundle' of interventions proven to be effective - Part 5 Central Venous Catheters
- Centers for Disease Control and Prevention *Guidelines for the Prevention of Intravascular Catheter-Related Infections*, 2002 http://www.cdc.gov/ncidod/dhqp/gl_intravascular.html
- Health Protection Scotland. Bundles – Infection control <http://www.hps.scot.nhs.uk/haic/ic/bundles.aspx>
- Queensland Health I-Care Program <http://www.health.qld.gov.au/chrisp/icare/about.asp>
- National Kidney Foundation Inc DOQI *Clinical Practice Guidelines for Haemodialysis Adequacy: Update 2000*
- *Caring for Australians with Renal Impairment (CARI)* <http://www.cari.org.au/>

Resources

- IV Team <http://www.ivteam.com/>
- Central Line Insertion and Post Insertion Care Guidelines (draft) March 2010. CLAB ICU project Clinical Excellence Commission <http://www.cec.health.nsw.gov.au/programs/clab-icu.html>
- CHRISP I Care Program <http://www.health.qld.gov.au/chrisp/icare/about.asp>

B4.5.2 Indwelling urinary catheters

Guidelines

- Tenke et al (2008) *European and Asian Guidelines on Management and Prevention of Catheter-Associated Urinary Tract Infections* <http://www.shea-online.org/evidence-based-guidelines.cfm>
- HICPAC Guideline for prevention of Catheter Associated UTI, 2009 http://www.cdc.gov/ncidod/dhqp/dpac_uti_pc.html
- Health Protection Scotland. CAUTI prevention bundle <http://www.hps.scot.nhs.uk/haic/ic/CAUTIPreventionBundle.aspx>
- NICE *Infection Control: Prevention of Healthcare-associated Infections in Primary and Community Care*. 2003 Section 3 <http://guidance.nice.org.uk/CG2/Guidance/pdf/English.html>

B4.5.3 Ventilation-associated pneumonia

Guidelines

- Canadian Critical Care Society *Evidence-Based Clinical Practice Guideline for the Prevention of Ventilator-Associated Pneumonia* http://www.canadiancriticalcare.org/bestpractices_guidelines.htm
- Masterton RG, Galloway A, French G et al. Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for Antimicrobial Chemotherapy, *J Antimicrobial Chemotherapy* (2008) 62, 5–34 <http://jac.oxfordjournals.org/cgi/content/full/dkn162>
- Scottish Infection Care Society Audit Group VAP prevention Bundle http://www.sicsag.scot.nhs.uk/SubGroup/VAP_Prevention_Bundle_Bedside_Aide_Memoire.pdf
- IHI Ventilator Bundle <http://www.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/Changes/ImplementtheVentilatorBundle.htm>

B4.5.6 Enteral feeding

Guidelines

- NICE *Infection Control: Prevention of Healthcare-associated Infections in Primary and Community Care*. 2003 Section 4 Enteral Feeding <http://guidance.nice.org.uk/CG2/Guidance/pdf/English>
- Queensland Health Fact Sheet *Tube Feeding at Home* http://www.health.qld.gov.au/nutrition/resources/etf_tfah.pdf

B4.5.7 Surgical-site infection

Guidelines

- NICE *Prevention and Treatment of Surgical Site Infection* 2008 <http://guidance.nice.org.uk/CG74>
- Health Protection Scotland. SSI prevention bundle <http://www.hps.scot.nhs.uk/haic/ic/ssipreventionbundle.aspx>
- Centers for Disease Control and Prevention *Prevention of Surgical Site Infections* 1999 <http://www.cdc.gov/ncidod/dhqp/guidelines.html>
- Institute for Healthcare Improvement 'Prevent Surgical Site Infections' bundle
- CHRISP Recommendations for surgical skin antisepsis in operating theatres http://www.health.qld.gov.au/chrisp/resources/rec_prac_skinprep.pdf
- WHO *Guidelines on Hand Hygiene in Health Care* (2009) <http://www.who.int/gpsc/tools/en/>

Standards

- 2006 ACORN *Standards for Peri operative Nurses including Nursing Roles, Guidelines, Position Statements and Competency Standards* <http://www.acorn.org.au/>
- ACORN S21 Surgical Scrubbing, Gowning and Gloving <http://www.acorn.org.au/about-acorn-standards.html>
- AWMA 2010 Standards for Wound Management for further information on wound management. www.awma.com.au

B4.5.8 Patient education tools and resources on devices

- The Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) FAQ sheet on intravascular devices, indwelling urinary catheters http://www.cdc.gov/ncidod/dhqp/HAI_shea_idsa
- Frequently Asked Questions Surgical Site Infection (SSI) http://www.cdc.gov/ncidod/dhqp/FAQ_SSI.html

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B5 Supplementary information

B5.1 Recommended routine cleaning frequencies for clinical, patient and resident areas in acute settings

The following table outlines the recommended minimum frequencies for routine cleaning of various items in healthcare facilities. It is applicable to all settings (although some items may not be relevant to all settings) and is presented by level of risk as per the key below. The table has been developed to provide a benchmark guide to best-practice cleaning schedules. Facilities should develop and implement a local cleaning schedule and policy that suits their environment, and consider regular monitoring and mechanisms to deal with specific organisms and outbreak situations. For guidance on cleaning of spills, see Section B1.4.3.

Very high risk	Outbreak in high-risk area
High risk	Intensive care unit, high dependency unit, burns unit, renal units, operating suite
Significant risk	General wards
Low risk	Rehabilitation, long-term care, office based
1	Medical surface detergent or a detergent wipe that is registered as a Class I Medical Device with the TGA (for cleaning of surfaces and frequently touched objects in clinical, patient and resident areas). This detergent or detergent wipe should be recommended with clear instructions in regards to materials compatibility.
2	Where transmission-based precautions are required, a TGA-registered hospital grade disinfectant must be used if a disinfectant is required. The disinfectant chosen should have label claims against the organism of concern.

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Alcohol hand rub dispenser, bedside	Clean daily & between patient use	Clean daily & between patient use	Clean daily & between patient use	Clean weekly	Detergent ¹
Alcohol hand rub dispenser, not in patient/treatment rooms	Clean daily	Clean daily	Clean daily	N/A	Detergent ¹
Bath	Clean daily & after use	Clean daily & after use	Clean daily & after use	Clean daily & after use	Detergent ¹

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Bed	Clean frame daily	Clean frame daily	Clean frame daily	N/A	Detergent ¹ Detergent + disinfectant for MRO ²
	Clean underneath weekly	Clean underneath weekly	Clean underneath weekly		
	Clean whole on discharge	Clean whole on discharge	Clean whole on discharge		
Bed rails	Clean twice daily & after discharge	Clean daily & after discharge	Clean daily & after discharge	Clean weekly & after discharge	Detergent ¹ Detergent + disinfectant for MRO ²
Bedside table	Clean twice daily & after use	Clean daily & after use	Clean daily	Clean weekly	Detergent ¹ Detergent + disinfectant for MRO ²
Bidet	Clean three times daily	Clean three times daily	Clean daily	Clean daily	Detergent ¹ and disinfectant
Blood pressure cuff	Clean after use	Clean after use	Clean after use	Clean after use	Detergent ¹
Carpet (soft floor)	Clean twice daily	Clean daily	Clean daily	Clean weekly	Vacuum with HEPA filter
	Clean weekly	Clean monthly	Clean 6-monthly to annually	Clean biannually	Shampoo or steam clean
Catheter stand / bracket	Clean daily & after use	Clean daily & after use	Clean before initial use, after use & monthly	Clean before initial use, after use & monthly	Detergent ¹
Ceiling	Spot clean	Spot clean	Spot clean	Spot clean	Detergent ¹ / Damp dust
	Wash yearly	Wash yearly	Wash yearly	Wash every 3 years	
Chair	Clean twice daily	Clean twice daily	Clean daily	Clean weekly	Detergent ¹ Detergent + disinfectant for MRO ²
Chair, dental and surrounds	NA	NA	NA	Clean daily & when visibly soiled	Detergent ¹
Cleaning equipment	Clean after use	Clean after use	Clean after use	Clean after use	Detergent ¹ Detergent + disinfectant for MRO ²
Clipboard	Clean daily & between patient use	Clean daily & between patient use	Clean daily & between patient use	Clean weekly	Detergent ¹

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Commode	Clean contact points after use	Clean contact points after use	Clean contact points after use	Clean contact points after use	Detergent ¹ Detergent + disinfectant for MRO ²
	Clean whole daily	Clean whole daily	Clean whole daily	Clean whole weekly	
Computer & keyboard	Clean weekly	Clean weekly	Clean weekly	Clean weekly	Manufacturer's recommendations. Install keyboard covers or washable keyboards where feasible Detergent ¹
Curtains and blinds	Bed curtains — change or clean weekly upon discharge	Bed curtains— change or clean monthly	Bed curtains — change or clean biannually	Bed curtains — change or clean annually	Replace with laundered curtains or steam clean while in place. Follow manufacturer's recommendations
	Patient with MRO ² or other infectious disease—change bed curtains or clean upon discharge	Patient with MRO ² —change bed curtains or clean upon discharge	Patient with MRO ² —change bed curtains or clean upon discharge	Patient with MRO ² —change bed curtains or clean upon discharge	
	Clean, change or replace yearly	Clean, change or replace yearly	Clean, change or replace yearly	Clean, change or replace bi-annually	
Door knob/ handle, general	Clean daily	Clean daily	Clean daily	Clean weekly	Detergent ¹
Door knob/ handle, patient room	Clean twice daily	Clean daily	Clean daily	Clean daily	Detergent ¹ Detergent + disinfectant for MRO ²
Drip/ intravenous stands	Clean contact points after use	Clean contact points after use	Clean contact points after use	Clean contact points after use	Detergent ¹ Detergent + disinfectant for MRO ²
Fan, patient	Clean daily & between patient use	Clean daily & between patient use	Clean daily & between patient use	Clean weekly & between patient use	Detergent ¹
Floor, non slip	Damp mop twice daily	Damp mop twice daily	Damp mop daily	Damp mop twice weekly	Detergent ¹ Detergent + disinfectant for MRO ²

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Floor, polished	Dust removal & clean twice daily	Dust removal & clean daily	Dust removal & clean daily	Dust removal & clean weekly	Detergent ¹ for routine Consider electrostatic mops Detergent + disinfectant for MRO ²
Fridges	Clean daily	Clean daily	Spot clean three times daily Clean weekly	Spot clean daily Clean weekly	Detergent ¹
Fridge (drug)	Clean weekly	Clean weekly	Clean weekly	Clean weekly	Detergent ¹
Glazing, internal (incl partitions)	Clean daily	Clean daily	Spot clean daily Clean weekly	Clean weekly	Detergent ¹
Hoist, bathroom	Clean contact points after use	Clean contact points after use	Clean contact points after use	Clean contact points after use	Detergent ¹
IV stand & poles	Clean daily & after use	Clean daily & after use	Clean weekly & after use	Clean monthly & after use	Detergent ¹ Detergent + disinfectant for MRO ²
Light switch	Clean daily	Clean daily	Clean weekly	Clean weekly	Detergent ¹
Locker	Clean contact points twice daily	Clean contact points twice daily	Clean contact points daily	N/A	Detergent ¹ Detergent + disinfectant for MRO ²
Manual handling equipment (i.e. hoists)	Clean contact points after use	Clean contact points after use	Clean contact points after use	Clean contact points after use	
Mattress	Clean weekly & after discharge	Clean weekly & after discharge	Clean monthly & after discharge	Clean monthly & after discharge	Detergent ¹ Detergent + disinfectant for MRO ² Preferable that entire mattress has waterproof cover
Medical equipment (e.g. IV infusion pumps, pulse oximeters) NOT connected to a patient	Clean daily & between patient use	Clean daily & between patient use	Clean daily & between patient use	Clean weekly & between patient use	Detergent ¹ Detergent + disinfectant for MRO ²
Medical gas equipment	Clean daily	Clean daily	Clean daily	Clean weekly	“

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Microwave	Clean three times daily	Clean three times daily	Clean daily	Clean daily	Detergent ¹
Nebuliser, portable (when in use)	Clean daily & after use	Clean daily & after use	Clean monthly & after use & before initial use	Clean bi-monthly & after use & before initial use	Detergent ¹
Notes folder	Clean daily	Clean daily	Clean weekly	Clean weekly	Detergent ¹
Oxygen equipment	Clean daily & after use	Clean daily & after use	Clean monthly & after discharge & before initial use	Clean monthly & after discharge & before initial use	Detergent ¹
Patient slide/board	Clean daily & after use	Clean daily & after use	Clean monthly & after use	Clean monthly & after use	Detergent ¹ Detergent + disinfectant for MRO ²
Pillow (waterproof cover)	Clean weekly & after discharge	Clean twice monthly & after discharge	Clean monthly & after discharge	Clean monthly & after discharge	Detergent ¹ Detergent + disinfectant for MRO ²
Sharps bin trolley	Clean daily	Clean twice weekly	Clean weekly	Clean monthly	Detergent ¹
Shower	Clean daily & after use	Clean daily & after use	Clean daily	Clean daily	Detergent ¹ Detergent + disinfectant for MRO ²
Sink (hand washing)	Clean twice daily & after use	Clean daily & after use	Clean daily	Clean daily	Detergent ¹
Surfaces (general) in patient room e.g. ledges	Clean twice daily & after discharge	Clean twice daily & after discharge	Clean daily & after discharge	Clean weekly & after discharge	Detergent ¹ Detergent + disinfectant for MRO ²
Telephone	Clean twice Daily	Clean twice daily	Clean daily	Clean weekly	Detergent ¹
Toilet	Clean twice daily	Clean twice daily	Clean daily	Clean daily	Detergent ¹ + disinfectant
Toilet seat, raised	Clean twice daily & after use	Clean daily & after use	Clean monthly & after use & before initial use	Clean monthly & after use & before initial use	Detergent for routine Detergent + disinfectant for MRO ²
Trolley, dressing	Clean before & after use	Clean before & after use	Clean before & after use	Clean before & after use	Detergent ¹ Detergent + disinfectant for MRO ²

Element	MINIMUM CLEANING FREQUENCY				Method
	Very high risk	High risk	Significant risk	Low risk	
Trolley, linen	Clean contact points daily	Clean contact points daily	Clean contact points daily	Clean contact points weekly	Detergent ¹
	Clean whole trolley weekly	Clean whole trolley weekly	Clean whole trolley weekly	Clean whole trolley monthly	
Trolley, resuscitation	Clean daily	Clean twice weekly	Clean weekly	Clean monthly	Detergent ¹
TV	Clean weekly	Clean weekly	Clean weekly	Clean weekly	Detergent ¹
TV, patient bedside	Clean daily & between patients	Clean daily & between patients	Clean weekly & between patients	Clean monthly & between patients	Detergent/damp dust
Walls	Spot clean	Spot clean	Spot clean	Spot clean	Detergent ¹ / Damp dust
Washbowl, patient	Clean between patient use	Detergent ¹ Detergent + disinfectant for MRO ²			
Waste receptacle	Clean weekly & spot clean as required	Detergent ¹			
Wheelchair	Clean daily & after use	Clean daily & after use	Clean monthly & after use	Clean monthly & after use	Detergent ¹

Source: Adapted from NHS national specifications for cleanliness launched in April 2001; Wales WHC (2003) 59 – National Standards of Cleanliness for NHS Trusts, Welsh Assembly Government, June 2003; NHS Estates - NHS Estates. Standards of cleanliness in the NHS: a framework in which to measure performance outcomes. Leeds: NHS Estates; 2003. Available at: http://patientexperience.nhsestates.gov.uk/clean_hospitals/ch_content/home/home.asp; National Patient Safety Agency 2007 - <http://www.nrls.npsa.nhs.uk/resources/?entryid45=59818>.

B5.2 Type and duration of precautions for specific infections and conditions

S = Standard C = Contact D = Droplet A = Airborne

DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs			ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	
Abscess Draining, major	Bacterial	Endogenous; contact	C	All patients	Duration of illness			✓	
Abscess Draining, minor or limited	Bacterial	Endogenous; contact	C	All patients	Duration of illness			✓	
Actinomycosis (<i>Actinomyces spp</i>)	Bacterial	Not transmitted person to person	S						
Amoebiasis (<i>Entamoeba histolytica</i>)	Protozoan	Ingestion; person to person transmission rare	S						
Anthrax (<i>Bacillus anthracis</i>) Cutaneous	Bacterial	Innoculation; person to person transmission rare	S					✓	
Anthrax (<i>Bacillus anthracis</i>) Pulmonary	Bacterial	Inhalation; Not transmitted person to person	S					✓	
Ascariasis (<i>Ascaris lumbricoides</i>)	Helminth	Ingestion; Not transmitted person to person	S						
Aspergillosis (<i>Aspergillus spp</i>)	Fungal	Inhalation; Not transmitted person to person	S						
Botulism	Bacterial	Ingestion; Not transmitted person to person	S						
Bronchiolitis	Viral, bacterial	Contact; droplet	C	All patients	Duration of illness				
Burkholderia cepacia	Bacterial	Contact; droplet	C; avoid exposure to other persons with CF	Patients with cystic fibrosis				✓	
Brucellosis (<i>Brucella spp</i>)	Bacterial	Inoculation; ingestion; person to person transmission rare (sexual); airborne transmission in laboratory accidents	S						
Campylobacter gastroenteritis	Bacterial	Ingestion	C	All patients	Duration of illness			✓	

PART B: Standard and transmission-based precautions

S = Standard C = Contact D = Droplet A = Airborne

DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Candidiasis (<i>Candida spp</i>)	Fungal	Usually endogenous	S	All patients						
Cat-scratch Fever (<i>Bartonellasp</i>)	Bacterial	Inoculation; not transmitted person to person	S							
Cellulitis	Bacterial, Fungal	Endogenous; Inoculation; not transmitted person to person	S							
Chancroid (<i>H. ducreyi</i>)	Bacterial	Transmitted sexually	S							
Chickenpox and shingles (<i>Varicella-Zoster Virus</i>)	Viral (enveloped)	Contact; airborne	C,A	All patients	Until all lesions dry and crusted over	✓	✓	✓	✓	Screen by history and serology; pre-employment Varicella vaccine. Post-exposure prophylaxis (vaccination, or ZIG in high risk cases and late pregnancy) may be indicated Susceptible healthcare workers must not attend the patient.
Chlamydia trachomatis Conjunctivitis	Bacterial	Contact	S							
Chlamydia trachomatis Genital	Bacterial	Transmitted sexually	S							
Chlamydia trachomatis Pneumonia (infants <=3 months)	Bacterial	Contact (vertical)	S							
Chlamydocphila pneumoniae	Bacterial	Contact; droplet	S							
Cholera (<i>Vibrio cholerae</i>)	Bacterial	Ingestion	C	All patients	Duration of illness			✓		Although alcohol-based hand hygiene products are inactive against spores of <i>C. difficile</i> , their use in accord with the 5 Moments Standard and glove use is still recommended. If hands become visibly soiled hand washing with soap and water is required.
Clostridium difficile	Bacterial	Contact	C	All patients	Duration of illness			✓		

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS	
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant		
Conjunctivitis Acute bacterial	Bacterial										
Conjunctivitis <i>Chlamydia</i>	Bacterial	Contact	S								
Conjunctivitis Gonococcal	Bacterial	Contact	S								
Conjunctivitis Acute viral (haemorrhagic)	Viral	Contact	C	All patients	Duration of illness			✓		Adenovirus, enterovirus, Coxsackie A24 most common. Highly contagious; outbreaks in eye clinics, paediatric and neonatal settings, institutions.	
Creutzfeldt-Jakob disease (CJD)	Prion	iatrogenic (CNS, instruments); grafts; hormones; zoonotic (vCJD)	S							Use disposable instruments or special sterilisation/ disinfection for surfaces, objects contaminated with neural tissue if CJD or vCJD not ruled out.	
Cryptosporidium	Protozoan	Ingestion	C	All patients	Duration of illness			✓			
Cysticercosis (<i>Taenia solium</i>)	Helminth	Ingestion; not transmitted person to person	S								
Cytomegalovirus (CMV) infection	Viral (enveloped)	Contact (mucosal)	S				✓		✓	Pregnant healthcare workers may be tested	
Dengue Fever	Viral	Mosquito bite; not transmitted person to person	S								
Diphtheria (<i>Corynebacterium diphtheriae</i>) Cutaneous	Bacterial	Contact	C	All patients	Until off antimicrobial treatment and culture negative			✓			
Diphtheria (<i>Corynebacterium diphtheriae</i>) Pharyngeal	Bacterial	Droplet	D	All patients	Until off antimicrobial treatment and culture negative			✓			
Echinococcosis (hydatids) (<i>Echinococcus granulosus</i>)	Helminth	Ingestion; not transmitted person to person	S								

PART B: Standard and transmission-based precautions

S = Standard C = Contact D = Droplet A = Airborne

DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Enterobiasis (<i>Enterobius vermicularis</i>)	Helminth	Ingestion; not transmitted person to person	S							
Enterococcus, vancomycin-resistant (VRE)	Bacterial	Contact	C	Faecally incontinent patients – single room with ensuite	Duration of incontinence					
Escherichia coli (if STEC)	Bacterial	Contact	S							Use contact precautions for diapered or incontinent persons for the duration of illness
Giardia	Protozoan	Ingestion	S							Use contact precautions for diapered or incontinent persons for the duration of illness
Gastroenteritis - bacterial (<i>Salmonella, Shigella, Campylobacter</i>)	Bacterial	Ingestion; Contact	C	Faecally incontinent patients – single room with ensuite desirable	Duration of illness			✓		
Gonococcal ophthalmia neonatorum (acute conjunctivitis of newborn)	Bacterial	Contact	S							
Gonorrhoea (<i>Neisseria gonorrhoeae</i>)	Bacterial	Sexual; contact	S							
Guillain-Barré syndrome			S							Not an infectious condition
Haemophilus influenzae (type b only) meningitis	Bacterial	Contact (droplet)	S					✓		
Haemophilus influenzae (type b only) pneumonia - adults	Bacterial		S					✓		
Haemophilus influenzae (type b only) pneumonia - children	Bacterial		D							
Helicobacter pylori	Bacterial	Exact route of transmission uncertain, contact most likely important	S							

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Hepatitis A	Viral (non-enveloped)	Ingestion; Contact	C	Incontinent patients – single room with ensuite desirable	For 7 days after onset of jaundice; for duration of hospitalisation for children <3 years	✓		✓		Immunise if at high risk; provide hepatitis A vaccine or normal human immunoglobulin (NHIG) post-exposure as recommended
Hepatitis B	Viral (enveloped)	Bloodborne	S			✓		✓		Immunise and test all healthcare workers. Occupational exposure protocol for blood borne viruses
Hepatitis C	Viral (enveloped)	Bloodborne	S					✓		Occupational exposure protocol for blood borne viruses
Hepatitis D	Viral (enveloped)	Bloodborne; cannot occur without hepatitis B coinfection	S					✓		Immunise and test all healthcare workers for hepatitis B. Occupational exposure protocol for blood borne viruses
Hepatitis E	Viral (non-enveloped)	Ingestion; Contact	C	Incontinent patients – single room with ensuite desirable	Period of communicability unknown, probably at least 14 days after onset of jaundice			✓	✓	
Herpes simplex virus infection	Viral (enveloped)	Contact (droplet, fomites, lesions)	S							
Herpes simplex virus infection encephalitis	Viral (enveloped)	Contact (droplet, fomites, lesions)	S							
Herpes simplex virus infection mucocutaneous, disseminated or primary, severe	Viral (enveloped)	Contact (droplet, fomites, lesions)	C	Patients with lesions; healthcare workers with lesions	Until lesions dry and crusted		✓	✓		
Herpes simplex virus infection mucocutaneous, recurrent (skin, oral, genital)	Viral (enveloped)	Contact (droplet, fomites, lesions)	S							
Herpes simplex virus infection neonatal	Viral (enveloped)	Contact (droplet, fomites, lesions)	C	All patients	Until lesions dry and crusted		✓			

PART B: Standard and transmission-based precautions

S = Standard C = Contact D = Droplet A = Airborne

DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS	
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant		
Hookworm (<i>Necator, Ancylostoma</i>)	Helminth	Skin penetration; Not transmitted person to person	S								
Human Immunodeficiency Virus (HIV)/AIDS	Viral (enveloped)	Bloodborne; sexual	S					✓			Occupational exposure protocol for blood borne viruses; post-exposure prophylaxis if indicated; patients with complicating conditions (e.g. tuberculosis) may need further precautions
Human Metapneumovirus	Viral (enveloped)	Contact; droplet	D	All patients	Duration of illness						
Impetigo	Bacterial	Contact	C		Until 24 hours after initiation of effective therapy			✓			
Infectious mononucleosis (glandular fever)	Viral (enveloped)	Saliva via oropharyngeal route	S								
Influenza	Viral (enveloped)	Contact; droplet	C,D	All patients during outbreak	Until 3-5 days from onset of illness, longer in children		✓	✓		Annual immunisation recommended	
Kawasaki syndrome			S								Not an infectious condition
Legionellosis (Legionnaires' Disease)	Bacterial	Inhalation of aerosolised contaminated water (not person to person)	S								
Leprosy	Bacterial	Contact	S								
Leptospirosis (<i>Leptospira spp</i>)	Bacterial	Contact; inhalation	S								Person-to-person transmission is rare
Lice (pediculosis) Head	Arthropod	Contact	C	All patients	Until 24 hours after initiation of effective therapy			✓			
Lice (pediculosis) Body	Arthropod	Contact	S								Transmitted person to person through infested clothing. Wear gown and gloves when removing clothing. Bag and wash clothing in hot cycle
Lice (pediculosis) Pubic	Arthropod	Contact (sexual)	S								

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Listeriosis (<i>Listeria monocytogenes</i>)	Bacterial	Usually via contaminated foods	S							Person to person transmission rare except mother-fetus
Malaria	Protozoan	Mosquito bite	S							Not transmitted person to person except rarely through blood transfusions
Measles (rubeola) virus	Viral (enveloped)	Airborne	A	All patients	Until 4 days after rash appears	✓	✓	✓		Screen by history/serology; pre-employment measles, mumps, rubella vaccine (MMR) if not pregnant. Non-immune staff should not care for patient
Melioidosis (<i>Burkholderia pseudomallei</i>)	Bacterial	Inoculation; inhalation; not transmitted person to person	S							
Meningococcal infection (<i>Neisseria meningitidis</i>)	Bacterial	Droplet	D	All patients	For 24 hours after beginning treatment					Immunisation possible in outbreaks. Post-exposure prophylaxis if indicated
Molluscum contagiosum	Viral (enveloped)	Contact	S							
Mucormycosis (<i>Mucor</i> , <i>Rhizopus</i> , <i>Absidia</i> , <i>Cunninghamella</i> etc)	Fungal	Inhalation; inoculation; not transmitted person to person	S							
Mumps	Viral (enveloped)	Contact; droplet (respiratory secretions)	C,D	All patients	Until 9 days after onset of swelling. Exposed non-immune people should be considered infectious from 12th-25th day after exposure, with or without symptoms	✓		✓		Screen by serology; pre-employment MMR if not pregnant
Myobacteria, nontuberculous (atypical) (see also Tuberculosis)	Bacterial	Inoculation; inhalation; not transmitted person to person	S							
Mycoplasma pneumoniae	Bacterial	Droplet	D	All patients	Duration of illness			✓		

PART B: Standard and transmission-based precautions

S = Standard C = Contact D = Droplet A = Airborne

DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Necrotising enterocolitis	Bacterial	Usually endogenous	S							Contact precautions when cases clustered temporarily
Nocardiosis (<i>Nocardia spp</i>)	Bacterial	Inhalation; inoculation; not transmitted person to person	S							
Norovirus	Viral (non-enveloped)	Contact; droplet	C, D	Faecally incontinent patients	Duration of illness			✓		Alcohol-based hand hygiene products are less effective than hand washing with soap and water for this infectious agent Use of a surgical mask by healthcare workers while patient is symptomatic
Orf	Viral (enveloped)	Contact (from animals); not transmitted person to person	S					✓		
Parainfluenza	Viral (enveloped)	Droplet	D	All patients	Duration of illness			✓		Viral shedding may be prolonged in immunosuppressed patients.
Parvovirus B19 Infection	Viral (non-enveloped)	Droplet	S	All patients				✓	✓	
Pertussis (Whooping cough)	Bacterial	Droplet	D	All patients	Until 5 days after treatment commenced; Single patient room preferred		✓	✓	✓	Pre-employment booster/vaccination recommended; post-exposure prophylaxis for healthcare worker in late pregnancy and high risk areas
Plague (<i>Yersinia pestis</i>)	Bacterial	Flea bites, contact, droplets								
Plague (<i>Yersinia pestis</i>) bubonic	Bacterial	Flea bites, contact	S					✓		
Plague (<i>Yersinia pestis</i>) pneumonic	Bacterial	Droplet	D	All patients	For 24 hours after beginning treatment. Patient must be in respiratory isolation room.			✓		Antimicrobial prophylaxis for exposed HCW

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Pneumococcal pneumonia (<i>Streptococcus pneumoniae</i>)	Bacterial	Droplet	S		Use droplet precautions if evidence of transmission within a facility			✓		
Pneumocystis pneumonia (<i>Pneumocystis jirovecii</i>)	Fungal	Uncertain	S							
Poliomyelitis	Viral (enveloped)	Ingestion	C	All patients	Duration of illness; may be shed in faeces for up to 6 weeks	✓		✓		HCW should be vaccinated (if have not had childhood vaccinations); non-immune HCW should not care for patient
Psittacosis/Ornithosis (<i>Chlamydia psittaci</i>)	Bacterial	Inhalation; not transmitted person to person	S							
Q Fever (<i>Coxiella burnetii</i>)	Bacterial	Inhalation; not transmitted person to person (rarely by sexual contact)	S							
Rabies/Australian Bat Lyssavirus	Viral (enveloped)	Transmitted by animal bites	S							Person to person transmission rare; if patient bites another person wash exposed area thoroughly and administer post-exposure prophylaxis
Respiratory Syncytial Virus (RSV)	Viral (enveloped)	Contact; droplet	C	All patients	Duration of illness	✓				May be prolonged shedding in immunocompromised patients
Rheumatic Fever	Not an infectious condition		S							
Rhinovirus	Viral (non-enveloped)	Contact; droplet	D	All patients	Duration of illness			✓		
Rickettsial fevers e.g. Tick typhus, Flinders Island Spotted Fever, Australian Spotted Fever)	Bacterial	Tick bites; not transmitted person to person	S							
Roseola infantum (exanthum subitum) HHV-6	Viral (enveloped)	Unknown, thought to be through oral secretions; low infectivity	S							

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Rotavirus gastroenteritis	Viral (non-enveloped)	Ingestion; contact; droplet	C	All patients				✓		Alcohol-based hand hygiene products are less effective than hand washing with soap and water for this infectious agent
Rubella	Viral (enveloped)	Contact; droplet	D	All patients	Until 7 days after onset of rash	✓		✓	✓	Screen by serology; pre-employment MMR if not pregnant; non-immune pregnant staff should not attend patient
Congenital Rubella	Viral (enveloped)	Vertical			Until 1 year of age	✓			✓	Standard precautions may be used if nasopharyngeal and urine cultures are repeatedly negative after 3 months of age; non-immune pregnant staff should not attend patient
Scabies (<i>Sarcoptes scabiei</i>)	Arthropod infestation	Contact (skin to skin) or from infested fomites	C	All patients	Until 24 hours after treatment commenced		✓	✓		Healthcare workers should be excluded from work until effective treatment has been commenced
Schistosomiasis (<i>Schistosoma spp</i>)	Helminth	Skin penetration; not transmitted person to person	S							
Severe Acute Respiratory Syndrome (SARS)	Viral (enveloped)	Contact; droplet; airborne	C, D, A	All patients	Duration of illness + 10 days after resolution of fever; provided respiratory symptoms are absent or improving			✓		
Staphylococcal infection (<i>Staphylococcus aureus</i>)	Bacterial	Contact	S for MSSA unless unable to contain wound drainage; C for MRSA	MRSA: all patients, healthcare workers with predisposing skin conditions				✓		Screen staff with exfoliative skin conditions
Staphylococcal infection (<i>Staphylococcus aureus</i>) Scalded skin syndrome		Contact	C	All patients	Duration of illness					Consider healthcare workers as potential source of nursery or NICU outbreaks

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Staphylococcal infection (<i>Staphylococcus aureus</i>) Skin, wound, or burn - Major			C	All patients	Duration of illness for draining wound					No dressing or dressing does not contain drainage adequately
Staphylococcal infection (<i>Staphylococcus aureus</i>) Skin, wound, or burn - Minor or limited			S (C if MRSA)	All patients						Dressing covers and contains drainage adequately
Staphylococcal infection (<i>Staphylococcus aureus</i>) Enterocolitis			S (C if MRSA)	All patients						Use Contact Precautions for diapered or incontinent children for duration of illness
Staphylococcal infection (<i>Staphylococcus aureus</i>) Pneumonia			S (C if MRSA)	All patients						
Staphylococcal infection (<i>Staphylococcus aureus</i>) Toxic shock syndrome			S							
Streptococcal infection (Group A)	Bacterial	Contact								
Streptococcal infection (Group A) Skin, wound, or burn - Major			C, D	All patients	Until 24 hours after treatment commenced			✓		No dressing or dressing does not contain drainage adequately
Streptococcal infection (Group A) Skin, wound, or burn - Minor or limited			S							Dressing covers and contains drainage adequately
Streptococcal infection (Group A) Endometritis (puerperal sepsis)			S							

PART B: Standard and transmission-based precautions

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Streptococcal infection (Group A) Pharyngitis in infants and young children			D	All patients	Until 24 hours after treatment commenced					
Streptococcal infection (Group A) Pneumonia			D	All patients	Until 24 hours after treatment commenced					
Streptococcal infection (Group A) Scarlet Fever in infants and young children			D	All patients	Until 24 hours after treatment commenced					
Streptococcal infection (Group A) Serous invasive disease			D	All patients	Until 24 hours after treatment commenced					Outbreaks of serious invasive disease have occurred secondary to transmission among patients and healthcare personnel
Streptococcal Disease (Group B), neonatal	Bacterial	Vertical	S							
Strongyloidiasis (<i>Strongyloides stercoralis</i>)	Helminth	Skin penetration; not transmitted person to person	S							
Syphilis	Bacterial	Sexually or vertically transmitted; close skin contact	S							
Tetanus	Bacterial	Inoculation; not transmitted person to person	S							
Tinea (dermatophytosis, dermatomycosis, ringworm)	Fungal	Inoculation; Rarely transmitted person to person	S							
Toxoplasmosis (<i>Toxoplasma gondii</i>)	Protozoan	Ingestion; rarely transmitted person to person (vertical, blood transfusion)	S							

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				ADDITIONAL COMMENTS
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	
Trachoma (<i>Chlamydia trachomatis</i>)	Bacterial	Contact; flies	S							
Trichomoniasis (<i>Trichomonas vaginalis</i>)	Protozoan	Sexually transmitted	S							
Tuberculosis	Bacterial	Airborne	A			✓	✓	✓		Pre-employment, screening, Regular screening for at-risk healthcare workers/ BCG may be offered in specific situations
Tuberculosis Extrapulmonary, draining lesion			A,C	All patients	Until patient improving clinically and drainage has ceased or 3 consecutive negative cultures		✓			
Tuberculosis Extrapulmonary but no draining lesion; meningitis			S							Examine for pulmonary TB. For infants and children use airborne precautions until active pulmonary TB ruled out in visiting family members
Tuberculosis Pulmonary or laryngeal disease, confirmed			A	All patients with smear-positive pulmonary TB, or laryngeal disease	Usually until after: 1 week treatment and 3 sputum smears negative; consult with respiratory physician	✓		✓		
Tuberculosis Pulmonary or laryngeal disease, suspected			A		Until TB excluded; alternate diagnosis or 3 sputum smears AFB negative, at least one an early morning specimen	✓		✓		
Tuberculosis Skin test positive; no evidence of current active disease			S							

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DISEASE	TYPE OF INFECTION	TRANSMISSION ROUTE	PRECAUTIONS		DURATION OF PRECAUTIONS	SPECIAL REQUIREMENTS FOR HCWs				
			TYPE	TARGET		Non-immune	Immunocompromised	Infected	Pregnant	ADDITIONAL COMMENTS
Tularaemia (Francisella tularensis)	Bacterial	Arthropod bites; inoculation; inhalation; ingestion; not transmitted person to person	S							
Typhoid (Salmonella Typhi)	Bacterial	Ingestion	C	All patients	Duration of illness			✓		
Viral haemorrhagic fevers (VHF) (Crimean-Congo, Ebola, Lassa, Marburg)	Viral (enveloped)	Blood or body substances (mucosal, parenteral) Lassa fever: aerosols	C	All patients; Contact state/territory quarantine officer. Get advice from health authorities	Duration of illness; isolation room			✓		Emphasise: use of sharps safety devices and safe work practices; hand hygiene; barrier protection against blood and body substances upon entry into room - gloves, fluid-resistant or impermeable gowns; face/eye protection with masks, goggles or face shields; appropriate waste handling
Varicella-Zoster Virus	See Chickenpox									
Vancomycin-resistant Enterococcus (VRE)	Bacterial	Contact	C	All patients; single room for faecally incontinent patients	Duration of illness					

Source: Adapted from Siegel, Rhinehart E, Jackson M et al (Health Care Infection Control Practices Advisory Committee) (2007) *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings, June 2007*. United States Centers for Disease Control and Prevention. <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>

B5.3 Exposure prone procedures (EPP)²⁴

Exposure prone procedures (EPPs) are invasive procedures where there is potential for direct contact between the skin, usually finger or thumb of the healthcare worker, and sharp surgical instruments, needles, or sharp tissues (e.g. fractured bones), spicules of bone or teeth in body cavities or in poorly visualised or confined body sites, including the mouth of the patient.

During EPPs, there is an increased risk of transmitting bloodborne viruses between healthcare workers and patients.

EPP categories

The nature of the EPP performed by the healthcare worker can be categorised according to level of risk of transmission, in increasing order of magnitude.

Category 1	A procedure where the hands and fingertips of the healthcare worker are usually visible and outside the body most of the time and the possibility of injury to the worker's gloved hands from sharp instruments and/or tissues is slight. This means that the risk of the healthcare worker bleeding into a patient's open tissues should be remote, e.g. insertion of a chest drain.
Category 2	A procedure where the fingertips may not be visible at all times but injury to the healthcare worker's gloved hands from sharp instruments and/or tissues is unlikely. If injury occurs it is likely to be noticed and acted upon quickly to avoid the healthcare worker's blood contaminating a patient's open tissues, e.g. appendicectomy.
Category 3	A procedure where the fingertips are out of sight for a significant part of the procedure, or during certain critical stages and in which there is a distinct risk of injury to the healthcare worker's gloved hands from sharp instruments and/or tissues. In such circumstances it is possible that exposure of the patient's open tissues to the healthcare worker's blood may go unnoticed or would not be noticed immediately, e.g. hysterectomy.

Source: DH/HP/GHP3. *HIV Infected Health Care Workers: Guidance on Management and Patient Notification*. London; 2005

Advice on EPPs in specific areas of clinical care

Accident and emergency (A&E)

A&E staff members who are restricted from performing EPPs should not provide pre-hospital trauma care. These staff should not physically examine or otherwise handle acute trauma patients with open tissues because of the unpredictable risk of injury from sharp tissues. Cover from colleagues who are allowed to perform EPPs would be needed at all times to avoid this eventuality.

Other EPPs which may arise in an A&E setting would include:

- rectal examination in presence of suspected pelvic fracture
- deep suturing to arrest haemorrhage
- internal cardiac massage.

(See also Anaesthetics, Biting, Paramedics and Resuscitation)

²⁴ This section has been adapted by the committee from DH/HP/GHP3 (2005) *HIV Infected Health Care Workers: Guidance on Management and Patient Notification*. London: UK Dept Health.

Anaesthetics

Endotracheal intubation, use of a laryngeal mask and procedures performed purely percutaneously are not exposure prone. The only procedures currently performed by anaesthetists which would constitute EPPs are:

- the placement of portacaths (very rarely done) which involves excavating a small pouch under the skin and may sometimes require manoeuvres which are not under direct vision
- the insertion of chest drains in accident and emergency trauma cases such as patients with multiple rib fractures.

The insertion of a chest drain may or may not be considered to be exposure prone depending on how it is performed. Procedures where, following a small initial incision, the chest drain with its internal trocar is passed directly through the chest wall (as may happen e.g. with a pneumothorax or pleural effusion) and where the lung is well clear of the chest wall, would not be considered to be exposure prone. However, where a larger incision is made, and a finger is inserted into the chest cavity (e.g. with a flail chest) and where the healthcare worker could be injured by the broken ribs, the procedure should be considered exposure prone.

Modern techniques for skin tunnelling involve wire guided techniques and putting steel or plastic trochars from the entry site to the exit site where they are retrieved in full vision. Therefore skin tunnelling is no longer considered to be exposure prone (see also Arterial cutdown).

Arterial cutdown

Although the use of more percutaneous techniques has made arterial or venous cutdown to obtain access to blood vessels an unusual procedure, it may still be used in rare cases. However, as the operator's hands are always visible, it should no longer be considered exposure prone.

Biting

Staff working in areas where there is a significant risk of being bitten should not be considered to be performing EPPs.

Bone marrow transplants

Not exposure prone.

Cardiology

Percutaneous procedures including angiography/cardiac catheterisation are not exposure prone. Implantation of permanent pacemakers (for which a skin tunnelling technique is used to site the pacemaker device subcutaneously) may or may not be exposure prone. This will depend on whether the operator's fingers are or are not concealed from view in the patient's tissues in the presence of sharp instruments during the procedure (see also Arterial cutdown).

Dentistry

The definition for exposure-prone procedures for dentistry is currently under review. The guideline will be updated once this issue is resolved.

Ear, nose and throat surgery (otolaryngology)

ENT surgical procedures generally should be regarded as exposure prone with the exception of simple ear or nasal procedures, and procedures performed using endoscopes (flexible and rigid) provided fingertips are always visible. Non-exposure prone ear procedures include stapedectomy/stapedotomy, insertion of ventilation tubes and insertion of a titanium screw for a bone anchored hearing aid.

Endoscopy

Simple endoscopic procedures (e.g. gastroscopy, bronchoscopy) have not been considered exposure prone. In general there is a risk that surgical endoscopic procedures (e.g. cystoscopy, laparoscopy – see below) may escalate due to complications that may not have been foreseen and may necessitate an open EPP. The need for cover from a colleague who is allowed to perform EPPs should be considered as a contingency (see also Biting).

General practice

See Accident and Emergency, Biting, Minor Surgery, Midwifery/Obstetrics, Resuscitation

Gynaecology (see also laparoscopy)

Open surgical procedures are exposure prone. Many minor gynaecological procedures are not considered exposure prone, examples include dilatation & curettage (D& C), suction termination of pregnancy, colposcopy, surgical insertion of depot contraceptive implants/devices, fitting intrauterine contraceptive devices (coils), and vaginal egg collection **provided fingers remain visible at all times when sharp instruments are in use**. Performing cone biopsies with a scalpel (and with the necessary suturing of the cervix) would be exposure prone. Cone biopsies performed with a loop or laser would not in themselves be classified as exposure prone, but if local anaesthetic was administered to the cervix other than under direct vision (i.e. with fingers concealed in the vagina), then the latter would be an EPP (category 1).

Haemodialysis/Haemofiltration

See Renal Medicine

Intensive care

Intensive care does not generally involve EPPs on the part of medical or nursing staff

Laparoscopy

These are mostly non-exposure prone because fingers are never concealed in the patient's tissues. Exceptions are: if main trochar inserted using an open procedure, as for example in a patient who has had previous abdominal surgery. Also exposure prone if rectus sheath closed at port sites using J-needle, and fingers rather than needle holders and forceps are used. In general there is a risk that a therapeutic, rather than a diagnostic, laparoscopy may escalate due to complications, which may not have been foreseen necessitating an open EPP. Cover from colleagues who are allowed to perform EPPs would be needed at all times to avoid this eventuality.

Midwifery/obstetrics

Simple vaginal delivery, amniotomy using a plastic device, attachment of foetal scalp electrodes, infiltration of local anaesthetic prior to an episiotomy and the use of scissors to make an episiotomy cut are not exposure prone. The only EPPs routinely undertaken by midwives are repairs following episiotomies and perineal tears: category 1 in the case of first-degree lacerations; category 2 in the case of second, third and fourth degree lacerations. Repairs of third and fourth degree tears are normally undertaken by medical staff members who may include general practitioners assisting at births in a community setting.

Minor surgery

In the context of general practice, minor surgical procedures such as excision of sebaceous cysts, skin lesions, cauterisation of skin warts, aspiration of bursae, cortisone injections into joints and vasectomies do not usually constitute EPPs.

Sharps occupational exposure

Healthcare workers need not refrain from performing EPPs pending follow up of occupational exposure to a BBV infected source. The combined risks of contracting a BBV from the source patient and then transmitting this to another patient during an EPP is so low as to be considered negligible. However in the event of the worker being diagnosed with a BBV, such procedures should cease in accordance with this guidance.

Nursing

General nursing procedures do not include EPPs. The duties of operating room nurses should be considered individually. Instrument nurses do not generally undertake EPPs. However, it is possible that nurses acting as first assistant may perform EPPs (see also Accident and Emergency, Renal Medicine/Nursing, and Resuscitation).

Obstetrics/Midwifery

See Midwifery/Obstetrics. Obstetricians perform surgical procedures, many of which will be exposure prone according to the criteria.

Operating room technicians

General duties do not normally include EPPs.

Ophthalmology

With the exception of orbital surgery, which is usually performed by maxillo-facial surgeons (who perform many other EPPs), routine ophthalmological surgical procedures are not exposure prone as the operator's fingers are not concealed in the patient's tissues. Exceptions may occur in some acute trauma cases, which should be avoided by EPP restricted surgeons.

Optometry

The training and practice of optometry does not require the performance of EPPs.

Orthodontics

See Dentistry

Orthopaedics

EPPs

- Open surgical procedures
- Procedures involving the cutting or fixation of bones, including the use of K-wire fixation and osteotomies
- Procedures involving the distant transfer of tissues from a second site (such as in a thumb reconstruction)
- Acute hand trauma
- Nail avulsion of the toes for in-growing toenails and Zadek's procedure.

Non-EPPs

- Manipulation of joints with the skin intact
- Arthroscopy, provided that if there is any possibility that an open procedure might become necessary, the procedure is undertaken by a colleague able to perform the appropriate open surgical procedure
- Superficial surgery involving the soft tissues of the hand
- Work on tendons using purely instrumental tunnelling techniques that do not involve fingers and sharp instruments together in the tunnel
- Procedures for secondary reconstruction of the hand, provided that the operator's fingers are in full view
- Carpal tunnel decompression provided fingers and sharp instruments are not together in the wound
- Closed reductions of fractures and other percutaneous procedures.

Paediatrics

Neither general nor neonatal/special care paediatrics has been considered likely to involve any EPPs. Paediatric surgeons do perform EPPs (see also Arterial cutdown).

Paramedics

In contrast to other emergency workers, a paramedic's primary function is to provide care to patients. Paramedics do not normally perform EPPs. However, paramedics who would be restricted from performing EPPs should not provide pre-hospital trauma care. This advice is subject to review as the work undertaken by paramedics continues to develop (see also Accident & Emergency, Biting and Resuscitation).

Pathology

In the event of injury to an EPP restricted pathologist performing a post mortem examination, the risk to other workers handling the same body subsequently is so remote that no restriction is recommended.

Podiatrists

Routine procedures undertaken by podiatrists who are not trained in and do not perform surgical techniques are not exposure prone. Procedures undertaken by podiatric surgeons include surgery on nails, bones and soft tissue of the foot and lower leg, and joint replacements. In a proportion of these procedures, part of the operator's fingers will be inside the wound and out of view, making them EPPs (see also Orthopaedics).

Radiology

All percutaneous procedures, including imaging of the vascular tree, biliary system and renal system, drainage procedures and biopsies as appropriate, are not EPPs (see also Arterial cutdown).

Renal medicine

These procedures are not exposure prone and neither haemofiltration nor haemodialysis constitute EPPs. The working practices of those staff members who supervise haemofiltration and haemodialysis circuits do not include EPPs.

Resuscitation

Resuscitation performed wearing appropriate protective equipment does not constitute an EPP.

Surgery

Open surgical procedures are exposure prone. This applies equally to major organ retrieval because there is a very small, though remote, risk that major organs retrieved for transplant could be contaminated by a healthcare worker's blood during what are long retrieval operations while the patient's circulation remains intact. It is possible for some contaminated blood cells to remain following pre-transplantation preparatory procedures and for any virus to remain intact since organs are chilled to only 10°C (see also Laparoscopy, Minor Surgery).

Volunteer healthcare workers (including first aid)

The important issue is whether or not an infected healthcare worker undertakes EPPs.

B5.4 Examples of how to perform aseptic non-touch technique

B5.4.1 ANTT for peripheral and central access intravenous therapy

Typically, IV maintenance procedures will be assessed as requiring Standard ANTT with the employment of a main general aseptic field and critical micro aseptic fields.

Figure B5.1: Aseptic non-touch technique for peripheral and central access intravenous therapy



Table B5.1: Aseptic non-touch technique for peripheral and central access intravenous therapy

1	<p>Perform hand hygiene</p> <p>This will break any potential transmission of infection from the clinical ward environment to the clean preparation area/room. Effective hand hygiene is vital to reduce the risk of contaminating key parts/sites.</p>
2	<p>Use a clean tray</p> <p>Such a tray provides a sufficiently large, robust and controlled working area. Reprocess re-usable trays according to local policy.</p>
3	<p>While the tray is drying, gather equipment</p> <p>Hands are contaminated when gathering equipment from storage cupboards etc. It's important therefore to gather all equipment before performing hand hygiene at Step 4. Gathering equipment at this point also allows the tray to dry properly and saves a little time.</p>
4	<p>Perform hand hygiene</p> <p>This occurs immediately before assembly of equipment and the preparation of drugs. This way, hands are optimally clean prior to glove application and non-touch technique key part manipulation.</p>
5	<p>Apply non-sterile gloves (use sterile gloves if you must touch key parts)</p> <p>Primarily, gloves are worn to protect the user from drug exposure and blood products. All peripheral and central access IV procedures should be performed without touching key parts. Therefore, non-sterile gloves will nearly always be the logical and efficient glove choice. In the event the healthcare worker unknowingly touches a key part, non-sterile gloves also act as a safety net as they are typically cleaner than skin.</p>
6	<p>Assemble equipment and prepare medications—protect key parts using non-touch-technique</p> <p>A non-touch technique is the most important component of aseptic practice because a key part cannot be contaminated directly if it is not touched. Key parts should be protected throughout the procedure when they are not in use. This can be achieved by using sterilised IV bungs or the inside of syringe packets. Both systems provide critical micro aseptic fields around the key part.</p>
7	<p>User assessment:</p> <p>If gloves become contaminated – decontaminate hands and re-glove</p> <p>This is necessary when it is not possible to proceed from preparation to administration without contaminating gloved hands (e.g. due to prepping a patient).</p> <p>If gloves remain uncontaminated between steps 6 & 7 proceed directly to step 7</p> <p>Where it is possible to retain the asepsis of gloved hands between preparation and administration, the user does not need to decontaminate hands between administration and preparation. This will promote compliance and save time.</p>
8	<p>Clean key parts</p> <p>2% chlorhexidine/70% alcohol wipes is the application of choice (Pratt et al 2007). In addition, the benefit of using friction and allowing key parts to dry has been demonstrated by Kaler & Chinn (2007).</p> <p>Method:</p> <p>A large 2% chlorhexidine and 70% alcohol wipe should be fully unfolded to provide a suitable working surface area.</p> <p>One side of the wipe should be exposed to the user's gloved hand, the other side should be introduced to the hub (non-touch technique).</p> <p>The port tip should be thoroughly wiped hard for 5 seconds—to create friction.</p> <p>This should be repeated 4 times using different parts of the tissue (to remove dirt from the tip).</p> <p>After cleaning the hub clean the sides of the port and line, working away from the port tip.</p> <p>Allowing the hub to air dry promotes asepsis.</p> <p>This technique provides the required level of friction. Using different parts of the wipe ensures any dirt is transferred from the hub to the wipe. The hub must dry before use otherwise it won't be aseptic (if organisms have remained, a wet tip will facilitate their transportation into the patient on injection).</p>

9	<p>Administer medication using non-touch technique</p> <p>Key parts cannot be contaminated by contact if they are not touched. A non-touch technique should therefore be used even if the user is wearing sterile gloves (because once sterile gloves are open to air they are no longer sterile, and can also be inadvertently contaminated by touch). If necessary, a small sterilised towel can be placed under a patient's line to promote safe handling.</p>
10	<p>Dispose of sharps and equipment then dispose of gloves</p> <p>Sharps are best disposed of at the bedside if possible (on the basis that the quicker they are disposed of the less chance there is of an accident).</p>
11	<p>Clean tray</p> <p>Re-usable trays are reprocessed at the end of the procedure to prevent cross infection between patients and staff. Trays are reprocessed according to local policy.</p>
12	<p>Perform hand hygiene</p> <p>It is essential that the post-procedure hand hygiene is performed immediately after glove removal i.e. before contact with the environment (because gloves encourage the hands to sweat-out organisms from the skin).</p>

B5.4.2 Aseptic non-touch technique for wound care

Wound care procedures are highly variable. Typically, a critical main aseptic field is employed and practice is dictated accordingly.

Figure B5.2: Aseptic non-touch technique for wound care



Table B5.2: Aseptic non-touch technique for wound care

1	With clean hands clean trolley surfaces Clean surface according to local policy to reduce the risk of aseptic field contamination.
2	Gather dressing pack and equipment, place on bottom shelf Hands are contaminated when gathering equipment from storage cupboards etc. It's important therefore to gather all equipment before the next hand hygiene. Gathering equipment at this point also allows the trolley to dry properly and saves a little time.
3	Perform hand hygiene This occurs immediately before assembly of the aseptic field drape and equipment etc in order to promote asepsis.
4	Open pack, place drape on top shelf and position waste bag
5	Assemble equipment and position onto top shelf, protecting key parts
6	Apply non-sterile gloves Non-sterile gloves are indicated because Steps 7 and 8 do not involve the touching of key sites or key parts.
7	Position a paper towel or drape under the wound This will promote asepsis and help protect the surrounding environment from contamination.
8	Remove dressing, expose wound and dispose of dressing into waste bag Disposing of the dressing here limits the movement of contaminated waste, helping to protect the wider clinical or community environment.
9	Perform hand hygiene Steps 7 and 8 are 'dirty' procedures and hand hygiene will promote asepsis.
10	Apply sterile gloves Although not essential for some small, minor dressings, sterile gloves at this stage will help promote asepsis of the wound. NB: Sterile gloves are essential at this stage if the wound requires touching directly with gloved hands.
11	Clean wound using non-touch technique A non-touch technique will help protect the wound from colonisation or infection.
12	Dress wound using non-touch technique A non-touch technique will help protect the wound from colonisation or infection.
13	Dispose of equipment, waste and gloves Folding the used equipment and waste into the aseptic field drape and disposing it in the attached waste bag will minimise the movement of waste and protect the wider working environment.
14	Clean trolley surfaces Cleaning according to local policy will prevent cross infection.
15	Perform hand hygiene This will help break any chain of potential cross infection.

B5.5 General infection control resources

B5.5.1 International guidelines on infection control

- Centers for Disease Control and Prevention - Infection Control in Healthcare Settings
<http://www.cdc.gov/ncidod/dhqp/us>
- epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England <http://www.epic.tvu.ac.uk/PDF%20Files/epic2/epic2-final.pdf>
- National Institute for Clinical Excellence Infection Control: Prevention of Healthcare-associated Infections in Primary and Community Care 2003
<http://www.nice.org.uk/guidance/index.jsp?action=byID&r=true&o=10922>

B5.5.2 Policies on infection control

State and Territory department of health infection policies

- NSW Health Department Policy Directive 2007_036. Infection Control Policy
http://www.health.nsw.gov.au/policies/pd/2007/PD2007_036.html
- NSW Health Department Guideline 2005_037 Infection Control Guidelines for Oral Health Care Settings http://www.health.nsw.gov.au/policies/GL/2005/GL2005_037.html
- NT Dept of Health and Families Infection Control http://www.health.nt.gov.au/Remote_Health_Atlas/Contents/Infection_Control/index.aspx
- Queensland Health Infection Control Guidelines and associated policies, recommended practices and advisories. <http://www.health.qld.gov.au/chrisp/>
- South Australian Infection Control Guidelines
<http://www.health.sa.gov.au/INFECTIONCONTROL/Default.aspx?tabid=157>
- Western Australia Department of Health and Public Health Policy on Health care Associated Infections http://www.public.health.wa.gov.au/3/369/3/policy__healthcare_associated_infections.pm
- Department of Health Victoria Infection prevention in health services
<http://www.health.vic.gov.au/infectionprevention/index.htm>

B5.5.3 Legislation/codes of practice

- Health care workers registration boards contain standards of health care professional standards of practice that include infection control standards (e.g. Australian Health Practitioners Regulation Agency).
- Public Health Acts for the various states and territories aim to provide basic safeguards necessary to protect public health through cooperation between the state Government, local governments, health care providers (e.g. ACT- The Public Health (Infection Control) Code of Practice 2005 (No 1), NSW -Public Health Act, 1991, QLD - The Public Health Act 2005).
- Occupational health and Safety legislation

B5.5.4 Commonwealth legislation

- Australian therapeutic products legislation (numerous relating to products and devices)
<http://www.tga.gov.au/legis/index.htm>
- Australian national notifiable diseases <http://www.health.gov.au/internet/main/publishing.nsf/Content/cdna-casedefinitions.htm> which are determined by the relevant State and Territory health departments Notifiable disease/ Public health Acts.

B5.5.5 Other resources

- Australian Commission for Safety and Quality in Healthcare <http://www.safetyandquality.gov.au/>
- Health Care Infection Control Special Interest Group
http://www.asid.net.au/hicsigwiki/index.php?title=Main_Page
- Australia Infection Control Association <http://www.aica.org.au/>
- ACORN <http://www.acorn.org.au/>
- Health Protection Agency (UK) <http://www.hpa.org.uk>
- National Resource for Infection Control (NRIC) (UK)
http://www.nric.org.uk/IntegratedCRD.nsf/NRIC_Home1?OpenForm
- Health Protection Scotland, Healthcare Associated infection & Infection Control
<http://www.hps.scot.nhs.uk/haic/index.aspx>
- Northern Ireland Regional infection Prevention and control Manual
<http://www.infectioncontrolmanual.co.ni/Default.html>
- DHS Victoria (2005). Guidelines for the Control of Infectious Diseases. The Blue Book
<http://www.health.vic.gov.au/ideas/bluebook>
- Community and Hospital Infection Control Association-Canadian <http://www.chica.org/>
- Society for Healthcare Epidemiology of America (SHEA) <http://www.shea-online.org/>

PART C

ORGANISATIONAL SUPPORT

Summary

For infection prevention and control to be effective at the clinical level, much organisational support is required. This includes embedding infection control into governance and management structures, initiating procedures (e.g. immunisation programs) to ensure that healthcare workers are protected, instituting processes for surveillance that feed into the overall quality control program, implementing systems for ongoing staff education and training, and incorporating infection control into planning for facility design and maintenance.

Infection control is a health and safety issue, which means that all those working in the healthcare facility—managers, healthcare workers and support staff—are responsible for providing a safe environment for patients and other staff.

Organisational support should aim to ensure that clinical work practices provide patient-centred care—this is not only essential from a safety and quality perspective but out of consideration for patient preferences. This may require consultation with patients and relevant consumer groups in the development of health care services.

The information presented in this Part is particularly relevant to managers of healthcare facilities. It outlines responsibilities of management of healthcare facilities, including governance structures that support the implementation, monitoring and reporting of effective work practices. While the focus of the information is acute-care facilities, much of the information is relevant in other healthcare settings.

CI Management and clinical governance

Summary

To be effective, infection prevention and control must be a priority in every healthcare facility—this requires total commitment at every level of the organisation.

- Organisational capacity is achieved by having appropriate governance and management structures. This means that managers are aware of the healthcare facility's performance in terms of infection transmission and there are systems in place to prevent the transmission of infection, reduce risk and address problems when they arise.
- The management structure and processes associated with infection control will differ depending on the size of the organisation and the types of healthcare services it delivers. However, the principles of clinical governance apply regardless of the setting and all essential roles and responsibilities should be fulfilled.
- The person in charge of the organisation (e.g. chief executive officer [CEO] of a hospital, principal of an office-based practice) must have overall responsibility for and direct involvement in the organisation's infection prevention and control program.
- There must be adequate resourcing for dedicated infection control staff, and resources to run the infection prevention and control program including professional development.
- Each organisation should define the outcome measures for monitoring infection prevention and control policies (see Section C4).
- All employees should understand their roles and responsibilities and have appropriate training to maintain a safe work environment (see Section C3).
- Patient-centred health care is safer health care—patients' healthcare rights must be considered during the development of programs, policies and procedures.

CI.1 Clinical governance in infection prevention and control

Addressing infection prevention and control requires a facility wide program and is everybody's responsibility. Healthcare facilities have a legal responsibility to provide a safe work environment, safe systems of work and a safe environment for patients and visitors. Clinical governance refers to the system by which managers and clinicians in each healthcare facility share responsibility and are held accountable for patient care. This involves minimising risks to patients and staff, and continuously monitoring and improving the quality of clinical care.

Preventing transmission of infectious agents should be a priority in every healthcare facility. This will involve action to:

- develop a facility-wide strategic plan for infection prevention and control
- establish a system to manage infection prevention and control (such as a committee) with input from across the spectrum of clinical services and management, and a mechanism for considering patients' feedback
- appoint infection control professionals and support their continuing professional development (e.g. attendance at relevant state or national professional organisation meetings)
- incorporate infection prevention and control into the objectives of the facility's patient and occupational safety programs
- provide administrative support, including fiscal and human resources, for maintaining infection prevention and control programs
- provide adequate staff training and protective clothing and equipment, and arrange workplace conditions and structures to minimise potential hazards.

All healthcare workers need to be aware of their individual responsibility for maintaining a safe care environment for patients and other staff.

CI.2 Roles and responsibilities

Management and clinical governance can have a positive impact on the effectiveness of infection prevention and control, by driving continuous quality improvement and promoting a non-punitive culture of trust and honesty (Victorian Quality Council 2004). Studies have found that where clinical governance and management encourage collaboration between healthcare managers and clinicians, change is more likely to be achieved than where there is unilateral governance (Ham 2003).

Change is also more likely to be achieved and sustained when the role of patients as partners in their health care is strengthened, and where there is a shared understanding of the role of patients, healthcare workers and organisations in achieving the best possible outcomes (ACSQHC 2008).

The roles and responsibilities described below are most relevant to acute health care settings. However, all the roles described in this section are important for effective infection prevention and control and can be readily adapted to other healthcare settings—for example, with the practice principal fulfilling relevant roles and responsibilities of a CEO, and the office manager or other staff representative with an interest in infection prevention and control fulfilling the role of infection control professional (see Section C1.2.4).

CI.2.1 Chief Executive Officer/Administrator

The healthcare facility's CEO or designated equivalent administrator should support and promote infection prevention and control as an integral part of the organisation's culture through the following strategies:

- having a performance agreement that includes infection prevention and control outcomes as a key performance indicator
- endorsing the inclusion of specific articulated infection prevention and control roles, responsibilities and accountabilities for relevant staff within the facility's management plan
- attending and participating in each Infection Prevention and Control (IPC) Committee meeting
- ensuring that infection control professionals are resourced
 - in terms of co-workers, information technology, access to up-to-date information, designated office/ work space and tools to meet relevant infection prevention-related legislative, regulatory and accreditation requirements
 - to achieve negotiated healthcare-associated infection reduction targets and to perform the essential tasks outlined in Section C1.2.2 below
- ensuring that the healthcare facility's IPC program includes involvement of one or more medical practitioners to support and play a shared leadership role
- ensuring that the rights of patients, as articulated in the Australian Charter of Healthcare Rights (ACSQHC 2008), are integral to the IPC program
- committing to the IPC program vision, mission, priorities, targets and annual infection prevention and control plan with specific, measurable goals for healthcare-associated infection risk mitigation and reduction—these should be outlined in an annual business plan which the CEO (or his or her designate) and the infection control professional jointly develop
- supporting an organisational culture that promotes individual responsibility for infection prevention and control among all staff and values the IPC program contribution to the safety of patients, healthcare workers and others—this support includes ensuring IPC program staffing levels are sufficient and incorporating responsibility for infection prevention and control into every staff member's job description

- authorising infection control professionals to:
 - implement IPC program recommendations
 - intervene when clinical or other practices pose infection risks (e.g. halt building and construction activities, close units during outbreaks and guide patient placement for isolation or cohorting)
- recommending remedial action when infection prevention and control measures are compromised or breached.

In some Australian states and territories and internationally, performance against infection control indicators is monitored. For example, in Tasmania, a performance monitoring process is in place. The indicators used to monitor performance and progress includes indicators relating to infection prevention and control.

CI.2.2 Infection control professionals

Infection control professionals should have the skills, experience and qualifications relevant to their specific clinical setting and be able to:

- develop, manage and evaluate governance of infection prevention and control systems, related programs and services
- provide expert infection prevention consultancy and strategic direction to the healthcare facility and external agencies.

Infection control professionals are primarily responsible for designing, coordinating, implementing and undertaking ongoing evaluation of the facility's infection prevention and control program and policies, including compliance with the respective state/territory and/or national accreditation, licensing, policy or regulatory requirements. They are also responsible for equipment and product evaluation.

Infection control professionals need to be supported by the facility with resources, authority and time to maintain clinical and professional currency (including support for credentialling and have preferably a postgraduate qualification [see Section C3.5.2]).

Infection control professionals must be involved in decisions on facility construction and design, patient placement ratios (e.g. single rooms, negative pressure rooms) and environmental assessments (see Section C6).

The infection control professional's performance should be appraised at least annually, along with negotiation of individual professional development goals, support, opportunities and plan of work.

CI.2.3 Infection prevention and control committee

A multidisciplinary IPC Committee should review and guide the healthcare facility's IPC program, strategies and plans. Membership must include, but not be limited to: the CEO or his/ her designate; an executive member with the authority to allocate the necessary resources and take remedial action as needed from time to time; an infection control professional; and one or more medical practitioners (preferably a clinical microbiologist and/or an infectious diseases physician).

The meeting frequency and content will depend on the facility's size, case-mix complexity and the infection risk of populations serviced. IPC Committee activity should be measured against an operational plan with set priorities to target within key focus areas.

The IPC Committee should have a formal mechanism for regularly considering patients' experiences and feedback and modifying the IPC program accordingly.

The IPC Committee should have an organisational communication strategy to facilitate day-to-day activities and reporting activities, which should be able to be escalated in response to an incident or outbreak. Regular and ad-hoc communication processes should exist between the IPC team and relevant public health authorities.

Healthcare facilities that do not have access to an IPC committee (or infection control professional) should consult with an infection control professional in a larger health service for program advice and support.

CI.2.4 Infection prevention and control processes in office-based practice

In office-based practice, the processes associated with infection prevention and control will differ although the responsibilities are the same. The principal of the practice is equivalent to the CEO; he or she has overall responsibility for infection prevention and control in the practice and should demonstrate a strong commitment to an agreed infection prevention and control plan based on the identified risks for that practice. Local policies and procedures need to be developed and implemented as part of standard operating procedures. A nominated staff member must take on the role of infection control professional, developing infection prevention and control procedures and overseeing their implementation. This staff member is likely to need additional training and perhaps ongoing external support in managing infection prevention and control issues. Infection prevention and control should be considered at every staff meeting, with discussion of procedures and processes of the practice and any problem areas.

CI.3 Infection prevention and control program

The IPC program is the means by which infection prevention and control practice is implemented in every part of the healthcare facility. Elements of an IPC program include:

- development of a risk-management policy for the facility (see Section C1.4)
- development of infection prevention and control policies and procedures that are based on national and/or state/territory guidelines and relevant to the healthcare facility and clinical area/department (including risk management)
- education and training of staff so that they can implement the policies and procedures
- oversight of the implementation of policies and procedures
- development of a monitor and review process to ensure that policies and procedures are being implemented correctly (e.g. completion of checklists during care provision, log books)
- oversight of surveillance of:
 - specific organisms that are relevant to the local environment (this may require consultation with infectious diseases specialists or epidemiologists)
 - surgical-site infections and other device-related infections
 - notifiable diseases.

The IPC program may also include antibiotic stewardship initiatives run in conjunction with the pharmacy department/services.

CI.3.1 Recommendations including policies and procedures

National and/or state infection prevention and control recommendations relevant to the facility should be endorsed and their principles applied as necessary according to local need by the IPC Committee. Compliance with these recommendations must be monitored. At a minimum, these recommendations form the basis of the infection control professional's directives, which should be easily accessible in hard copy, electronic or other formats. Suggested topics to be addressed, depending on the facility, include:

- hand hygiene
- standard and transmission-based precautions, including:
 - aseptic technique and prevention of device-related infections and other healthcare-associated infections (e.g. surgical-site infections, IVD-related bloodstream infections)
 - environmental cleaning and disinfection (with Environmental Services)
 - reprocessing of reusable equipment and supplies (with Reprocessing Services)
 - safe management of clinical and related waste and sharps
- healthcare-associated infection surveillance
- communicable disease post-exposure management and follow-up
- outbreak management, including systems to designate patients known to be colonised or infected with a targeted MRO and to notify receiving healthcare facilities and personnel before transfer of such patients within or between facilities
- critical incident management and investigation
- epidemiologically significant organisms (including MROs)
- use of appropriate infection prevention and control measures (including transmission-based precautions) of potentially infectious persons at initial points of patient encounter such as at the time of admission and in the outpatient settings (triage areas, emergency departments, outpatient clinics, clinicians' offices)
- prevention and management of bloodborne pathogen exposure
- surge capacity for novel respiratory and other communicable disease emergencies (with emergency response committees and outbreak management teams)
- construction/ refurbishment/ engineering.

CI.3.2 Infection prevention measures

To implement the measures outlined in infection prevention and control policies and procedures, the facility must have access to an accredited (e.g. National Association of Testing Authorities [NATA]) laboratory and pharmacy staff, as well as systems, protocols and resources to:

- implement the recommendations included in national and state/territory guidelines
- perform surveillance and auditing
- provide regular, meaningful feedback of HAI data to individual clinicians, specific specialty departments/units, quality improvement, senior management and others as stipulated in the annual IPC program business plan
- implement and participate in periodic intensive local, state, national or global HAI reduction campaigns including application of recommendations for healthcare-associated infection surveillance and reporting
- ensure collaboration between the infection control professional and other stakeholders such as infectious disease and pharmacy departments to support antibiotic stewardship

- collaborate with product and device committees to assess the infection prevention implications of new devices, procedures and technologies
- provide education regarding infection prevention core principles to all new staff and to existing staff at least annually
- provide advice and information to staff regarding new and emerging infectious disease threats and trends
- have a process for engaging patients in the safety of their healthcare by routinely:
 - providing advice and education related to specific and general healthcare-associated infection prevention to patients and families (e.g. brochures, pamphlets, face-to-face discussions, information sheets)
 - asking patients and families for feedback about their care.

CI.3.3 Quality improvement

Safe and high quality infection prevention and control practices contribute to continual improvements in the quality of healthcare provided in any setting. These practices occur at the organisational, staff and patient levels.

IPC programs include principles of quality management, through the use of approaches such as *plan-do-study-act* that enable processes to be enhanced and improved. It is essential to performance improvement that healthcare workers understand the value of monitoring and evaluating their own clinical practice. Examining patient and carer experiences can provide an insight into their perspectives and allow these to be taken into account in improving the quality of care.

Integrating monitoring and review processes into policies and procedures (e.g. through infection prevention and control audits) enables data to be collected. Performance indicators can be developed from this, such as surveys on compliance with protocols and monitoring the use of infection prevention and control products.

In the acute setting, it is recommended that healthcare facilities support local research regarding specific cases of infection, outbreaks or preventative strategies, and adopt relevant research findings that reduce or prevent healthcare-associated infections. In addition, comprehensive and epidemiologically sound systems, protocols and resources should exist to:

- actively manage all infection prevention components of accreditation
- design, undertake and respond to results of periodic audits and formal reviews of relevant clinical practice and performance (e.g. antibiotic use, hand hygiene compliance, cleaning)
- collaborate with Clinical Risk Departments and Executive Staff to develop appropriate methods for rapid response, remediation, investigation and evaluation of infection prevention critical incidents (e.g. sterilisation or disinfection failures)
- provide basic, minimum infection prevention and control education to staff, healthcare workers and volunteers appropriate to their roles, risks and the services provided by the healthcare facility
- include patient feedback on their care as an integral part of quality improvement.

Surveillance and healthcare-associated infection monitoring strategies should be designed and driven according to local activity, performance and trends in the incidence of epidemiologically significant organisms.

A useful resource is the ACSQHC *Measurement for improvement tool kit*, which provides a set of practical methods to measure the safety and quality of clinical health care services.²⁵

25 Available at: <http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/CommissionPubs>

CI.3.4 Resource allocation

Healthcare facility managers should ensure that there are sufficient human and fiscal resources available to support all aspects of the IPC program, including:

- providing specific infection prevention and control full-time equivalents, determined according to the scope of the IPC program, the complexity of the healthcare facility, the characteristics of the patient population and the needs of the facility and community (office-based practices may choose to attribute responsibilities and functions relating to infection prevention and control to a particular staff member)
- meeting occupational health needs related to infection prevention and control (e.g. provision of appropriate technologies and protective personal equipment, healthcare worker immunisation, post-exposure evaluation and care, evaluation and management of healthcare workers with communicable infections)
- in a hospital setting, providing clinical microbiology laboratory support, including a sufficient number of medical technologists trained in microbiology, appropriate to the healthcare setting, for detecting endemic and emerging pathogens, monitoring transmission of microorganisms, planning and conducting epidemiologic investigations
- funding surveillance cultures, rapid diagnostic testing for viral and other selected pathogens, preparation of antibiotic susceptibility summary reports and trend analysis.

CI.4 Risk management

Risk management is the basis for preventing and reducing harm arising from healthcare-associated infections and underpins the approach to infection prevention and control throughout these guidelines. Within a healthcare facility, a successful approach to risk management includes action at the organisational level (for example providing support for effective risk management through an organisational risk-management policy, staff training and monitoring and reporting) as well as in clinical practice.

CI.4.1 Organisational support for risk management

For risk management within an organisation to be effective there needs to be appropriate infrastructure and culture; a logical and systematic approach to implementing the required steps (outlined in CI.4.2); and embedding of risk-management principles into the philosophy, practices and business processes of an organisation, rather than it being separate activity or focus. Factors that support risk management across the organisation include development of a risk-management policy; staff training in risk management; implementation of a risk register, risk treatment schedule and integrated action plans; monitoring and audit; and risk-management reporting.

An infrastructure and environment that encourages two-way communication between management and healthcare workers and among healthcare workers is an important factor in increasing the level of support for and compliance with IPC programs. Management should:

- provide direction (e.g. nominate issues for attention that are relevant to the core business of the organisation, such as respiratory hygiene and cough etiquette in general practice, prevention of diarrhoeal disease in paediatrics, appropriate management of urinary catheters in spinal injury care)
- establish and evaluate periodic goals (i.e. nominate reduced rates for performance improvement)
- seek feedback on policy directives particularly in regards to changes in clinical care protocols or new technologies and how patients can be involved in policy formation
- provide information to individuals, self-directed work groups, patients and other stakeholders, with an emphasis on continually improving performance.

Healthcare workers can contribute to the development of risk-management structures, and are

integral to the strategies within these. Strategies to assist individual healthcare workers to reduce risk are included at the end of each section of Part B.

CI.4.2 A stepwise approach to risk management

The Australian/New Zealand Standard on Risk Management (AS/NZS ISO 31000:2009) outlines a stepwise approach to risk management:

- *establishing the context*—identifying the basic parameters in which risk must be managed (e.g. the type of healthcare facility, the extent of and support for the facility's infection prevention and control program)
- *avoiding risk*—establishing whether there is a risk and whether potential risk can be averted (e.g. by questioning whether a procedure is necessary)
- *identifying risks*—a systematic and comprehensive process that ensures that no potential risk is excluded from further analysis and treatment (e.g. using root cause analysis [see below])
- *analysing risks*—considering the sources of risk, their consequences, the likelihood that those consequences may occur, and factors that affect consequences and likelihood (e.g. existing controls)
- *evaluating risks*—comparing the level of risk found during the analysis process with previously established risk criteria, resulting in a prioritised list of risks for further action
- *treating risks*—selecting and implementing appropriate management options for dealing with identified risks (for example modifying procedures, protocols or work practices; providing education; and monitoring compliance with infection prevention and control procedures).

An example of the application of this approach is given in Section A2.2.

CI.5 Taking an organisational systems approach to infection prevention quality and safety

Addressing infection prevention and control issues requires a multi-component, facility-wide program and is everybody's responsibility. This section gives an outline of a systematic approach that has been shown to be effective (care bundles), together with examples of the organisational support required at facility level to address two crucial areas of infection prevention and control—reducing sharps injuries to healthcare workers and lowering the incidence in patients of bloodstream infections associated with intravascular devices. C2 to C6 discuss the separate aspects of a systems approach to infection prevention and control.

CI.5.1 Care bundles

'Care bundling' is an approach developed by the US Institute of Healthcare Improvement (IHI) to improve consistency of practice in healthcare facilities, particularly for conditions and procedures known to increase patients' risk of healthcare-associated infections. While large studies have not yet been undertaken, the approach has been shown to reduce healthcare-associated infections within hospitals²⁶ and is now used widely, particularly in the US and UK.

A 'care bundle' is set of four or five evidence-based processes that aims to tie routine processes together into a cohesive unit that must be adhered to for every patient. The keys to the bundle strategy's success are the standardised and unvarying application of bundle practices, the use of multidisciplinary rounds, and daily tracking and auditing of compliance.

Care bundles can be used to monitor care and to feedback care bundle results to clinical staff in order to decrease the rate of healthcare-associated infections related to that condition or

26 For details see <http://www.ihl.org/IHI/Topics/CriticalCare/IntensiveCare/ImprovementStories/BundleUpforSafety.htm>

that procedure. It is important that bundles are designed, implemented and evaluated with measurement designed for quality improvement rather than research or judgement.

Examples of some procedural care bundles are given in Section B4.

CI.5.2 Reducing sharps injuries

Safe handling of sharps is discussed in more detail in Section B1.3. A systems approach can support reducing sharps injuries by addressing (CDC 2008):

- *clinical governance*—championing a culture of safety underpinned by concepts of patient-centred care
- *staff health and safety*—adopting and evaluating the use of safety engineered devices as alternatives to sharps without safety engineered features, standardising changes to work practices that will reduce risk (e.g. using instruments, rather than fingers, to grasp needles, retract tissue, and load/unload needles) (see Section C2)
- *education and training*—providing education in the use of new devices and work practices (see Section C3)
- *surveillance*—ensuring comprehensive reporting of injuries and preventive strategies
- *facility design*—applying engineering controls (e.g. sharps disposal containers and sharps devices with integrated engineered sharps injury prevention features).

CI.5.3 Lowering the incidence of IVD-related bloodstream infections

Section B4.2 outlines infection prevention and control guidance for healthcare workers to follow when inserting a therapeutic device such as a central venous catheter. A range of measures is required for safe use of devices, the first consideration being whether the device is necessary or if a safer alternative could be used.

Facility management and the infection prevention and control team have a key role in working with clinical staff to improve the safety of procedures such as IVD insertion, by providing the necessary support and infrastructure.

The care bundle (see also Section B4.1) for central venous catheter insertion stipulates the use of hand hygiene, maximal barrier protection, optimal intravascular catheter site selection, topical chlorhexidine for skin disinfection, and daily review to ensure that catheters are removed as soon as they are no longer necessary. Support and infrastructure requirements to facilitate implementation of these measures include:

- *clinical governance*—championing a culture of safety underpinned by concepts of patient-centred care
- *education and training*:
 - orientation programs for staff including rigorous grounding in facility policies and procedures for standard procedures, particularly hand hygiene
 - development and promotion of a supporting education program that addresses IVD-associated BSI
 - engagement of patients, so they have the knowledge and skills to be actively involved in their own care.
- *surveillance*:
 - implementation of a tool to quantify adherence to practice (e.g. checklists)
 - measurement of bloodstream infection rates with feedback to relevant staff.
- *facility design and equipment*—provision of appropriate equipment, such as IVD-insertion kits with standardised contents to enable a competent health professional to perform the procedures and adhere to accepted techniques.

C2 Staff health and safety

Summary

- Infection protection for healthcare workers should be an integral part of the infection prevention and control and occupational health and safety programs of every healthcare facility.
- This includes implementing a staff health screening policy, promoting immunisation, instituting extra protection for healthcare workers in specific circumstances (e.g. pregnant healthcare workers), and having processes for minimising and managing risk exposure.
- While the organisation has a duty of care to healthcare workers, staff members also have a responsibility to protect themselves and to not put others at risk.

C2.1 Roles and responsibilities

In the course of their duties, healthcare workers can be exposed to infectious agents (e.g. through direct contact with an infectious patient, visitor or colleague or indirectly through a contaminated surface or environment [i.e. air] or as the result of a sharps injury). Healthcare workers can also place patients at risk of transmission of infection (e.g. if the healthcare worker has an infectious condition that is capable of being transmitted as they perform their duties).

To ensure the safety of everyone in the facility, both employers and employees have a responsibility in relation to infection prevention and control and occupational health and safety.

C2.1.1 Responsibilities of healthcare facilities

Workplace Health and Safety Acts for the various states and territories place a duty of care on employers to ensure workplace health and safety, including where occupational infectious disease hazards exist.

As part of its IPC program, each healthcare facility should develop, implement and document effective policies and procedures related to staff health and safety, including strategies to prevent occupational exposure to infection hazards; prevent occupational risks from chemicals or processes used for recommended infection prevention and control activities; and implement healthcare worker immunisation programs for infectious agents they may encounter in the course of their duties.

At the start of their employment, all healthcare workers should be informed of the facility's policy on health screening and be counselled, as appropriate, about their work placement in accordance with these policies. As personal and organisational circumstances change over time, reassessment and additional education may be necessary. Similarly, training institutions should inform healthcare students before their course admission about policies and procedures for staff health and safety and their implications, and provide counselling for students who may be prohibited from completing any requirements of their course due to transmissible infections.

Healthcare worker's privacy and civil rights must always be respected and not breached.

Positive measures should be undertaken to implement and sustain appropriate infection prevention and control. There are five measures of protection:

- health status screening (see Section C2.2.1)
- education on safe work practices that minimise the transmission of infection (see Section C3)
- safe systems of work, with workplaces designed to allow clinical practice that minimises transmission of infection (see Section B4)
- physical protection, involving the use of PPE (see Section B.1.2) and immunisation (Section C2.2.2)
- reporting systems for compliance and identifying breaches of infection prevention and control protocols.

C2.1.2 Responsibilities of healthcare workers

Healthcare workers have an obligation to always follow specific established infection prevention and control policies as part of their contract of employment. This includes reporting their infectious status if it places others at risk as well as any known potential exposures to blood and/or body substances. Failure to follow infection prevention and control policies and procedures may be grounds for disciplinary action. Some states/territories have statutory infection prevention and control requirements for healthcare workers.

Healthcare workers with infections should seek appropriate medical care from a doctor qualified to manage their condition. Where there is a risk of a healthcare worker transmitting infection to a patient or other healthcare worker (e.g. if he or she is infected with an acute or other transmissible infection, carries a blood borne virus, or has a predisposing skin condition), the healthcare worker should be counselled about work options and either rostered appropriately or provided with equipment, information and facilities to enable him or her to perform their duties without placing others at risk.

The appropriate work option will depend on the specific circumstances:

- healthcare workers with symptoms of acute infections (e.g. vomiting, diarrhoea, flu symptoms) should not come to work for the specified exclusion period (see Section C2.3)
- healthcare workers who carry a bloodborne virus (e.g. hepatitis B, hepatitis C, HIV) may need to accept that their duties may be modified if they perform exposure-prone procedures that pose a potential risk to patients and other staff. In some jurisdictions, healthcare workers who carry a bloodborne virus are legally obliged to declare their infectious status.

Healthcare workers should be aware of their requirements for immunisation against infectious diseases and maintain personal immunisation records.

Healthcare workers in specific circumstances (e.g. pregnant healthcare workers) may be particularly susceptible to some infections and should work with occupational health and safety officers to ensure their safety (see Section C2.4).

Education about safe work practices is discussed in Section C3.

C2.2 Health status screening and immunisation

C2.2.1 Staff health screening policies

Before beginning employment, all staff should be assessed and offered testing and/or vaccination for specific infectious diseases before being allowed to work in high-risk areas. Particular attention should be paid to immune status, skin conditions and pregnancy in staff, as well as risk factors for specific groups of patients. These conditions may vary according to state/territory specific requirements and recommendations.

Routine screening and assessment

Routine screening at the start of employment occurs in three forms:

- *personal assessment of disease and immune status*—a questionnaire (with recording of information gained) should check for details of medical history, particularly for rubella, measles (rubeola), mumps, chickenpox (varicella), hepatitis B, immune disorders and skin conditions, and for prior exposure to tuberculosis (including working in high-risk settings and high-risk demographic background)
- *immunisation*—(see Section C2.2.2)
- *laboratory and other testing*—this should include a routine tuberculin skin test. Routine screening for patients who are streptococcus carriers is not recommended, although this form of screening may be instituted in the case of an outbreak.

These principles for screening and immunisation also apply to any healthcare students, work experience students and volunteers who are likely to be exposed to potential risks.

Pre-employment screening and immunisation

Pre-employment screening and immunisation requirements for healthcare workers can be determined using a risk classification system that assesses the exposure to blood and body substances. Work activities, rather than job title, must be considered on an individual basis when determining risk categorisation.

All Category A healthcare workers (see Table C2.1) are required to be able to provide evidence of serological immunity or vaccination history. Acceptable evidence of protection includes a written record of vaccination signed by the provider and/or serological confirmation of protection. This does not include a statutory declaration.

Table C2.1: Determining risk categorisation for pre-employment screening and immunisation

Category	Risk	Examples
A	Direct contact with blood or body substances This category includes all persons who have physical contact with, or potential exposure to, blood or body substances	dentists, medical practitioners, nurses, allied health practitioners, health care students, laboratory staff, maintenance engineers who service equipment, sterilising service staff, cleaners, and staff responsible for the decontamination and disposal of contaminated materials.
B	Indirect contact with blood and body substances Rarely have direct contact with blood or body substances. These employees may be exposed to infections spread by the airborne or droplet routes, but are unlikely to be at occupational risk from blood borne diseases.	catering staff and ward clerks
C	Minimal patient contact Occupational groups that have no greater exposure to infectious diseases than do the general public. The exact nature of job responsibilities should be taken into account when deciding immunisation requirements, and all staff should be encouraged to be fully vaccinated.	office clerical staff, gardening staff and kitchen staff
Laboratory staff	May have additional vaccination requirements if they are working with or may be exposed to specific agents, e.g. Q Fever; anthrax, poliomyelitis, Japanese encephalitis	

Source: Adapted by the Committee from NSW policy *Occupational Assessment, Screening and Vaccination Against Specific Infectious Diseases PD2007_006*.

Vaccine	Risk category	Vaccination/ screening notes	Occupational considerations
Hepatitis A	A		Recommended for healthcare workers who work with remote indigenous communities, persons with intellectual disabilities childcare staff, maintenance staff in contact with sewage.
Hepatitis B	A	To be considered immune a blood test result (anti-HBs) must be provided. Anti-HBs >10 at any stage post vaccination indicates lifelong immunity to hepatitis B.	Healthcare workers must be aware of their status if performing exposure prone procedures (EPP) by undertaking testing every 12 months (refer to guidelines).
Hepatitis C	A		
HIV	A		
Influenza	A,B		Annual seasonal influenza vaccine may be offered to all staff
Measles Mumps Rubella (MMR)	A,B,C	Birthdate prior to 1966 or documented history of 2 measles-containing vaccines. Serology to confirm immunity to all three if uncertain.	Cat C staff should be included as measles is highly infectious
Pertussis	A,B	One booster dose (or full course if not previously vaccinated)	Staff working with neonates and pregnant women are at high risk of exposure and of transmitting infection to vulnerable patients
Tuberculosis (TB)	A	Tuberculin skin test prior to commencement of employment; record to be available for subsequent placements. Chest x-ray report is required for healthcare workers with positive Mantoux result.	Vaccination of healthcare worker who may be at high risk of exposure to drug-resistant cases of tuberculosis
Chicken Pox (Varicella)	A,B	Healthcare workers can be considered immune if they have a documented medical history of chicken pox or shingles. Healthcare workers with an unsure history should have serological screening.	To be considered for healthcare workers with patient contact

C2.2.2 Immunisation

Employers should take all reasonable steps to ensure that staff members are protected against vaccine-preventable diseases. Where healthcare workers may be at significant occupational risk of acquiring or transmitting a vaccine-preventable disease, a comprehensive occupational vaccination program should be implemented. Such a program should include:

- a vaccination policy
- maintenance of current staff vaccination records
- provision of information about the relevant vaccine-preventable diseases
- the management of vaccine refusal (which should, for example, include reducing the risk of a healthcare worker transmitting disease to a vulnerable patient).

Healthcare facilities should advise healthcare workers of the potential consequences if they refuse

reasonable requests for immunisation. Such advice and refusal to comply should be documented. Duties may be modified if healthcare workers have a confirmed infection that may directly affect the risk of transmission of infection during exposure-prone procedures. This is determined at the local facility level.

Vaccine refusal, contraindication to vaccination and vaccine non-response may be managed by ensuring appropriate work placements, work adjustments and work restrictions.

Recommended vaccinations

The most recent edition of *The Australian Immunisation Handbook* (currently NHMRC 2008) provides detailed information on immunisation schedules and vaccines. Staff vaccination programs should comply as much as possible with these schedules, which acknowledge that some circumstances may require special consideration before vaccination.

Table C2.2: Recommended vaccinations for all healthcare workers

Occupation	Disease/vaccine
Healthcare workers	
All healthcare workers: including all workers and students directly involved in patient care or the handling of human tissues	Hepatitis B Influenza Pertussis (dTpa, provided dTpa has not been given previously) MMR (if non-immune) Varicella (if seronegative)
Healthcare workers who work with remote Indigenous communities in NT, QLD, SA and WA; medical, dental and nursing undergraduate students (in some jurisdictions)	Vaccines listed for 'All healthcare workers', plus hepatitis A
Healthcare workers who may be at high risk of exposure to drug-resistant cases of tuberculosis	Vaccines listed for 'All healthcare workers', plus BCG

Source: *Australian Immunisation Handbook* Available at: <http://www.health.gov.au/internet/immunise/publishing.nsf/Content/Handbook-specialrisk238>

Pre-vaccination screening

Pre-vaccination screening is outlined in Section 1.3.4 of the *Australian Immunisation Handbook*, including a pre-vaccination checklist.²⁷ Healthcare facilities should have education programs to support their immunisation policy and reinforce the need for compliance.

C2.2.3 Staff records

Employers and healthcare facilities need to retain details of screening results and immunisations provided, including vaccine preventable disease history, date and results of serology, record of immunisations consented/ refused, date given and batch number, type and brand name of vaccine.

Records need to be secure and accessible by authorised personnel when needed, updated when relevant events occur, and maintained in accordance with confidentiality and privacy laws.

²⁷ See <http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/handbook-prevaccination-screening>.

C2.3 Exclusion periods for healthcare workers with acute infections

Every healthcare facility should have comprehensive written policies regarding disease-specific work restriction and exclusion, which include a statement of authority defining who can implement such policies.

Any employee who has an infectious disease has a responsibility to:

- consult with an appropriate medical practitioner to determine that they are capable of performing their tasks without putting patients or other workers at risk
- undergo regular medical follow-up and comply with all aspects of informed clinical management regarding their condition.

These policies should encourage healthcare workers to seek appropriate preventive and curative care and report their illnesses, medical conditions, or treatments that can render them more susceptible to opportunistic infection or exposures. They should not penalise healthcare workers with loss of wages, benefits, or job status.

The overarching principle for exclusion periods is that staff members should not come to work if they have signs or symptoms of a potentially infectious disease.

Table C2.3: Staff exclusion periods for infectious illnesses

Acute infection	Exclusion period
Conjunctivitis	Must not provide patient care for the duration of symptoms (i.e. while eye discharge is present).
Gastroenteritis* (except norovirus)	Must not come to work while symptomatic (e.g. diarrhoea and/or vomiting) and until 24 hours after symptoms have resolved
Glandular fever	NO need for exclusion, even if having direct patient contact, provided staff members are well enough to return to work and employ standard precautions.
Herpes Simplex (cold sores)	Must not provide direct care to neonates, newborns, patients in delivery suites, severely immunocompromised patients, burns patients, patients with extensive eczema, or patients in operating room if there is an exposed herpetic lesion May provide direct patient care to other patients, do not need to wear a mask
Herpes Zoster (Shingles)	Must not provide ANY direct patient care if lesions cannot be covered (e.g. ophthalmic zoster) If active lesions can be covered, can provide care to all patients except for pregnant women, neonates, severely immunocompromised patients, burns patients and patients with extensive eczema.
Influenza	Employees should remain off work for 5–6 days or until they are symptom free
Norovirus	Must not come to work while symptomatic (e.g. diarrhoea and/or vomiting) and until 48 hours after symptoms have resolved (see GPP below)
Pertussis (Whooping Cough)	Remain away from work until at least 5 days after commencement of appropriate antibiotic therapy; or for 21 days after the onset of symptoms if not receiving antibiotic treatment.
Scabies and Lice	Remain off work until 1st treatment has been completed.
Staphylococcal infection	Any staphylococcal lesions (e.g. boils, wound infections) must be covered with an occlusive dressing while at work. If lesions cannot be covered, must not perform patient care or prepare hospital food until they have received appropriate antibiotic therapy and the infection has resolved

Acute infection	Exclusion period
Streptococcal infection	Any employee with streptococcal lesions (e.g. impetigo, tonsillitis) must ensure that lesions are covered with an occlusive dressing while at work. If lesions cannot be covered, employees must not provide direct patient care nor prepare hospital food until 24 hours after commencement of appropriate antibiotic therapy. Employees with pharyngitis/tonsillitis should avoid patient contact for at least 24 hours after starting appropriate antibiotic therapy.
Tuberculosis (TB)	If TB disease is suspected or is present, staff to be notified to TB Services and treated. Any personnel with pulmonary TB is to be excluded from the workplace until cleared by TB Services. Any active TB must be monitored by TB Services.
Viral rashes	<p>Measles (Rubeola)—If suspected, must remain off of work until appropriate test results are known. May return to work if they have serological evidence of immunity (i.e. are IgG sero-positive and IgM sero-negative); but must be excluded until 4 days after the appearance of the rash if they develop measles.</p> <p>Mumps—If suspected, must remain off work until appropriate test results are known. May return to work if they have serological evidence of immunity (i.e. are IgG sero-positive and IgM sero-negative). Must be excluded from work for 9 days after the onset of parotid gland swelling if they develop mumps.</p> <p>Rubella (German Measles)—If suspected, must remain off of work until appropriate test results are known. May return to work if they have serological evidence of immunity (i.e. are IgG sero-positive and IgM sero-negative). Personnel must be excluded for 4 days after the appearance of the rash if they develop Rubella.</p> <p>Chickenpox (Varicella)—Before starting employment, personnel should be screened by completing a pre-employment health assessment; non immune staff should be offered vaccination unless contraindicated; personnel must be until all blisters have dried.</p> <p>Human Parvovirus B19 (Slapped Face)—does not require exclusion from work, non-infectious once rash develops.</p>
Viral respiratory tract infections (e.g. common cold).	Staff should be excluded from contact with susceptible persons, until they are no longer symptomatic. Staff with viral respiratory tract infections should stay at home until they feel well.

* Includes giardiasis, *Shigella* infection, *Salmonella* infection, *Campylobacter* infection

Source: Adapted from Staying Healthy in Child Care - Preventing infectious diseases in child care - Fourth Edition

Good practice point

Norovirus exclusion periods

Healthcare workers should not return to work until diarrhoea and vomiting have ceased for 2 days.

It is extremely important that healthcare workers comply with appropriate hand hygiene methods and stringent infection prevention and control practices upon return to work, as some studies have shown prolonged viral shedding with this infection.

C2.4 Healthcare workers with specific circumstances

Healthcare facilities need to assist healthcare workers experiencing circumstances that place them at greater risk of infection to develop management plans that ensure their well-being.

Where a healthcare worker is known to be particularly susceptible to healthcare associated infections, work duties are assessed to ensure that the welfare of that person, patients and other healthcare workers is safeguarded. This may involve appropriate work placements, adjustments or restrictions, or deployment to a role involving less risk. Healthcare workers in this situation may require counselling on what tasks they can perform, what they should avoid and the possible impact of their work on their health.

C2.4.1 Pregnant healthcare workers

Employers should provide information on the risks associated with pregnancy and should assist pregnant healthcare workers to avoid infectious circumstances that may present a risk to her or the baby. It is the responsibility of pregnant healthcare workers to advise their doctor and employer of their pregnancy; this information must remain confidential.

All pregnant healthcare workers should adhere to standard and transmission-based precautions and ensure that they are appropriately vaccinated. However, pregnant healthcare workers should be given the opportunity to avoid patients with specific infections.

For more information, refer to Section 2.3.2 of the *Australian Immunisation Handbook*.

C2.4.2 Immunocompromised healthcare workers

Healthcare workers with immune deficiencies are more at risk of acquiring infections. The type of employment they can undertake should include only duties that will minimise their exposure to infections. Predisposing conditions include neutropenia, disseminated malignancy and infections that produce immunodeficiency (e.g. HIV).

Refer to Section 2.3.3 of the *Australian Immunisation Handbook* for guidance on the immunisation of immunocompromised healthcare workers.

C2.4.3 Healthcare workers with skin conditions

Skin integrity is the ultimate barrier to transmission of infectious agents. When staff members have damaged skin or weeping skin conditions (e.g. allergic eczema, psoriasis, exfoliating dermatitis), they may be readily colonised by healthcare associated microorganisms and may become a vehicle for disseminating these organisms. Healthcare workers in this situation should be identified by personal history screening when they start employment, and need to be informed of the risks they may pose to patients. Any damaged skin must be appropriately covered before healthcare workers carry out procedures. Consideration must be given to providing these staff members with appropriate, individual PPE such as specific types of gloves, hand hygiene product and moisturising lotion.

C2.5 Exposure-prone procedures

Exposure prone procedures (EPPs) are invasive procedures where there is potential for direct contact between the skin, usually finger or thumb of the healthcare worker, and sharp surgical instruments, needles, or sharp body parts (e.g. fractured bones), spicules of bone or teeth in body cavities or in poorly visualised or confined body sites, including the mouth of the patient.

During EPPs, there is an increased risk of transmitting bloodborne viruses between healthcare workers and patients. A list of EPPs is in Section B5.3. The nature of EPPs can be categorised according to level of risk of transmission, in increasing order of magnitude.

Table C3: Categories of exposure prone procedures

Category 1	A procedure where the hands and fingertips of the healthcare worker are usually visible and outside the body most of the time and the possibility of injury to the worker's gloved hands from sharp instruments and/or tissues is slight. This means that the risk of the healthcare worker bleeding into a patient's open tissues should be remote (e.g. insertion of a chest drain).
Category 2	A procedure where the fingertips may not be visible at all times but injury to the healthcare worker's gloved hands from sharp instruments and/or tissues is unlikely. If injury occurs it is likely to be noticed and acted upon quickly to avoid the healthcare worker's blood contaminating a patient's open tissues (e.g. appendectomy).
Category 3	A procedure where the fingertips are out of sight for a significant part of the procedure, or during certain critical stages, and in which there is a distinct risk of injury to the healthcare worker's gloved hands from sharp instruments and/or tissues. In such circumstances it is possible that exposure of the patient's open tissues to the healthcare worker's blood may go unnoticed or would not be noticed immediately (e.g. hysterectomy).

Source: DH/HP/GHP3. *HIV Infected Health Care Workers: Guidance on Management and Patient Notification*. London; 2005

C2.5.1 Responsibilities

Employers

Employers must ensure that employees who perform EPPs have access to appropriate information, testing, training, counselling and vaccination programs. Serological testing may be provided by the healthcare facility or healthcare workers may choose to seek testing from outside sources. Healthcare facilities should aim to achieve voluntary compliance and self-disclosure by providing an environment in which healthcare workers know their confidentiality will be maintained.

Under current notification requirements, medical practitioners or laboratories must notify the chief medical officer or state/territory health department of cases of HIV, HBV and HCV, by either name or code.

A medical practitioner may be legally obliged to bring to the attention of the appropriate registration board any registered professional who is unable to practise competently or who poses a threat to public safety.

Healthcare workers who need to modify their work practices because they are carriers of a bloodborne virus should be provided with counselling and, where practical, with opportunities to continue appropriate patient-care activities, either in their current position or in a redeployed position, or to obtain alternative career training.

Healthcare workers

Healthcare workers who undertake EPPs have a responsibility to know their infectious status with regard to bloodborne viruses such as hepatitis B virus, hepatitis C virus and HIV, and should be given relevant information about the tests available and encouraged to have voluntary testing.

Healthcare workers who carry a bloodborne virus have a clear responsibility to follow the treatment recommended by their doctor and modify their involvement in direct patient care. They **must not** perform EPPs if they are:²⁸

- HIV antibody positive
- hepatitis B e antigen (HBeAg) positive and/or hepatitis B DNA positive at high titres²⁹
- hepatitis C RNA positive (by nucleic acid test).

Healthcare workers who carry a bloodborne virus and are not in these categories must not perform EPPs until specialist medical advice has been sought.

Healthcare workers who are currently hepatitis B surface antigen (HBsAg) positive and hepatitis B DNA negative or hepatitis C antibody positive and hepatitis C RNA negative must obtain ongoing medical advice regarding their potential infectiousness and the appropriateness of their continued performance of EPPs.

Healthcare students

Conditional registration may be required for students who have had to undertake modified training programs. This will require an undertaking that individuals who are known to carry HIV, HCV or HBV will report their infectious status at the start of their training and agree not to perform EPPs. Training courses that require the performance of EPPs should include information, counselling, opportunities for testing and career advice.

Training institutions should counsel student healthcare workers carrying bloodborne illness capable of being transmitted through EPPs, against a career in any profession that may involve such procedures.

C2.6 Occupational hazards for healthcare workers

Needlestick and other blood or body substance incidents are the main causes of occupational hazards for healthcare workers, including HIV, HBV and HCV.

C2.6.1 Sharps injuries

Healthcare workers face the risk of injury from needles and other sharp instruments during many routine procedures. Injuries most often occur after use and before disposal of a sharp device, during use of a sharp device on a patient and during disposal (CDC 2009). There are many possible mechanisms of injury during each of these periods.

Measures to help combat needlestick and other sharps injuries include: training and education on the risks associated with procedures and on the use of needlestick devices; and safer working practices (including adherence to proper handling and disposal procedures and ensuring that disposal containers are not overfilled [see also Section C1.5.1]).

The use of devices with safety engineered protective features was mandated in the US in 2000 and has been associated with reduced rates of incidence of needlestick injuries (Jagger et al 2008). Despite difficulties in determining the direct impact of using safety-engineered devices compared to standard devices, safety-engineered devices are an important component in percutaneous injury prevention (Tuma & Sepkowitz 2006). Typically a sharps-injury campaign involves multi-modal strategies. As a result many studies that show a reduction in incidence of needlestick injuries

28 Communicable Disease Network Australia Guidelines for Managing Blood-Borne Virus Infection in Health Care Workers 2005, which are currently under review.

29 Previously published guidelines have stated that HCWs must not perform EPPs if they are HBeAg positive and/or hepatitis B DNA positive at high titres. Whether HCWs with any level of hepatitis B DNA should perform EPPs is under review by Australian infectious disease experts. When there is a nationally agreed approach this Guideline will be updated, but in the mean time, HCWs wishing to perform EPPs who are hepatitis B DNA positive should consult their local health authority for advice.

with the use of safety engineered devices have also involved a combination of other intervention measures such as training and education, overarching healthcare facility policies and other technologies (Whitby et al 2008).

Australia is the only country with well-developed systems of infection prevention and control and occupational health and safety that has not yet mandated the use of safety or retractable devices. Such mandates exist in the USA, Canada and most recently the European Union, including the UK. The current UK policy recommends the provision of medical devices that incorporate a sharps protection mechanism where there are clear indications that they will provide safe systems of working for healthcare workers. Consideration of economic and social costs, staff preferences, ease of use, and time required to train staff is necessary before widespread implementation of safety-engineered devices in Australia. In the meantime, if a facility chooses to use safety-engineered devices, introduction of the devices must be supported by a comprehensive training and education program.

C2.6.2 Managing risk of exposure

Exposures that might place a healthcare worker at risk of hepatitis B virus, hepatitis C virus, HIV or human T-cell lymphotropic virus type I (HTLV-I) are percutaneous injury (e.g. needlestick or cut with a sharp object) or contact of mucous membrane or non-intact skin (e.g. exposed skin that is chapped, abraded, or affected by dermatitis) with blood, tissue or other potentially infectious body substances.

Each healthcare facility requires a policy on the management of needlestick injuries, and on providing immediate post-exposure advice for sharps injuries and other blood or body substance incidents involving healthcare workers, as generic policies may not be relevant to individual settings (e.g. access to care, especially after hours).

Treatment protocols include removal of contaminated clothing, thorough washing of the injured area with soap and water; and flushing of affected mucous membranes with large amounts of water.

Healthcare workers should be aware that they must report occupational exposures immediately.

Post-exposure prophylaxis

Post-exposure prophylaxis (PEP) is the medical response given to prevent the transmission of bloodborne pathogens following a potential exposure. PEP includes first aid, counselling including the assessment of risk of exposure to the infection, testing, and depending on the outcome of the exposure assessment, the prescription of antiretroviral drugs, with appropriate support and follow-up (WHO 2008).

- For people who have an exposure to a known source, post exposure prophylaxis (PEP) should be offered for HIV as soon as possible after the incident. Initiation of HIV PEP depends on the type of exposure, the source's stage of HIV infection, the source's HIV viral load and the source's history of HIV antiretroviral therapy. Therefore, a thorough assessment of risk guides the actions to be taken.
- Initiation of HBV PEP is dependent on the type of exposure, the source's HBsAg status and the exposed persons HBV immunisation history.
- At this time, there is no prophylaxis proven to be effective for Hepatitis C. The aim of follow up is to detect acute hepatitis C as soon as possible so that appropriate management can be instituted.

Standard guidelines for pre-test counselling or pre-test discussions for HIV, HBV and HCV must be followed when testing the source and the healthcare worker.

Specific guidance on PEP can be found in WHO guidelines (WHO 2008) and CDC (2005). The ASHM guidelines are relevant to non-occupational exposure but include references to jurisdictional guidelines for occupational exposure (see Section C7 for links).

C3 Education and training

Summary

- Education and training underpin efforts to integrate infection prevention and control practices into practice at all levels of every healthcare facility.
- Essential education for all healthcare workers should cover infection prevention and control work practices and their role in preventing the spread of infection, as part of undergraduate education, staff orientation and continuing professional development.
- Specific postgraduate education of infection control professionals is strongly recommended.
- Engaging patients, their carers and families in their own healthcare is integral to effective infection prevention and control. All healthcare workers should be informed about the rights and responsibilities of patients and learn how to apply this understanding in the way that they deliver care.

C3.1 Universities and training colleges

All healthcare workers need to understand the basis and importance of infection prevention and control. Up-to-date information on infection prevention and control basics, policy, procedures, quality assurance and incident monitoring should be included in the curriculum of all undergraduate and postgraduate courses in health-related areas.

Universities and training colleges also have an obligation to inform prospective students about the impact that particular infections may have on their ability to complete the course and engage in the full spectrum of clinical practice after graduation (see Section C2). This information should include advice about specific measures, including immunisation, that reduce the risk of acquiring infection.

C3.1.1 Education of infection control professionals

While some states in Australia have requirements for practising as an infection control professional, there is currently no minimum or standardised educational requirement to practice as an infection control professional, or to coordinate an organisational IPC program. A range of postgraduate education programs are currently available for nurses seeking or establishing a career in infection control in Australia, although the content of these courses is variable.

Good practice point

Education of infection control professionals

Postgraduate education gives infection control professionals the necessary expertise to fulfil the role. Specific professional development should be supported at all levels.

Case study—Requirements for infection control professionals in Tasmania³¹³⁰

Senior infection control professionals (e.g. at Clinical Nurse Consultant or Clinical Nurse Manager level) must have adequate skills including:

- *formal post graduate qualifications at a Diploma level and working towards a Masters degree or higher in an area relevant to infection prevention and control*
- *being a credentialled infection control professional (AICA or CBIC)*
- *participation in professional development opportunities including attendance at relevant state and/or national professional organisation meetings in accordance with Award conditions.*

Infection control professionals at clinical nurse or clinical nurse specialist level must:

- *have formal postgraduate qualifications at a Certificate level or higher in an area relevant to infection prevention and control*
- *have regular access to professional and clinical support*
- *participate in professional development opportunities*
- *be credentialled (AICA or CBIC).*

C3.2 Healthcare worker education

Healthcare facilities should provide specific education and training for all healthcare workers and students about infection prevention and control principles, policies and procedures that are relevant to the facility. The aim is to inform and educate healthcare workers about the infectious hazards they will face during their employment, and their role in minimising the spread of infection to others. Special attention should be given to advice about hand hygiene (see Section C3.4). The role of clinical educators in providing this education needs to be supported, as they provide a vital link between teaching and healthcare facilities.

At a minimum, all staff (both clinical and non clinical) should be educated about:

- modes of transmission of infectious agents
- risk identification, assessment and management strategies including transmission-based precautions
- orientation to the physical work environment with a focus on its risks for infection
- safe work procedures
- correct use of standard precautions
- correct choice and use of PPE, including procedures for putting on and removing PPE and fit checking of respirators
- appropriate attire (shoes/hair/nails/jewellery)
- hand hygiene practices (see case study in Section C3.4)
- levels of cleaning required for clinical areas and equipment
- how to deal with spills
- safe handling and disposal of sharps
- reporting requirements of incidents such as sharps injuries and exposures
- waste management
- antibiotic policy and practice.

³⁰ As outlined in the Tasmanian Healthcare Associated Infection Prevention Strategy 2009–11

This information should be provided in the context of their roles in the organisation or practice, and with a focus on respecting and maintaining patient confidentiality at all times. It should be provided as part of their orientation, with periodic updates and refresher courses as required for their specific jobs.

Healthcare workers may also require job or task-specific education and training, such as:

- instrument cleaning and sterilisation competency testing
- insertion and management of central and peripheral lines
- risks and prevention of MRO transmission.

Job-specific training should be provided as part of orientation, when new procedures affect the employee's occupational exposure, before rostering to hazardous areas (e.g. caring for patients on airborne precautions in a negative pressure room); and at a minimum, in annual refresher courses. Healthcare workers should be assessed to ensure that they are competent in using and consistently adhering to the specific infection prevention and control practice. Healthcare facilities should maintain records of participation by healthcare workers in infection prevention and control education programs.

C3.3 Education strategies

The term 'educational strategies' encompasses a wide range of commonly applied interventions that aim to bring about and sustain changes in the practice of healthcare workers. A review was undertaken to inform the development of these guidelines, identifying relevant systematic reviews of educational interventions in general healthcare settings and, more specifically, where education has been used to reduce healthcare associated infections and improve hand hygiene in the workplace.

Examples of education activities include:

- educational meetings, either didactic (e.g. lecture, presentation) or interactive (e.g. workshop with role play and case discussion)
- educational materials, either printed or audiovisual
- educational outreach, where an intervention is delivered by a visiting infection prevention and control expert
- continuing medical education
- multifaceted, tailored interventions to address barriers to good practice
- inter-professional education.

While the overall findings of the reviews were inconclusive, they did identify some consistent trends:

- Multifaceted strategies, which consider the needs of the target group, potential barriers and facilitators and the context in which educational strategies are applied, are likely to be more effective than single strategies, although it is not known what combination of interventions, if any, is optimal.
- Active educational interventions that are repeated with some frequency have a greater chance of changing behaviour than a single, didactic session. Repetition and interactivity have both been shown to be important factors in achieving behaviour change that is sustained.
- The distribution of printed materials on their own was not found to be consistently effective, but may contribute when included in a multifaceted intervention. The use of multiple forms of media in an education intervention may be more effective than the use of single media.
- Educational outreach visits have been found to be an effective method, especially when combined with other strategies such as interactive education and printed materials, but are costly to implement. They seem to be most effective when related to prescribing practices of moderate complexity.

Education activities can be integrated into staff orientation programs, credentialling packages,

annual training and competency testing, implementation of policy and procedure manuals, and in decision support tools available on the facility intranet. The infection control professionals' contact details should be readily available to all staff and included in all resources.

E-learning (e.g. interactive web-based training) is being used in some states, and may be a useful addition to other education strategies. For example, the Queensland Health Clinician Development Education Service offers interactive flexible on-line learning programs across a wide range of topics, including infection prevention and control, which are available 24 hours a day from work or home.

C3.4 Example of education in practice—hand hygiene

Hand hygiene is the most important of the infection prevention and control strategies. According to the *Hand Hygiene Australia Manual*, healthcare workers must perform hand hygiene before and after every patient contact to prevent patients becoming colonised with pathogens from other patients and the healthcare facility environment. Emphasis must also be placed on preventing the transfer of organisms from a contaminated body site to a clean body site during patient care. The latest guidelines also recommend hand hygiene after contact with inanimate objects, including medical charts and equipment in the immediate vicinity of the patient.

Hand hygiene is a good example of the role of education in efforts to improve infection prevention and control practice. Although the concept of hand hygiene is straightforward, improving hand hygiene practices involves changing attitudes and behaviour among healthcare workers. Numerous barriers to appropriate hand hygiene have been reported, several of which reflect lack of understanding and knowledge (Grayson et al 2009):

- all hand hygiene agents being thought to cause skin irritation and dryness
- patient needs being perceived to take priority over hand hygiene
- perception that glove use dispenses with the need for additional hand hygiene
- belief that there is insufficient time for hand hygiene, due to high workload
- inadequate knowledge of guidelines or protocols for hand hygiene
- lack of role models
- lack of recognition of the risk of cross-transmission of microbial pathogens.

As discussed in Section B1.1, the use of alcohol-based hand rub, coupled with changes in the recommended indications for hand hygiene and a change in attitudes and behaviour of healthcare workers provides the best approach to preventing HCAI transmission.

C3.4.1 National Hand Hygiene Initiative

Recent hand hygiene programs in Victorian hospitals have led to significantly increased compliance with hand hygiene (Grayson et al 2008; Johnson et al 2005). These were comprehensive culture-change programs involving widespread availability of alcohol-based hand rubs in clinical areas and targeted education of healthcare workers.

The National Hand Hygiene Initiative (NHHI) coordinated by ACSQHC is based on the above studies and the WHO '5 moments' program. It aims to implement a national approach to improving hand hygiene and monitoring its effectiveness. In the initiative, healthcare worker education is a key component of a multi-modal intervention strategy, involving basic educational sessions for all healthcare workers, including:

- definition, impact and burden of HAI
 - common pathways for disease transmission, specifically the role of hands
 - prevention of HAI and the role of hand hygiene
 - 5 Moments for Hand Hygiene – with key messages
 - when to perform hand hygiene
 - use of alcohol-based hand rubs
 - use at point of care.
- As well as introductory educational sessions, a program of formal regular sessions and updates is recommended, taking the form of specific orientation programs, in-service lectures or special workshops. All education sessions are supported by an online training package, DVD, video demonstrations of each of the five moments, and slide presentations.

Other opportunities for education include:

- informal education opportunities in day-to-day activities such as nursing ward rounds, clinical unit meetings, increased presence on the ward by infection prevention and control staff, and prompt feedback of compliance results
- promotional activities to raise awareness, with promotional products (e.g. stickers) or incentives for staff who attend education sessions.

For healthcare workers, a multi-modal approach is also recommended, led by hand hygiene champions who encourage all staff to act as role models for others. Other opportunities include regular scientific presentations at surgical and medical meetings, including Grand Rounds, and regular attendance by infection prevention and control staff at medical ward rounds. All healthcare workers should be regularly assessed for their hand hygiene compliance and be provided with rapid feedback of results (see 3.5.1).

Other measures to increase compliance with hand hygiene are discussed in Section C6.

C3.5 Patient engagement

Informing patients and carers about infection prevention strategies and taking their experience and feedback into account are pivotal to safe and effective clinical care. Patient engagement is not just about giving information, it is a process of informing, listening and interacting that gives patients the skills and knowledge to be actively involved in their own health care, give feedback and participate in quality improvement activities.

Through open, respectful interactions with healthcare workers, patients and carers can be given information and support to ensure that they are able to maintain a safe environment in which they receive their care (e.g. information on caring for wounds, basic advice on hand hygiene and spread of infection).

Written material (such as brochures and posters) can be used to reinforce verbal discussions with patients as part of their care. Examples of useful instructional materials for patients and visitors include:

- recommended hand hygiene
- respiratory hygiene and cough etiquette practices
- the need for and application of transmission-based precautions
- information about specific MROs (e.g. MRSA or *C. difficile*) and how to stop them spreading.

Patient engagement is especially important in the event of a gastroenteritis or influenza outbreak or entry into a ward that houses immunosuppressed patients.

C3.6 Compliance and accreditation

C3.6.1 Auditing

Auditing of healthcare worker behaviour is important for surveillance and accreditation, and to reinforce positive signs of culture change within the facility. Auditing to measure compliance with infection prevention and control policies and procedures can occur through:

- direct observation
- examining logs and registers of specific activities (e.g. sterilisers)
- monitoring use of PPE or hand hygiene products.

Timely feedback is a critical aspect of auditing. In acute-care settings, measurement and feedback generally occurs at ward level.

C3.6.2 Accreditation and credentialing

AICA (Australian Infection Control Association), the peak national body representing the interests of the specialist practice of infection prevention and control within Australia, recommends certificated credentialing of infection control professionals. This is a self-regulatory process to determine and acknowledge that an individual has demonstrated prescribed competence of the relevant specialist nursing role.

C3.6.3 Mentoring, support and networking

While there are no formal mentoring programs in place, many infection control professionals provide mentoring to less experienced staff. Mentoring requires the support of health facility administrators, so that it is recognised as being part of healthcare worker core time, but additional to their workload. Mentoring can also take place more broadly, as illustrated in this case study.

Mentoring of infection control professionals in Tasmania

The Tasmanian Infection Prevention and Control Unit established a forum for infection control professionals to get together every two months. All infection control professionals working in acute hospitals are encouraged to join in via video conference. Each forum, three to four infection prevention and control related research papers are presented and discussed. Each infection control professional is expected to present one paper in a 12-month period. Included in the forum is discussion around current issues faced or new developments in the world of infection prevention and control.

There are networking and support forums available through AICA and the AICA state and territory affiliated associations, as well as region-based forums, and infection control professionals can also use other informal networks and contacts with other infection control professionals.

C4 Healthcare-associated infection surveillance³¹

Summary

- Appropriate surveillance can substantially reduce healthcare-associated infections, morbidity and mortality.
- Both outcome and process measures are used for surveillance in large health facilities; process measures alone can provide a useful alternative, particularly in smaller facilities.
- Timely targeted feedback is critical for effective surveillance.

Many infections can be prevented using approaches based on quality and safety theories such as:

- quality improvement methodologies
- creating a safety culture (individuals taking responsibility for ensuring safety and quality of themselves and others)
- application of systems thinking (i.e. understanding the factors in the system that allow errors to occur).

To be successful, all these approaches need to be based on comprehensive information obtained through surveillance—‘the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health’ (CDC 2001).

All healthcare facilities require healthcare-associated infection surveillance systems—local data collection that results in timely feedback has been shown to reduce infection rates.

C4.1 Role of surveillance in reducing HAI

Surveillance is important for wider systems of quality management, but the main purpose of collecting reliable data is to improve quality within a service or facility. Collecting such data can provide the impetus for change and make it possible to evaluate the effectiveness of an intervention. For example, monitoring both hand hygiene compliance and the rate of bloodstream infections, and disseminating the information within the facility, can improve hand hygiene practices.

Surveillance of healthcare-associated infections draws information about the agent, host, environment and risk factors from a number of data sources:

- provides baseline information on the frequency and type of HAI
- enables breakdowns in infection prevention and control to be identified
- allows for timely investigation and appropriate infection prevention and control measures to be instituted.

There is a surveillance cycle, described as ‘data collection–data analysis and interpretation–data dissemination’ (Rothman et al 1998).

All healthcare facilities, including small acute-care facilities and office practices, should collect data on healthcare-associated infections, infection prevention and control breaches, outbreaks of infectious disease and antibiotic resistance. Post-discharge surveillance by community-based healthcare practices should also be considered.

³¹ Unless otherwise specified, this section is drawn from the ACSQHC report Cruickshank M & Ferguson J (eds) (2008) Reducing Harm to patients from Health care Associated Infection: The Role of Surveillance. Australian Commission for Safety and Quality in Health Care.

The surveillance system used by a healthcare facility depends on the type and size of the facility, its case mix, and the resources available.

C4.2 Types of surveillance programs

It is not feasible to conduct facility-wide surveillance for all events; therefore surveillance is often targeted, with a focus on specific events, processes, organisms, medical devices or high-risk patient populations. Healthcare-associated infections surveillance programs may focus on:

- specific sites of infection (e.g. bloodstream, surgical sites)
- specific populations (e.g. neonates, healthcare worker occupational exposure to blood and body substances)
- specific organisms or types of organisms (e.g. MRO, *C.difficile*, RSV, rotavirus)
- specific locations in the healthcare facility or community (e.g. intensive care unit, neonatal intensive care unit, long-term care facility).

There are two main methods of surveillance—process and outcome. Process measurements are usually easier to measure, less ambiguous and more widely applicable than outcome indicators. Process surveillance may be an adjunct to outcome surveillance; alternatively, it can entirely replace outcome surveillance for practices or locations that have too few adverse outcomes for statistical analysis (e.g. small facilities where the number of patients at risk of infection may be too small to calculate valid infection rates).

C4.2.1 Process surveillance

Process surveillance involves auditing practice against a certain standard, guideline or policy. As no single intervention will prevent any healthcare-associated infection, packages of evidence-based interventions have been developed and are increasingly being used in process surveillance (e.g. care bundles, see also Sections B4 and C1.5).

Process measures that are linked by evidence to important outcomes (McKibben et al 2005):

- do not require risk adjustment
- can predict outcomes
- can easily be acted on because potential improvements are usually the responsibility of the clinical service
- can be captured quickly
- are sensitive because many episodes of inappropriate care do not cause harm.

Examples of published process indicators of high value include:

- aseptic insertion and management of peripheral or central intravascular devices
- healthcare workers' compliance with hand hygiene and the techniques they used
- perioperative and intraoperative practice such as antibiotic prophylaxis, normothermia, normoglycaemia and appropriate hair removal
- healthcare workers' uptake of immunisation.

C4.2.2 Outcome surveillance

Outcome surveillance involves measuring adverse events, a proportion of which are preventable. The sensitivity and specificity of event definitions and the reliability of data collection need to be considered when developing methods to detect adverse events. It is important to create a balance between avoiding false positives (specificity) and picking up true positives (sensitivity), given that true positives are rare events in the overall patient population.

Certain outcome measures—for example, the incidence of healthcare-associated MRSA bacteraemia—appear to be reliable and have driven practice change, leading to significant improvements in patient safety.

Outcome surveillance with laboratory-based data is used in the signal events system that was designed by Queensland and is implemented in Queensland and South Australia (see also Section C5.3). However, Australia currently has no system-wide approach to measurement of patient mortality caused by or associated with HAI. These deaths are unlikely to be reported using existing mechanisms such as adverse event reporting systems. Mortality from infection may be seen as ‘anticipated’ even though the occurrence of the infection that led to the death was unanticipated.

A further challenge in measuring patient deaths is differentiating between patients who die with a healthcare-associated infection and those who die from a healthcare-associated infection or suffer serious injury due to a healthcare-associated infection (i.e. attributable injury or death). One new approach is to evaluate such patient deaths to determine whether mortality was unexpected, and then analyse the contributing factors to determine preventable root causes that might be modified in future. In this approach, infection events (usually deaths or BSI) are considered and investigated individually. Although mandated by the UK’s National Health Service, evidence of the value of this approach is lacking.

C4.2.3 Critical incidents

If there has been a breakdown in an infection prevention and control procedure or protocol, a ‘lookback’ investigation may be necessary to identify, trace, recall, counsel and test patients or healthcare workers who may have been exposed to an infection, usually a bloodborne virus.

Lookback investigations must be managed with due regard to ethical and legal considerations. In the event of such an incident (e.g. failure of sterilisation or disinfection), the local public health unit should be advised immediately.³²

Monitoring of critical incidents and other sentinel events is an important part of surveillance. Root cause analysis of sentinel events is a structured process for identifying the process and contributing factors, exploring and identifying risk reduction strategies and implementing solutions (see Section C1.4.2).

³² The NHMRC publication *Guidelines under Section 95 of the Privacy Act 1988* provides further information on the protection of privacy in relation to the compilation or analysis of statistics for health services management or medical research.

C4.3 Data collection and management

Surveillance involves:

- defining surveyed events precisely
- systematic collection of data
- analysis and interpretation
- communication of findings to relevant people.

The following epidemiologic principles should be applied during healthcare-associated infection surveillance:

- use standardised definitions of infection
- use laboratory-based data (when available)
- collect epidemiologically important variables (e.g. clinical service in hospitals and other large facilities, population-specific risk factors, underlying conditions that predispose to serious adverse outcomes)
- analyse data to identify trends that may indicated increased rates of transmission
- feedback information on trends in the incidence and prevalence of healthcare-associated infections, probable risk factors and prevention strategies and their impact, to the appropriate healthcare workers, administrators, and as required by local and state/territory health authorities.

Surveillance data for quality improvement must be of high quality. The characteristics that qualify data as evidence for action include (Booth 1995):

- representativeness—the data fairly represent the thing measured
- accuracy—the data reflect what is intended to be measured
- precision—the data and the target of measurement correspond closely
- authoritative— the data are appropriate for drawing a meaningful conclusion
- clarity—the data are presented in a form that the target audience can understand.

Data of this nature are more likely to arise from surveillance processes:

- that involve all stakeholders in design and implementation
- for which there are agreed organisational objectives, and processes that are relevant to the population served
- that use trained staff to collect and manage data, and that provide them with appropriate information technology support
- that use definitions of surveillance events that are unambiguous, practical, specific and can be validated
- that have reliable and practical methods for detecting events
- for which the processes that determine an outcome are thoroughly understood
- for which appropriate denominators are collected for risk adjustment
- for which reporting links measurement to prevention efforts, and meets the needs of both clinicians and managers.

C4.4 Outbreak surveillance

An outbreak may be defined as the occurrence of infections at a rate greater than that expected within a specific geographical area and over a defined period of time.

Ideally, surveillance systems should facilitate the early detection of outbreaks. Increasingly, microbiological data are being relied on for this purpose, although outbreaks may be detected using other sources such as pharmacy records.

In some instances, the occurrence of an outbreak is obvious, such as in an episode of food poisoning that affects both healthcare workers and patients. It is more usual, however, for the outbreak to have an insidious onset that is not immediately apparent. When an outbreak is detected, the infection prevention and control committee should be informed and an outbreak team formed. Depending on the size and severity of the outbreak, it may be necessary to involve occupational health and safety staff, facility administrators, engineers and public health officials. Details on the steps involved in the management of an outbreak are provided in Section B3.2.

Legislation requires that the relevant public health authority be informed of outbreaks related to notifiable infections. It may also be prudent to involve public health officers at an early stage, if an outbreak is likely to come to the attention of the media.

The principles for investigating outbreaks in healthcare facilities are the same as for community-based outbreaks. There are three basic steps:

- describing the outbreak
- developing a hypothesis
- testing the hypothesis with analytical epidemiology.

The tasks involved in any investigation can be summarised as follows:

- Confirm that an outbreak is occurring.
- Determine the background rate of infection, as a temporal cluster of cases may be due to chance alone.
- Confirm the diagnosis using microbiological methods. If possible, confirm that cases are related by typing methods (which may require reference laboratory facilities).
- Define a case, and count cases. Develop a case definition that may include clinical and laboratory data. Start with a broad definition that can be redefined later. In health care establishments, case definition can be relatively easy, with data available through laboratory records and infection prevention and control surveillance data. Remember that cases may have been discharged from the establishment.
- Describe the data in terms of time, place and person and construct an epidemic curve. In healthcare facilities, age, gender and underlying disease are the most useful 'person' attributes to record. The location may suggest risk factors.
- Determine who is at risk of becoming ill.
- Look at changes that may have affected the rate of infection (eg new staff, new procedures, new tests, new units and healthcare worker:patient ratios).
- Develop a hypothesis and test it by comparison with the facts.
- Undertake analytical epidemiology, such as a case-control or retrospective cohort study, to test the hypothesis quickly.

- After interim control measures are in place, a larger, more systematic study may be warranted, possibly with a different analytical methodology.
- Evaluate the data and prepare a written report.
- Implement longer-term infection prevention and control measures for the prevention of similar outbreaks.

In the interests of public safety (and because of the threat of litigation), all outbreaks, however minor, should be investigated thoroughly and the outcomes of such investigations documented. All institutions should therefore have adequate resources for the detection and control of outbreaks.

C4.5 Disease surveillance in office-based practice

All staff members in office-based practices need to be aware of the possibility that patients will present with suspected or confirmed infectious diseases.

For certain diseases, timely notification to the relevant authority will be required, sometimes by telephone. Systems need to be in place so that authorities are able to trace those with whom infectious patients have been in contact. A staff member should be responsible for checking national and state websites for relevant guidelines (RACGP 2006).

In most office-based practices, there will not be enough procedures performed to undertake outcome surveillance. Process surveillance can be used to evaluate processes and procedures and to monitor sentinel events. Systems should be in place for monitoring for threats of outbreaks (e.g. chickenpox [varicella], measles [rubeola]) and emerging diseases (e.g. H1N1, community-acquired MRSA [CA-MRSA]).

C4.6 Notifiable diseases

C4.6.1 Notifiable diseases

Notifiable diseases in Australia are listed at:

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-distype.htm>.

Certain diseases are listed as quarantinable under the *Quarantine Act 1908* (Commonwealth) and its proclamations. These include yellow fever, cholera, plague, rabies and four viral haemorrhagic fevers (Crimean–Congo, Ebola, Lassa and Marburg). Quarantinable diseases are also notifiable and public health authorities in the relevant jurisdiction must notify their Chief Medical Officer.

C4.6.2 State and territory health departments

Public health legislation in each state and territory mandates the reporting of certain diseases by medical practitioners, hospitals, and/or laboratories to the relevant state or territory Communicable Diseases Unit. Notifications are collected at the state/territory level, and computerised, de-identified records are sent to the Australian Government Department of Health and Ageing for collation into the National Notifiable Diseases Surveillance System (NNDSS) for analysis at a national level. NNDSS was established in consultation with the Communicable Diseases Network Australia (CDNA).

Links to state and territory public health legislation can be found at:

<http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm>.

C5 Antibiotic stewardship³³

Summary

- Inappropriate antibiotic use hastens the emergence and amplification of resistant pathogens and subsequent transmission among patients in healthcare facilities. This can have a significant impact on morbidity, mortality and treatment costs.
- Antibiotic stewardship programs aim to change antibiotic prescribing to decrease unnecessary use, reserve so-called last-line agents, and promote the use of agents less likely to select resistant bacteria. All activities are informed by guidelines and demonstrated incidence of antibiotic resistance.
- Surveillance data can be used to identify changes in usage that may be linked to development of resistance and to measure the impact of antibiotic stewardship programs.

C5.1 Background

There is a well-documented relationship between prior antibiotic usage and the emergence of bacterial resistance (McGowan 1987). WHO and other international bodies have nominated antibiotic resistance as a major public health concern, and the ACSQHC has established a national Antibiotic Stewardship Program to facilitate the establishment of effective antibiotic stewardship programs at national, state, healthcare facility and community levels.

The use of particular antibiotic classes is linked with the emergence and amplification of specific multi-resistant pathogens, particularly *C. difficile*, MRSA, VRE and multi-resistant Gram-negative organisms. If unchecked, high levels of antibiotic usage increase the number of patients who are colonised or infected with resistant organisms, both in healthcare facilities and in the community (Cosgrove & Carmeli 2003; van de Sande-Bruinsma et al 2008).

C5.1.1 In healthcare facilities

Comparison with international data shows that Australian antibiotic usage rates in healthcare facilities are high for some classes of drugs, and there is considerable unexplained variation between hospitals in the use of certain antibiotics, particularly broad-spectrum antibiotics (NAUSP 2007). Month-to-month variation in use of specific antibiotic classes has been shown to correlate closely with subsequent variation in antibiotic resistance (e.g. changes in hospital MRSA incidence) (Lopez-Lozano 2000).

Problems resulting from inappropriate use of antibiotics apply to both current and future healthcare facility patients due to changes in healthcare facility microbial ecology resulting from the resistance.

Additional costs of infections caused by resistant organisms include:

- the need for more expensive and broader spectrum antibiotics to treat the infections
- the need to isolate patients colonised with resistant organisms in order to minimise cross-infection.

³³ This section is drawn from Cruickshank M & Ferguson J (eds) (2008) *Reducing Harm to patients from Health care Associated Infection: The Role of Surveillance*. Australian Commission for Safety and Quality in Health Care. (available at: http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/prog-HAI_Surveillance#report). For further information on definitions and reporting mechanisms please refer to this report.

C5.1.2 In the community

In the 1990s, community antibiotic use in Australia was high compared with other developed nations (McManus et al 1997). Today, multi-resistant bacteria, such as community strains of MRSA (CA-MRSA) and extended-spectrum beta-lactamase-producing Gram-negative bacteria, are causing increasing human morbidity and there is concern that past excessive antibiotic use in the community or in animal production systems (or both) is responsible.

National Prescribing Service (NPS) targeting of antibiotic prescribing contributed to a significant decline in antibiotic prescribing between 1999 and 2004 (NAUSP 2008), but this decline has not been sustained. There is currently no comprehensive system to monitor changes in resistance prevalence as a result of altered prescribing patterns. Most monitoring is done at the institutional level, except in Queensland, which has a system for monitoring resistance in its public hospitals.

C5.1.3 What is antibiotic stewardship?

Antibiotic stewardship aims to optimise antimicrobial use among patients in order to reduce antibiotic resistance, improve patient outcomes and safety, and ensure cost-effective therapy. At the healthcare facility level, antibiotic stewardship involves:

- implementing an antibiotic stewardship program; and
- continual monitoring and analysis of antibiotic usage, to track changes in antibiotic resistance and to monitor effects of containment strategies.

C5.2 Antibiotic stewardship programs

Intervention programs that restrict the use of broad-spectrum antibiotics have shown dramatic effects in optimising antibiotic prescribing. Successful antibiotic stewardship programs have been associated with reduced facility resistance rates as well as morbidity, mortality and associated costs of these and some Australian hospitals have also demonstrated significant cost savings through reduction in drug costs.

The density of antibiotic use within specialised units such as intensive care units, haematology and oncology units, and solid-organ transplant units is several-fold higher than in other hospital settings. This increased use has been shown to generate high rates of antibiotic resistance; therefore, these areas should be a particular focus for surveillance and intervention.

Key requirements of a healthcare facility antibiotic stewardship program are listed in Table C4.

Table C4: Key requirements of a healthcare facility antibiotic stewardship program

Essential strategies for all healthcare facilities

- Implementation of clinical guidelines that comply with Therapeutic Guidelines: Antibiotic and incorporate local microbiology and resistance patterns.
- Formulary restriction and approval systems that include restriction of broad-spectrum antibiotics to those patients where use is clinically justified.
- Clinical microbiology services reporting patient-specific culture and sensitivity results to optimise individual antibiotic management.
- Review of antibiotic prescribing with intervention and direct feedback to the prescriber.
- Activities according to local priorities and resources
- Provision of effective education of prescribers and pharmacists about antibiotic usage, development of resistance and judicious prescribing.
- Point of care interventions including: streamlining or de-escalation of therapy, dose optimisation, parenteral to oral conversion
- Use of information technology such as electronic prescribing with clinical decision support, on-line approval systems
- Monitor antibiotic prescribing by measuring antibiotic consumption; drug use evaluations and using Quality Use of Medicine indicators.
- Annual publication of antibiograms validated by a clinical microbiologist.
- Governance and structure
- Support and collaboration of hospital administration including allocation of resources to provide education and measure and monitor antibiotic usage.
- A multidisciplinary antibiotic stewardship team with core membership of an infectious diseases physician (lead doctor) and a clinical pharmacist. A clinical microbiologist, and infection control professional may also be included.
- Antibiotic stewardship resides within the healthcare facility's quality improvement and patient safety governance structure and there is collaboration between the stewardship team and drug and therapeutics and infection prevention and control committees.

Case study—effect of an active antibiotic stewardship program

A large tertiary teaching hospital in New South Wales has had an active approach to antibiotic stewardship for many years. It is underpinned by locally relevant antibiotic guidelines and enthusiastic staff in the areas of pharmacy, infectious diseases and microbiology. Clinical teams are regularly engaged in guideline review, development and implementation at local and national levels. Specific discussions about patients are prompted by an online anti-infective registration (approval) system, where clinicians who prescribe broad-spectrum agents register the indication for use and are advised on correct dosage. Twice-weekly infectious diseases and microbiology patient rounds take place in ICUs. These frequently lead to changes in antibiotic therapy, generally to early cessation.

A drug usage evaluation pharmacist regularly audits antibiotic use for particular agents or clinical syndromes or situations, mainly community-acquired pneumonia and surgical prophylaxis. These audit data are used to provide feedback to clinicians to encourage more appropriate use.

Monthly data on usage are supplied to the National Antimicrobial Utilisation Surveillance Program. This allows for benchmarking of intensive care unit and non-intensive care usage against other large Australian hospitals. A study of usage of selected high-cost (predominantly broad-spectrum) antibiotics in 2006 indicated that, for most agents, use in intensive care unit and non-intensive care situations in this hospital was far lower than the national average. Based on purchase cost alone, the net cost difference in 2006 was \$278,000 (\$59,000 of this was for intensive care unit use).

C5.3 Antibiotic stewardship surveillance methods

C5.3.1 Healthcare facilities

There are two main methods of antibiotic data collection in healthcare facilities: patient level surveillance and population surveillance.

- **Patient level surveillance** involves collecting data about the dose, dosage interval and duration of therapy for individual patients. This approach gives the most accurate information, particularly if the aim is to link excessive antibiotic use with development of resistance in a particular area of practice. Such information is usually only available through reviews of drug usage, although electronic prescribing and recording of drug administration will make patient level surveillance more practical in the future.
- **Population-surveillance** involves aggregating antibiotic use data, mostly supplied through pharmacy reports, and summarised at the level of a hospital or unit. Currently, this type of surveillance is the only realistic alternative for ongoing and systematic monitoring of antibiotic use. In most hospitals in Australia, aggregate data from issues to wards combined with individual patient dispensing records are used. Another data collection method is to use pharmacy purchase data; however, this is less representative than aggregation of ward issues and individual inpatient supplies.

South Australia and Queensland have programs for state-wide monitoring of antibiotic usage. The National Antimicrobial Utilisation Surveillance Program provides bi-monthly reports on hospital inpatient antibiotic usage to contributing hospitals, and bi-monthly reports to the Australian Department of Health and Ageing. Data are contributed by 50% of principal referral hospitals from six states, which is currently 42% of major city principal referral centres.

C5.3.2 Community

Measurement of community antibiotic use is generally based on prescription data. In Australia, this is collected from two sources: Medicare Australia records of prescriptions submitted for payment under the Pharmaceutical Benefits Scheme (PBS) and Repatriation Pharmaceutical Benefits Scheme (RPBS); and an estimate of non-subsidised medicines obtained from an ongoing survey of a representative sample of community pharmacies. These data also include antibiotics dispensed to outpatients and discharged patients in most states.

C6 Influence of facility design on healthcare-associated infection

Summary

The design of a healthcare facility can influence the transmission of healthcare-associated infections by air, water and contact with the physical environment. Key design features that minimise the transmission of infection include:

- surface finishes that are easy to maintain and clean (floors, walls, benches, fixtures and fittings);
- ventilation, air conditioning, cooling towers and water systems that meet Australian standards for the facility they are to service;
- the ability to isolate patients:
 - in a single room (infectious patients) or negative pressure room (to prevent transmission of airborne pathogens)
- positive pressure rooms or use of laminar airflow filtration (LAF) for immunocompromised patients
 - triaging of patients in waiting rooms with separation of infectious patients;
- appropriate work place design:
 - separation of procedural and cleaning areas
 - movement of work flow systems
 - ready access to hand hygiene facilities
 - adequate storage for all patient-care items;
 - easily accessible storage for PPE;
 - adequate waste management procedures and linen handling; and
- involvement in demolition, construction and renovation projects of a multidisciplinary team that includes infection prevention and control staff to coordinate preventive measures.

C6.1 Facility design and its impact on infection prevention and control

Infection prevention and control requirements are critical to the planning of a healthcare facility and need to be incorporated into plans and specifications. All areas of a healthcare facility should be designed, constructed, furnished and equipped to minimise the risk of transmission of infection. In particular, the design and layout of the facility should facilitate the application of standard and transmission-based precautions by all staff.

C6.1.1 Evidence on the influence of environmental design on healthcare-associated infection

There are few randomised controlled trials relevant to the effects of specific design features or interventions on health outcomes. However, from case reports, published literature relating to outbreaks and from a theoretical risk-management perspective, it is clear that the design of buildings can have an impact on rates of HAIs. Reliable patterns across several studies emerged, which were broadly consistent with predictions based on established knowledge and theory concerning environment and healthcare outcomes.

However, it is difficult to distinguish the independent effect of any environmental factor, as most changes of the physical environment in healthcare settings alter several environmental factors simultaneously. For example, renovating an intensive care unit with two-bed patient rooms to create single-bed rooms would be likely to alter not only the number of patients per room, but also the ratio of hand-hygiene sinks per bed and possibly the room ventilation or air quality.

C6.2 Mechanisms for influencing healthcare-associated infection through environmental design

Many studies indicate that infection rates are lower when there is very good air and water quality, greater physical separation of patients and greater space per patient (with isolation where appropriate).

C6.2.1 Reducing airborne transmission

Reservoirs for airborne pathogens include (Ulrich & Wilson 2006):

- dust (e.g. spores of *C. difficile* or *Aspergillus*)
- aerosols (e.g. TB, severe acute respiratory syndrome [SARS], influenza, chickenpox)
- skin scales shed by patients infected with MRSA.

Airborne transmission has also been implicated in outbreaks of other infections such as *Acinetobacter* and *Pseudomonas* spp. (Beggs 2003; Beggs et al 2008).

Most pathogens in healthcare settings originate from patients, staff and visitors within the buildings. Other pathogens can enter buildings from outside air through dust that harbours pathogens such as *Aspergillus*, streptococci or staphylococci (Beggs 2003). There are also less common sources of airborne infections; for example, bird droppings or aerosols from contaminated water in a warm-water therapy pool (Angenent et al 2005).

Approaches to airborne transmission

Approaches to reducing airborne transmission include:

- installation of effective air filtration
- specifying appropriate ventilation systems and air change rates (eg negative airflow pressure)
- employing monitoring and control measures during construction or renovation
- using single-bed instead of multi-bed rooms.

In dental practices, engineering rules state there must be separation between inlet air for compressors and air conditioning outlets (ADA 2008).

Filtration

An effective way to prevent infections is to control the source of pathogens. Heating, ventilation and air-conditioning systems control the concentration of airborne particulates in high risk areas, to minimise the risk of infection by means of air pressure, flow control and air filtration (the physical removal of particulates from air). The level of control should be proportional to the risk.

In acute healthcare settings, a commonly used approach to filtration is the HEPA filter (Streifel 1999). There is evidence that there is a lower incidence of infection when immunocompromised and other high-acuity patients are housed in HEPA-filtered isolation rooms. HEPA filters must comply with AS 1324 and AS 4260.

Ventilation systems and airflow control

Optimal ventilation rates, airflow patterns and humidity can help to minimise the spread of infection.

- The ventilation rate is a measure used to control indoor air quality, and in healthcare facilities is usually expressed as room air changes per hour (ACH). The peak efficiency for particle removal in the air space often occurs between 12 ACH and 15 ACH—Australian guidelines recommend that isolation rooms have a minimum of 12 ACH or 145L/sec whichever is greater (NSW Health 2007), and other rooms in Australian healthcare facilities are required to comply with AS1688.2 (1991). However, there is a lack of consistency in the minimum ventilation requirements needed for effective prevention of infections.

A study of 17 Canadian hospitals found that the risk of healthcare workers acquiring TB was strongly linked with exposure to infected patients in rooms with low ACH rates, such as waiting areas (Menzies et al 2000).

- Airflow direction is also important:
 - **Negative airflow pressure** is preferred for rooms housing infectious patients to prevent the dispersion of pathogen-laden aerosols (e.g. measles [rubeola], TB, chickenpox [varicella]), dust and skin scales from the locus of the infected patient to other spaces. A review of 40 studies concluded that there is strong evidence to support and recommend the use of negatively pressurised isolation rooms (Li et al 2007).
 - **Positive airflow pressure** is desirable to safeguard them from aerial pathogens entering from adjacent spaces in the care of immunocompromised patients (e.g. surgical patients, patients with underlying chronic lung disease, or dialysis patients) or immunosuppressed patients (e.g. transplant patients or cancer patients).
 - **Laminar air flow (LAF)** is HEPA-filtered air blown into a room at a rate of 27 ± 3 m/min in a unidirectional pattern with 100–400 ACH (Sehulster et al 2004). LAF can reduce air contamination to the lowest possible level and is therefore recommended for operating rooms and areas with ultraclean room requirements (e.g. immunocompromised patients) (Alberti et al 2001; Arlet et al 1989; Dharan & Pittet 2002; Friberg et al 2003; Hahn et al 2002; Sherertz et al 1987).

Maintenance systems

Ventilation and airflow control systems need to be maintained regularly by suitably qualified staff according to an agreed maintenance plan, and accurate documented in a maintenance record.

Maintaining air quality during construction or renovation

Effective control and prevention measures are necessary during construction and renovation within a healthcare facility, because such activities have been frequently implicated in outbreaks of airborne infection. The key to eliminating infections is to minimise the dust generated during the construction activity and to prevent dust infiltration into patient-care areas near the construction. Examples of such measures include installing barriers between patient-care areas and construction/renovation areas, generating negative air pressure for construction/renovation areas relative to patient-care areas, using portable HEPA filters and sealing patient windows.

For more information, refer to Public Health Agency of Canada guidelines from 2001, *Construction-related Nosocomial Infections in Patients in Health Care Facilities: Decreasing the Risk of Aspergillus, Legionella and Other Infections*, which contain a risk assessment and preventive measures checklist (available at: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/01vol27/27s2/27s2f_e.html).

C6.2.2 Reducing infections spread through the physical environment

The prevention of contact-spread infections is of paramount importance in healthcare settings. Contact contamination is generally recognised as the principal transmission route of healthcare acquired infections, including pathogens such as MRSA, *C. difficile* and VRE, which survive well on environmental surfaces and other reservoirs.

Environmental routes of contact-spread infections include direct person-to-person contact and indirect transmission via environmental surfaces.

Reducing surface contamination through hand-hygiene compliance

Healthcare workers' hands play a key role in both direct and indirect transmission (see Sections B1.1 and C3.4). Given the importance of maximising hand-hygiene compliance, it is absolutely essential that all areas of the facility are designed to facilitate compliance with hand-hygiene requirements.

Accessibility

Conveniently located alcohol-based product dispensers, sinks and basins can facilitate healthcare worker compliance with hand-hygiene requirements (Grayson et al 2009).

Hand-hygiene compliance can be increased by providing a greater number of alcohol-based product dispensers, particularly if they are placed in appropriate locations (where clinical care is provided [e.g. bedside] or where indirect care tasks are performed). Other aspects of design that may increase compliance include automated dispensers of hand-hygiene products, electronic monitoring and computerised voice prompts.

Alcohol-based handrub dispensers need to be suitably located out of the reach of children, or in supervised locations. Placement of dispensers must be carefully considered in mental health facilities and alcohol withdrawal units. Further guidance is available from HHA ([http://www.hha.org.au/UserFiles/file/Manual/ManualJuly2009v2\(Nov09\).pdf](http://www.hha.org.au/UserFiles/file/Manual/ManualJuly2009v2(Nov09).pdf)).

Consideration needs to be given to ensuring availability of basins for healthcare workers that are separate from patient bathrooms.

As well as being installed in all patient-care areas, hand-hygiene facilities should be placed in all areas where careful attention to hygiene is essential, such as kitchens, laundries, pharmacies, laboratories and staff amenities areas (e.g. bathrooms, toilets and change rooms).

Personal protective equipment

It is also essential that all areas of the facility are designed to facilitate appropriate use of PPE. All rooms should have dedicated and accessible areas for storage of gowns, aprons, gloves, masks and protective eyewear.

C6.2.3 Control of surface contamination through material selection

Ease of cleaning should be a key consideration in selecting appropriate floor and furniture coverings. Several design-related factors should be considered to minimise the risk of infection stemming from contaminated surfaces:

- the nature and type of contamination that is likely to occur
- if a suitable cleaning method for that surface can be performed.

Areas that may be in direct contact with blood and body substances (e.g. surfaces such as floors and bench tops) need to be made of impervious material that is smooth and easy to clean.

Healthcare flooring

A wide range of floor covering materials is used in healthcare settings. These include but are not limited to: ceramic tiling, linoleum, rubber, textile floor covering, vinyl, sheet terrazzo, cork, timber laminates, mats and matting, cementitious toppings, seamless coatings and outdoor flooring.

Floor coverings have not been generally related to healthcare associated infection. Some studies have identified carpeting as susceptible to contamination by fungi and bacteria (Anderson et al 1982; Boyce et al 1997; Skoutelis et al 1994; Beyer & Belsito 2000).

When selecting floor covering for a health care setting consideration needs to be given to the following:

- Who is at risk of acquiring infection?
- What is the risk of exposure to the infectious agents?
- What is the nature of the possible infectious agents?
- How can the agent be transmitted? (eg airborne; through cleaning techniques; through contact especially in environments in which there are young children)

In terms of infection prevention and control, the advantages of hard floor coverings include:

- being easier to clean
- being easier to disinfect where required
- allowing use of the most appropriate disinfectant, rather than a product that is suitable for use on carpet
- costing less, as disinfectant is less expensive than steam cleaning, and steam cleaning may not be readily available
- there is less surface area so hard floor coverings are less likely to act as a reservoir of infectious agents than carpet
- when additional cleaning is required, hard floor surfaces are easier to clean than carpet.

However, carpeting may offer advantages unrelated to infection prevention and control, including noise reduction (Philbin & Gray 2002). Textile floor finishes should not be considered unless there is a comprehensive maintenance and replacement program in place complying with AS/NZS 3733. Care and maintenance of floor covering need to consider manufacturer's recommendations.

Carpeting should be avoided in areas where (Schulster & Chinn 2003):

- spills are likely to occur (e.g. around sinks or in isolation or soiled utility/holding areas)
- patients may have direct contact with contaminated carpets (e.g. children/babies crawling on the floor)
- patients are at greater risk of airborne infections.

Furnishings

Noskin et al (2000) identified fabric-covered furniture as a source of VRE infection in hospitals and suggested the use of easily cleanable, nonporous material.

A study comparing the performance of a variety of furniture upholstery types with respect to VRE and *Pseudomonas aeruginosa* (PSAE) contamination (Lankford et al 2006) found that performance was similar across different furniture coverings in terms of reductions in VRE and PSAE after cleaning and the transfer of VRE and PSAE to hands through contact. However, while there were no differences in the ability of different upholstery types to harbour PSAE, the VRE pathogen survived less well or for shorter periods on vinyl (Lankford et al 2006).

The CDC/HICPAC guidelines (Schulster & Chinn 2003) recommend minimising the use of upholstered furniture in areas housing immunocompromised patients.

Blinds and curtains should be easy to clean and discourage the accumulation of dust.

C.6.2.4 Reducing water-borne transmission

Compared with airborne and contact transmission of infection, fewer studies were identified on waterborne transmission in relation to healthcare facility design factors. The literature nonetheless is clear that waterborne infections can be a serious threat to patient safety. Many bacterial and some protozoal microorganisms can proliferate or remain viable in moist environments or aqueous solutions in healthcare settings (Schulster et al 2004).

Contaminated water systems in healthcare settings (such as inadequately treated wastewater) may lead to the pollution of municipal water systems, enter surface or ground water, and affect people in the community (Iversen et al 2004).

Sources of water contamination

The CDC/HICPAC guidelines (Schulster & Chinn 2003) identify the following categories of environmental routes or sources of waterborne transmission:

- direct contact, such as hydrotherapy (Angenent et al 2005)
- ingestion of water, such as drinking water (Conger et al 2004; Squier et al 2000)
- inhalation of aerosols dispersed from contaminated water sources, such as improperly cleaned or maintained cooling towers, showers (Mineshita et al 2005), respiratory therapy equipment and room air humidifiers
- aspiration of contaminated water.

Approaches to reducing waterborne transmission

Water supply system

The water supply system should be designed and maintained with proper temperature and adequate pressure; stagnation and back flow should be minimised and dead-end pipes should be avoided.

To prevent the growth of *Legionella* and other bacteria, the CDC/HICPAC guidelines recommend that healthcare facilities maintain cold water at a temperature below 20°C, store hot water above 60°C, and circulate hot water with a minimum return temperature of 51°C (Schulster & Chinn 2003).

When the recommended standards cannot be achieved because of inadequate facilities that are unable to be renovated, other measures such as chlorine treatment, copper-silver ionisation, or ultraviolet lights are recommended to ensure water quality and prevent infection (Schulster & Chinn 2003).

Point-of-use fixtures

Water fixtures such as sinks, faucets, aerators, showers, and toilets have been identified as potential reservoirs for pathogenic microorganisms (Blanc et al 2004; Conger et al 2004; Mineshita et al 2005; Squier et al 2000). Such fixtures produce aerosols that can disperse microbes and they have wet surfaces on which moulds and other microorganisms can proliferate. However, empirical evidence linking these fixtures to HAIs is still limited; no consensus has been reached regarding the disinfection or removal of these devices for general use (Schulster et al 2004).

Regular cleaning, disinfection and preventative maintenance programs should be provided, especially in areas housing immunocompromised patients.

Ice machines

Ice storage receptacles and ice-making machines should be properly maintained and regularly cleaned. Ice and ice-making machines may be contaminated through improper handling of ice by patients and/or staff. Ice for human consumption should be differentiated from ice for first aid or storage of clinical specimens. Pharmaceuticals or medical solutions should not be stored on ice intended for consumption.

Machines that dispense ice are preferable to those that require ice to be removed from bins or chests with a scoop. Ice machines and their dispensers should be flushed and cleaned if they have not been disconnected before anticipated lengthy water disruptions

All ice-storage chests should be cleaned, disinfected, and maintained on a regular basis as per manufacturers instructions.

Suggested steps to avoid improper handling of ice include (Sehulster & Chinn 2003):

- avoiding handling ice directly by hand
- washing hands before obtaining ice
- using a smooth-surface ice scoop to dispense ice
- keeping the ice scoop on a chain short enough that the scoop cannot touch the floor, or keeping the scoop on a clean, hard surface when not in use
- avoiding storing the ice scoop in the ice bin.

Water features

Despite the absence of empirical documentation linking properly maintained fountains to healthcare-acquired infections, the AIA & FGI Guidelines (2006) recommend that fountains not be installed in enclosed spaces in healthcare facilities.

C6.3 The benefits of single-bed rooms for patient isolation

The three routes of transmission often overlap, and environmental approaches may influence more than one transmission route. For example, single rooms play a key role in preventing a patient with a contagious or aerial spread infection from infecting others, and also protect immunocompromised patients in nearby patient-care areas from airborne pathogens.

- Studies of cross-infection for contagious airborne diseases (such as TB, measles [rubeola], and chickenpox [varicella]) indicate that placing patients in single rooms, single-bed cubicles with partitions, isolation rooms, or rooms with fewer beds and more space between patients, is safer than housing them in multi-bed spaces with more patients.
- Surfaces near infected patients quickly become contaminated, creating numerous reservoirs that can transfer pathogens to patients and staff.
- Screening for MROs or specific pathogens is effective but results may not be available on admission; placing MRO colonised/infected patients with non-colonised /infected patients in multi-bed rooms increases the spread of MROs.
- Single-bed rooms can facilitate greater frequency of cleaning and decontamination, as there is limited impact on neighbouring patients.
- Hand-hygiene compliance is likely to be improved through greater prominence of sinks or hand hygiene dispensers.
- Ensuite bathrooms are a key factor in preventing the spread of *C. difficile* and other infectious agents that spread via enteric and contact mechanisms.

International bodies including the American Institute of Architects recommend that acute-care facilities have 80% single-bed rooms. This recommendation is being implemented in a number of current hospital redevelopments (e.g. Royal Canberra Hospital, Royal Perth Hospital) and should be considered during planning for redevelopment of any acute healthcare facility.

Anterooms

Anterooms enable visitors and healthcare workers to change into and dispose of appropriate PPE when caring for an infectious patient. Anterooms increase the effectiveness of isolation rooms by reducing the potential escape of airborne infectious particles into the corridor.

Ideally the pressure in the anteroom is lower than that of ambient pressure in the adjacent corridor (AusHFG).

C6.4 Construction and renovation

Infection prevention and control precautions during construction and renovation should be integrated into the design and documentation of the facility from the beginning of the design stage. It is important that the dust control and infection prevention and control principles developed during the pre-design stage are integrated from the initial stages of design development until the completion of the activity.

Identification of the 'at risk' population, knowledge of the transmission route of a likely pathogen and location of the 'at risk' population all need to be taken into account in the planning stages.

C6.4.1 Risk management

The risk-management approach should, as a minimum:

- identify the location of high-risk patients in relation to the site
- identify ventilation system types and potential impact
- determine air monitoring requirements, methodology and frequency
- include taking of air quality samples to establish a baseline
- identify possible contaminants and their locations (contaminants may be present in ceiling dust, service shafts (especially if dampness is present), spray-on fire retardants and bird droppings).

Refer to Section D of the Australasian Health Facility Guidelines (AusHFG) for further guidance and the definition of infection prevention and control risk, location/area table and infection prevention and control strategies.

C7 Resources

C7.1 Management and clinical governance

- ACSQHC Resources
 - *Measurement for improvement tool kit*
<http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/CommissionPubs>
 - Australian Charter of healthcare rights <http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/content/pr>
 - HAI priority program. Building Capacity for Infection Control Professionals <http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/content/priorityprogram-03iorityprogram-01>
- Clinical Excellence Commission Quality Systems Assessment <http://www.cec.health.nsw.gov.au/programs/qa.html>
- AS/NZS ISO 31000:2009 Risk Management: Principles and Guidelines
- CDC Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program <http://www.cdc.gov/sharpssafety/> (2008)

C7.2 Staff health and safety

Occupational health and safety

Pre-employment screening and Immunisation

Legislation/ policy

Each state and territory has numerous legislation/ Acts relating to occupational health and safety, workers compensation and the employers responsibility to provide a safe work environment.

Immunisation of health care workers is an aspect of occupational health and safety in the health care setting. Each state has its own policies, examples are provided below:

- *Immunisation for Health Care Workers* (Revised October 2007) – DHS Victoria http://www.health.vic.gov.au/immunisation/general/guide_hcw
- Health Department Policy Directive 2007_006 *Occupational Assessment, Screening & Vaccination Against Specified Infectious Diseases*
http://www.health.nsw.gov.au/policies/pd/2007/PD2007_006.html
- NSW Health Department Policy Directive 2005_203. *Infection Control Management of Reportable Incidents*
- *Immunisation for HCWs in South Australia* – www.health.sa.gov.au/infectioncontrol/

Guidelines

- *National Immunisation Program Schedule – 2007 DoHA*
- *Australian Immunisation Handbook - 9th Edition 2008 (NHMRC)*

Exposure to blood and blood products

Legislation/codes of practice

- National Occupational Health and Safety Commission. *National Code of Practice for the Control of Work-related Exposure to Hepatitis and HIV (blood-borne) Viruses* [NOHSC 2010 (2003) 2nd ed.] Canberra: Australian Government National Occupational Health and Safety Commission. 2003

Each state has its own policies, examples are provided below:

NSW

- NSW Health Department Policy Directive 2008_021 *Occupational Exposures to Blood-Borne Pathogens: NSW Health Notification Requirements to WorkCover* http://www.health.nsw.gov.au/policies/pd/2008/PD2008_021.html
- NSW Health Department Policy Directive 2005_311 *HIV, Hepatitis B and Hepatitis C - Management of Health Care Workers Potentially Exposed* http://www.health.nsw.gov.au/policies/PD/2005/PD2005_311.html

WA

- WA *Worksafe Commission Code of Practice – Personal Protective Clothing and Equipment* (2002). http://www.docep.wa.gov.au/WorkSafe/PDF/Codes_of_Practice/Code_first_aid.pdf

QLD

- Queensland Health *Infection Control Guidelines* and associated policies, recommended practices and advisories <http://www.health.qld.gov.au/chrisp/>
- Queensland Health Sharps Safety Programs http://www.health.qld.gov.au/chrisp/resources/sharps_safety.asp

Post-exposure prophylaxis

Guidelines

- Australian Society for HIV Medicine (ASHM) (2007) National guidelines for post-exposure prophylaxis after non-occupational exposure to HIV. Available at: http://www.ashm.org.au/default2.asp?active_page_id=251%20
- WHO (2008) Post-exposure prophylaxis to prevent HIV infection. Joint WHO/ILO guidelines on post-exposure prophylaxis (PEP) to prevent HIV infection. Geneva 2008. Available at: <http://www.who.int/hiv/pub/guidelines/PEP/en/index.html>
- CDC (2005) Management of Occupational Exposures to HIV and Recommendations for Postexposure Prophylaxis. Available at: <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5409a1.htm>

C7.3 Education and training

- ACORN Standard S24 visitors to the perioperative environment <http://www.acorn.org.au/about-acorn-standards/standards-index.html>
- AICA <http://www.aica.org.au/>
- Hand Hygiene Australia <http://www.hha.org.au/>
- Australian Commission for Safety and Quality in Healthcare HAI program. Capacity building for Infection control professionals <http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/PriorityProgram-03>

C7.4 Surveillance

- Cruickshank M & Ferguson J (eds) (2008) *Reducing Harm to patients from Health care Associated Infection: The Role of Surveillance*. Australian Commission for Safety and Quality in Health Care. http://www.safetyandquality.gov.au/internet/safety/publishing.nsf/Content/prog-HAI_Surveillance#report

Policies

- National Notifiable Diseases Surveillance System <http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-nndssintro.htm>

Notifiable diseases

- Department of Health and Ageing- Australian Notifiable Diseases <http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-distype.htm>
- Links page to state and territory Public Health Legislation, the Quarantine Act, and the National Health Security Act 2007 <http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm>

C7.5 Antimicrobial Stewardship

- National Antimicrobial Utilisation Surveillance Program (NAUSP) <http://www.health.sa.gov.au/INFECTIONCONTROL/Default.aspx?tabid=191>

C7.6 Facility design

More detailed information on facility design is available from the following sources. State and territory department of health policies also provide information.

Guidelines

- *Australasian Health Facility Guidelines* (AusHFG) <http://www.healthfacilityguidelines.com.au/guidelines.htm>
- NSW Health Department Guideline GL2007_003 *Health Facility Guidelines - Use of Australasian Health Facility Guidelines (AUS HFG)* http://www.health.nsw.gov.au/policies/gl/2007/GL2007_003.html
- Guidelines DHS, Victoria - *Guidelines for the Classification and Design of Isolation Rooms in Health Care Facilities* Victorian Advisory Committee on Infection Control 2007
- Victorian DHS *Design Guidelines for Hospitals and Day Procedure Units* 2005 <http://www.healthdesign.com.au/vic.dghdp/guidelines.htm>
- NSW Department of Health TS-7 Floor Coverings in Healthcare buildings http://www.healthfacilityguidelines.com.au/hfg_content/guidelines/aushfg_TS7_FloorCoverings221009.pdf
- *Isolation room engineering requirements TS 11* Engineering and Sustainable Services. Available in the NSW Health Infection Control Policy (Circular 2002/45, NSW Health 2002)
- Hand Hygiene Australia manual ([http://www.hha.org.au/UserFiles/file/Manual/ManualJuly2009v2\(Nov09\).pdf](http://www.hha.org.au/UserFiles/file/Manual/ManualJuly2009v2(Nov09).pdf).)

International literature

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<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm>
- CDC guidelines on tuberculosis, SARs and pandemic influenza.
- CAS Z317.2-01 Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities
- CHICA position statement on construction and design for information related to this section [<http://www.chica.org/pdf/HFDposition.pdf>]
- Public Health Agency of Canada guidelines from 2001, Construction-related Nosocomial Infections in Patients in Health Care Facilities: Decreasing the Risk of Aspergillus, Legionella and Other Infections, which contain a risk assessment and preventive measures checklist (available at: http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/01vol27/27s2/27s2f_e.html)
- American Institute of Architects and Facilities Guidelines Institute
- American Society of Heating, Refrigerating and Air-conditioning Engineers

General

Standards

- Standards Australia. HB 260-2003. Hospital acquired infections – Engineering down the risk. Sydney: Standards Australia International Ltd. 2003
- AS 1324 - 'Air filters for use in general ventilation and air-conditioning' and AS 4260 - 'High efficiency particulate air (HEPA) filters - Classification, construction and performance'.
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- AS 1668.2-2002/Amdt 2-2003
The use of ventilation and airconditioning in buildings - Ventilation design for indoor air contaminant control
- AS/NZS:4849.1.2003 Upholstery Cleaning
- AS/NZS 3733 Textile floor coverings - Cleaning maintenance of residential and commercial carpeting
- S 14 Purchasing and Safety Considerations for New Equipment and Instruments
<http://www.acorn.org.au/about-acorn-standards.html>

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APPENDIX I

MEMBERSHIP AND TERMS OF REFERENCE OF THE WORKING COMMITTEE

Members

	Affiliation	Area of expertise
Dr Ann Koehler (Chair)	Director, Communicable Disease Control Branch, SA Health	Clinical microbiology, communicable disease control, epidemiology
Prof Chris Baggoley	Chief Executive Officer of the Australian Commission on Safety and Quality in Healthcare	Safety and quality in healthcare
Clinical Prof Keryn Christiansen	Clinical Microbiologist, PathWest Laboratory Medicine, Royal Perth Hospital WA	Microbiology, infectious diseases, antimicrobial resistance and surveillance
Dr Liz Coates	Senior Consultant, Adelaide Dental Hospital. ADA representative	Infection control in dental settings
Professor Peter Collignon	Infectious diseases physician and microbiologist Director, Infectious Diseases Unit and Microbiology Department, The Canberra Hospital. Professor, School of Clinical Medicine, Australian National University, ACT	Antibiotic resistance and infection control in hospitals
Dr Celia Cooper	Director, Microbiology and Infectious Diseases, Children's, Youth and Women's Health Service, Adelaide	Infectious diseases, public health, and medicine
Dr Nick Demediuk	General Practitioner, Royal Australian College of General Practitioners	General practice, infection control in office based practice
Ms Sylvia Gandossi	Vice President, Australian Infection Control Association. Infection Control Consultant	Infection control practice in both the public and private health sectors
A/Prof Tom Gottlieb	Senior specialist in microbiology and infectious diseases Department of Microbiology and Infectious Diseases, Concord Hospital, NSW	Microbiology, infectious diseases
Mr Brett Mitchell	Director, Tasmanian Infection Prevention and Control Unit, Department of Health and Human Services	Infection prevention and control in Australia and internationally
Assoc Prof Peter Morris	Paediatrician, NT Clinical Studies School, Royal Darwin Hospital and Menzies School of Health Research, Darwin	Indigenous health, evidence-based medicine

Terms of Reference

The Infection Control Steering Committee (the Committee) will oversee and provide expertise in the revision of the *Infection control guidelines for the prevention of transmission of infectious disease in the health care setting* (2004) (the Guidelines).

1. The revision will take into account but not be limited to:
 - The current *Infection control guidelines for the prevention of transmission of infectious disease in the health care setting* (2004) produced by the CDNA.
 - The best available current scientific evidence.
 - NHMRC recommended standards on guideline development.
 - Comments provided by the broader community and health care sector through feedback from the project's stakeholder group, targeted consultations and public consultation.
2. The Committee will provide advice on the following areas of the Guidelines revision:
 - The scope and requirements of the systematic review
 - The formulation of recommendations from the results of the systematic review
 - The content of the Guidelines
 - The development of educational materials and companion documents
 - Identification of indicators for the purpose of evaluation and monitoring the guidelines implementation
 - The development of an implementation strategy
 - Key stakeholders to undertake liaison/consultation.
3. The Committee will provide regular reports on the progress of guideline development to the CEO of the NHMRC.
4. The Committee will provide the NHMRC CEO with a draft report for the CEO to seek advice from Council.

APPENDIX 2

PROCESS REPORT

The NHMRC was approached by the Australian Commission on Safety and Quality in Health Care (the Commission) in November 2007 to review and update the *Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting*. These guidelines were produced by the Communicable Diseases Network Australia (CDNA) and released in 2004.

The NHMRC revised guideline (the Guideline) aimed to provide a coordinated approach to the management of health care associated infection (HAI) in Australia by supporting the Commission's other HAI priority program initiatives including the:

- National HAI Surveillance Strategy
- Hand Hygiene Initiative
- Antibiotic Stewardship.

The NHMRC developed a range of partnerships to support and assist in the guideline development process including the NHMRC's National Institute of Clinical Studies, CDNA, the Office of Health Protection in the Australian Government Department of Health and Ageing, the Commission and guideline users.

The project plan for the revision of the guidelines was approved by the NHMRC Acting Chief Knowledge Development Officer on 25 January 2008. The Infection Control Guidelines Steering Committee (the Committee) was established under the *NHMRC Act (1992)* as a Section 39 committee, and was chaired by Dr Ann Koehler, the South Australian representative of the CDNA. The committee was first established with eight members, comprising of experts in microbiology and infectious disease, public health, Indigenous health as well as jurisdictional representatives and infection control professionals. During 2008, two Committee members resigned from the Committee (Ms Dolly Oleson and Ms Claire Boardman) but an additional five members were appointed to broaden the expertise of the Committee. The Committee from November 2008 until the completion of the project is outlined in Appendix 1.

Appointment of technical writers

Ampersand Health Science Writing was selected through a Request for Quote process from the NHMRC Technical Writers and Editors Panel. The two key personnel from Ampersand working on this project were Ms Elizabeth Hall and Ms Jenny Ramson, who participated in the forums and Steering Committee meetings to gain an understanding of the issues and the context of the infection control guidelines.

Scope

The Guideline targets clinicians, ancillary staff and administrators across Australia's various health care settings. Initial feedback indicated that the following health care settings should be considered when developing the guidelines:

- private and public acute care
- long-term care
- community health including home care
- remote area health services
- office based practices involved in invasive procedures such as dental, obstetrics and gynaecology, ophthalmology, surgical and general practice.

As a means of addressing this broad scope of practice it was decided that the guidelines would be structured to address the 'core principles' of infection prevention and control and the underpinning key practice principles. The core principle of infection prevention and control is to prevent the transmission of infectious organisms and manage infections if they occur. The underpinning key practice principles include:

1. an understanding of the modes of transmission of infectious agents and an overview of risk management
2. effective work practices that minimise the risk of selection and transmission of infectious agents
3. governance structures that support the implementation, monitoring and reporting of infection prevention and control work practices
4. compliance with legislation, regulations and standards relevant to infection prevention and control.

It is acknowledged there may be variation in some current practices due to differences in technology, resources and systems supporting a healthcare facility. To address this, a risk-management approach was adopted that considers how factors associated with the transmission of infectious agents can be identified and managed within various health care settings.

This approach ensures that common infections such as gastrointestinal viruses and evolving infectious agents such as influenza or antibiotic resistant bacteria can be managed effectively using the principles of infection prevention and control.

Preliminary scoping

The initial focus of the project was to liaise with stakeholders across a broad range of healthcare settings to identify the usefulness and applicability of the 2004 guidelines. This was managed through stakeholder surveys and a series of organised forums. The stakeholder survey was developed to allow participants and the organisations they represented to consider the issues prior to attending the forums. The survey was targeted towards state-based infection control professional associations, public health medical officers and the aged care accreditation alliance. This survey was circulated to stakeholders participating in forums to gather feedback on the guidelines and to organisations wishing to provide feedback but unable to attend the forums.

Stakeholder forums

Stakeholder forums were conducted in Sydney, Canberra and Melbourne in early March 2008, and were facilitated by Carla Cranny & Associates. In all, 59 representatives from various health care settings, the medical device industry, professional associations, health care funders and government agencies attended. The purpose of the forums was to gain feedback from stakeholders in the healthcare setting on the usefulness and applicability of the 2004 guidelines as well as identify gaps and areas of ambiguity in the guidelines.

The forums identified:

- current gaps in the 2004 guidelines, in particular the need for better guidance on:
 - healthcare worker infection prevention and control issues
 - pandemic planning
 - sterilisation and reprocessing of equipment
 - environmental cleaning and waste management
 - MROs - management of patients in the various health care settings
 - the impact of healthcare facility design on infection prevention and control
 - the scope of practice of infection control professionals and guidance on staffing profiles across the range of service settings
- areas of uncertainty or clinical variation in infection prevention and control practice
- barriers to implementation of the guidelines including cross references to guidance that is not freely available; healthcare worker attitudes and behaviours and the lack of accountability of health care managers
- additional tools required to support implementation
- options on formatting and presentation.

Priority setting

The stakeholder forums identified several key areas the guidelines need to address. These issues relate to: emerging pathogens; screening and clearance of patients with MRO infections; areas where gaps in evidence resulted in variation in clinical practice; and medical device technology.

Using the feedback from the forums, the Committee actively engaged with stakeholders across the healthcare setting to seek feedback on the priority areas the revised infection prevention and control guidelines should address. With significant input from the Australian Infection Control Association, the Committee carefully considered and systematically identified the priority areas of infection prevention and control that need to be addressed by the guidelines. The Committee developed a framework encompassing the broad scope of infection prevention and control activities across the health care setting. Priority areas identified at the forums and by the Committee were placed in the framework and then ranked according to which issues have the greatest impact on infection prevention and control.

From this priority-setting exercise, the Committee identified the key issues that required further research. These issues formed the basis for the development of the clinical questions for systematic review.

Systematic review of the evidence

The recommendations for the Guideline were developed using a twofold approach.

- For areas where clinical variation exists or it is considered there are emerging issues in infection prevention and control, systematic reviews of the literature were conducted to gather the evidence for the specific guideline section. The NHMRC level and grades pilot program was implemented in reviewing and synthesising the evidence.
- For areas of established practice, recommendations from current national and international guidelines were adapted for an Australian context by the Committee. Guidelines were selected according to their currency and clinical relevance and were appraised using the Appraisal of Guidelines for Research and Evaluation (AGREE) instrument to assess the rigor with which they had been developed.

Drafting of clinical questions for systematic review

Dr Adele Weston, a member of the NHMRC evidence-based medicine expert panel, attended the 12 May committee meeting to inform the members on the NHMRC systematic review process including how recommendations are drafted from the evidence. The clinical questions commenced being drafted at that meeting using the population, intervention, comparator, outcome, time (PICOT) approach. They were further refined, circulated and discussed via a series of teleconferences before being released in a Request for Tender in July 2008. The questions are outlined below.

Table App2.1: Clinical questions for systematic review

QUESTION	POPULATION	INTERVENTION	COMPARATOR	OUTCOME
Environmental cleaning	Population	Intervention	Comparator	Outcome
1. Which environmental cleaning/disinfection agents have the greatest efficacy against: <ul style="list-style-type: none"> • Bacteria (specifically MRSA, C. difficile, VRE and Acinetobacter spp) • Enveloped and non enveloped viruses (specifically blood-borne viruses, rotavirus, norovirus and respiratory viruses). This information should be presented in a matrix that demonstrates what cleaning agent should be used dependent on what organisms considering its mode of transmission (droplet, contact, respiratory).	Bacteria, non-enveloped and enveloped viruses	Environmental cleaning agent	Alternative environmental cleaning agents and mode of transmission of organisms	Reduced levels of surface agents
2. Considering the information above, what is the frequency of cleaning required to limit the survival of these organisms considering their survival rates in the environment.	Bacteria, non-enveloped and enveloped viruses	Cleaning agent	Frequency of agent use considering survival rates of the organisms	
MROs	Population	Intervention	Comparator	Outcome
3. What is the most effective method to demonstrate effective decolonisation of MRSA, VRE and MRGNs in patients: <ul style="list-style-type: none"> • previously colonised with the above? • currently colonised with the above? 4. Does this decolonisation reduce the rate of transmission of these pathogens?	Patients with previously MRSA, VRE or MRGN Patients currently with MRSA, VRE or MRGN	Screening / clearance methods	Other screening / clearance methods	Decolonisation

5.	Does detection of MROs (listed below) through systematic patient screening (and in the case of MRSA with staff) reduce the rate of transmission to other patients: <ul style="list-style-type: none"> • VRE (in high risk areas such as bone marrow transplant ward, ICUs and haemodialysis units) • MRSA • MRGN 	Patients Staff (in the instance of MRSA)	Screening for MROs	Not screening	Reduced transmission Transmission outcomes
6.	Does isolation in managing patients with VRE or MRGN reduce the patient's length of stay / spread of infection to other patients?	Patients	Isolation	Shared bays	Reduced acquisition rates of pathogen in other patients
7.	Does PPE reduce the transmission of MRSA or VRE?	Patients	Gloves, gowns, aprons	No gloves, gowns, PPE	Reduced acquisition rates of MRSA or VRE
Device management		Population	Intervention	Comparator	Outcome
8.	What methods of management have the best efficacy for preventing infection associated with the insertion and maintenance of: <ul style="list-style-type: none"> • Intravascular devices • Haemodialysis access devices 	Patients neonates adults	Device insertion and management	Comparisons of one form of skin antiseptics with others, e.g. alcoholic vs aqueous products including chlorhexidine, povidone iodine, betadine	Reduced post procedural infection
Stick injuries		Population	Intervention	Comparator	Outcome
9.	Is there a decreased incidence of stick injuries for healthcare workers using automated cleaning practices compared to manual cleaning practices?	Healthcare Workers	Automated cleaning	Manual cleaning	Reduced stick injuries
10.	Does the use of retractable devices show a decreased rate in the incidence of sharps injuries for healthcare workers?	Healthcare Workers	Safety devices etc	Non retractable devices	Sharps injuries
Facility design		Population	Intervention	Comparator	Outcome
11.	Can the risk factors for nosocomial infections in healthcare facilities be identified and ranked according to relative risk? Risk factors could include bed occupancy levels, staffing ratios and building design	Healthcare facilities	Bed occupancy levels, staffing ratios and building design Infection control program management	Rates in other facilities, clinical areas	Reduced acquisition rates

12. Do negative pressure rooms reduce transmission of airborne pathogens to non-infected patients compared to standard rooms? This is inclusive of tuberculosis, multi-resistant tuberculosis, chickenpox/shingles (varicella zoster virus), measles (rubeola) and viral haemorrhagic fevers.	Patients	Isolation in negative pressure room	Normal pressure room isolation	Reduced infection transmission to other patients
13. Do positive pressure rooms reduce the transmission of infection to immunocompromised patients compared to normal pressure rooms?	Patients	Isolation in positive pressure room	Single room isolation	Reduced infection rates of immunocompromised patients
Staff Health	Population	Intervention	Comparator	Outcome
14. What is the evidence supporting the length of time a healthcare worker should remain excluded from work post the resolution of symptoms of gastroenteritis?	Healthcare Workers	Exclusion period	Different periods of time	Rates of transmission of infection to healthcare worker or patients
Hand hygiene (Level I evidence only)	Population	Intervention	Comparator	Outcome
15. What concentrations of which alcohols are adequate for hand hygiene to decontaminate specific organisms?	Healthcare Workers	Hand hygiene comparing different concentrations of alcohol, and of different alcohols e.g. ethyl, methyl, isopropyl	Washing with water and soap/detergent/chlorhexidine, Other concentrations of same alcohol Other alcohols	Decontamination of hands
16. What is the efficacy of alcohol-based products compared to non alcohol-based, e.g. soap and water and other hand-hygiene products, in reducing the risk of transmission of: <ul style="list-style-type: none"> • Clostridium difficile • non-enveloped viruses? 	Healthcare Workers	Hand hygiene	Non alcohol-based products	Decontamination
Education (Level I evidence only)	Population	Intervention	Comparator	Outcome
17. What is the effectiveness of education program changing healthcare worker behaviour	Healthcare workers	Education programs	Other education programs	Changes in clinician behaviour

The Request for Tender process was ultimately unsuccessful and systematic reviewers were approached using a Request for Quote or Direct Sourcing approach. The systematic reviews were conducted by the following:

Contractor	Topic
Joanna Briggs Institute	<ul style="list-style-type: none"> • Effectiveness of environmental cleaning agents, • Decolonisation of MDRO • Patient screening for MDRO • Effectiveness of isolation for VRE and MRGN • Effectiveness of PPE in reducing VRE and MRSA transmission.
Griffith University	Intravascular device management
Royal Darwin Hospital	Hand-hygiene products
NHMRC	<ul style="list-style-type: none"> • Staff exclusion periods for norovirus • Efficacy of positive pressure rooms • Efficacy of negative pressure rooms • Educational strategies to improve hand-hygiene compliance

A number of clinical questions that were identified as a priority were unable to be conducted due to resource constraints. These included:

1. Does the use of retractable devices show a decreased rate in the incidence of sharps injuries for healthcare workers?
2. Is there a decreased incidence of stick injuries for healthcare workers using automated cleaning practices compared to manual cleaning practices?
3. Can the risk factors for nosocomial infections in healthcare facilities be identified and ranked according to relative risk? Risk factors could include bed occupancy levels, staffing ratios and building design.

Due to a paucity of evidence or low quality evidence some systematic reviews were not used to draft recommendations. These include:

- effectiveness of environmental cleaning agents
- decolonisation of MROs
- patient screening for MROs
- efficacy of negative pressure rooms.

Recommendations for these areas were drawn from existing guidelines and supported by expert opinion. The education review to identify strategies to improve hand-hygiene compliance was incorporated into Section C *Governance structures*, which contains no graded recommendations for practice.

The systematic reviews for:

- intravascular device management
- hand-hygiene products
- effectiveness of isolation for VRE and MRGN
- effectiveness of PPE in reducing VRE and MRSA transmission
- staff exclusion periods for norovirus
- efficacy of positive pressure rooms

were conducted according to approved NHMRC processes and systematic review methodology with a documented search strategy, inclusion and exclusion criteria, critical appraisal methodology and summary of the evidence. These systematic reviews are provided in the full report, which is available on the NHMRC website. The systematic reviewer summarised the questions and sub questions into the NHMRC template, which documents the evidence base (number of studies, level of evidence and risk of bias in the included studies), consistency, clinical impact, generalisability and applicability.

The NHMRC template was used by the Steering Committee to draft evidence statements and recommendations corresponding to the summary of evidence provided by the systematic reviewer. These evidence statements and recommendations are summarised in Attachment 2b of the full report. The grades assigned by the systematic reviewers are documented with the corresponding grades assigned by the Committee. The grades were assigned by the Committee via teleconferences and meetings with the final recommendations and grading outlined in Attachment 2c of the full report. Dissenting opinions were noted.

Development of recommendations from guidelines and standards

As a part of the prioritisation process a mapping exercise was conducted to identify relevant guidelines and standards that existed nationally and internationally on infection prevention and control in the health care setting. Links to standards and legislation relevant to infection prevention and control that were identified will be included at the end of each relevant section. It is envisaged that targeted and public consultation will provide more feedback in this section.

For areas of established practice not covered by the systematic review, guidelines developed using rigorous methodology were used to adapt recommendations from for an Australian context. Guidelines were identified by a combination of literature searches, current use in practice and by the ICG Committee. Guidelines were selected according to their currency and clinical relevance and were appraised using the *Appraisal of Guidelines for Research and Evaluation* (AGREE) instrument to assess the rigor with which they had been developed. The AGREE scores were calculated across the six domains and used to identify which guidelines to use. The NHMRC engaged numerous stakeholders identified during the forums and through the Commission to assist with the appraisal of the guidelines.

Three reviewers per guideline with appropriate clinical experience in infection prevention and control, infectious diseases or guideline development reviewed each guideline. The reviewers included Committee members, the Commissions' Health Care associated Infection Implementation Advisory Committee and members of the Australian Dental Association.

Reviewers were asked to rate an item on a scale of 1 to 4, with 1 being 'strongly disagree' and 4 being 'strongly agree'. Domain scores were calculated by summing up all the scores of the individual items in a domain and by standardising the total as a percentage of the maximum possible score for that domain. Generally, a higher score indicates the guideline rated well against the AGREE criteria.

The six domains were:

- scope and purpose
- stakeholder involvement
- rigour of development
- clarity and presentation
- applicability
- editorial independence.

An overall assessment and recommendation was provided by each reviewer. Guidelines selected to draft recommendations from were:

- United States Centre for Disease Control and Prevention (CDC)
 - *Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings (2007)*
 - *Management of Multidrug-Resistant Organisms in Healthcare Settings (2006)*
 - *Guidelines for infection control in the dental setting (2003)*
 - *Guidelines for environmental infection control in health-care facilities (2003)*
 - *Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program (2008)*
 - *Guidelines for the Prevention of Intravascular Catheter-Related Infections, (2009)*
- Pratt et al (2007)—*Epic2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England*
- WHO *Guidelines on Hand Hygiene in Health Care (2009)*
- National Institute of Clinical Excellence—*Surgical site infection prevention and treatment of surgical site infection (2008)*
- US government website pandemicflu.gov (2006)—*Interim Guidance on Planning for the Use of Surgical Masks and Respirators in Health Care Settings during an Influenza Pandemic*
- Muscedere J et al for the VAP Guidelines Committee and the Canadian Critical Care Trials Group (2008) Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: Prevention. *Journal of Critical Care* 23: 126–37
- Tenke P, Kovacs B, Bjerklund Johansen TE et al (2008) European and Asian guidelines on management and prevention of catheter-associated urinary tract infections. *International Journal of Antimicrobial Agents* 31S (2008) S68–S78
- NICE (2003) *Prevention of Healthcare-associated Infection in Primary and Community Care*
- Asterton RG, Galloway A, French G et al (2008) Guidelines for the management of hospital-acquired pneumonia in the UK: Report of the Working Party on Hospital-Acquired Pneumonia of the British Society for Antimicrobial Chemotherapy. *J Antimicrobial Chemotherapy* 62, 5–34
- Nathwani D, Morgan M, Masterton RG, et al. on behalf of the British Society for Antimicrobial Chemotherapy Working Party on Community-Onset MRSA (2008) Guidelines for the UK practice for the diagnosis and management of methicillin-resistant *Staphylococcus aureus* (MRSA) infections presenting in the community. *J Antimicrob Chemother* 61: 976–94.

Relevant recommendations were drawn out of each approved guideline and categorised appropriately by the technical writers. These recommendations were circulated to committee members and additional infection prevention and control representatives in topic subgroups, to prioritise what should be used in the guidelines. Comments were collated by the NHMRC and the technical writers and the recommendations chosen for the guideline were refined at a face-to-face meeting. The approach taken to consensus setting was developed in consultation with NICS and comprised attributes of the Delphi and RAND/UCLA processes.

These recommendations were prioritised and then regraded from their original guideline grading to an NHMRC grading based on matching criteria from the original guideline developers. The Committee considered these grades and dissenting comments were noted. The recommendations with their original grading and the assigned NHMRC grading are summarised in Attachment 2c of the full report.

A preliminary draft was provided to jurisdictions for feedback in October 2009. A summary of the feedback and NHMRC responses is provided in Attachment 2d of the full report.

Glossary

This section outlines the way in which certain terms are used in these guidelines.

Acinetobacter	An aerobic Gram-negative bacillus commonly isolated from the hospital environment (especially intensive care units) and hospitalised patients; can cause healthcare-associated infections, especially wound infections and pneumonia.
Aerosols	Microscopic particles < 5 µm in size that are the residue of evaporated droplets and are produced when a person coughs, sneezes, shouts, or sings. These particles can remain suspended in the air for prolonged periods of time and can be carried on normal air currents in a room or beyond, to adjacent spaces or areas receiving exhaust air.
Airborne precautions	A set of practices used for patients known or suspected to be infected with agents transmitted person-to-person by the airborne route.
Alcohol-based hand rub	A TGA-registered alcohol-containing preparation designed for reducing the number of viable microorganisms on the hands without the use or aid of running water and which is included on the ARTG as a medicinal product.
Anteroom	A small room leading from a corridor into a room.
Antibiogram	The result of a laboratory testing for the sensitivity of an isolated bacterial strain to different antibiotics.
Antibiotic	A substance that kills or inhibits the growth of bacteria, fungi or parasites.
Antisepsis	The use of chemical or physical methods to prevent infection by destroying or inhibiting the growth of harmful microorganisms.
Asepsis	'Freedom from infection or infectious (pathogenic) material'.
Aseptic Non Touch Technique (ANTT)	A practice framework for aseptic technique.
Aseptic technique	An aseptic technique aims to prevent microorganisms on hands, surfaces and equipment from being introduced to susceptible sites. Therefore, unlike sterile techniques, aseptic techniques can be achieved in typical ward and home settings.
Bloodstream infection	The presence of live pathogens in the blood, causing an infection.
Bundle	A set of evidence-based practices that have been shown to improve outcomes when performed collectively and consistently. The concept was developed by the Institute for Healthcare Improvement in the United States to improve the care process and patient outcomes.
Catheter	A thin, flexible, hollow tube used to add or remove fluids from the body.
Clean technique	Clean technique refers to practices that reduce the number of infectious agents, and should be considered the minimum level of infection control for non-invasive patient-care activities. Practices include: personal hygiene, particularly hand hygiene, to reduce the number of infectious agents on the skin; use of barriers to reduce transmission of infectious agents (including proper handling and disposal of sharps); environmental cleaning; and reprocessing of equipment between patient uses.
Clinical waste	Waste material that consists wholly or partly of human or animal tissue, blood or body substances, excretions, drugs or other pharmaceutical products, swabs/dressings, syringes, needles or other sharp instruments.
Cohorting	Placing together in the same room patients who are infected with the same pathogen and are suitable roommates.

Colonisation	The sustained presence of replicating infectious agents on or in the body without the production of an immune response or disease.
Contact	The touching of any patient or their immediate surroundings or performing any procedure.
Contact point	The area of direct contact of skin to equipment.
Contact precautions	A set of practices used to prevent transmission of infectious agents that are spread by direct or indirect contact with the patient or the patient's environment.
Decontamination	Use of physical or chemical means to remove, inactivate, or destroy pathogens on a surface or item so that they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.
Detergent solution	A detergent product which is intended to be used in the cleaning of surfaces or other medical devices diluted with water as per manufacturer's instructions.
Disinfectant	A TGA-registered disinfectant chemical product that is intended for use in disinfection of surfaces or medical devices.
Disinfection	Destruction of pathogenic and other kinds of microorganisms by physical or chemical means.
Droplet precautions	A set of practices used for patients known or suspected to be infected with agents transmitted by respiratory droplets.
Droplets	Small particles of moisture generated when a person coughs or sneezes, or when water is converted to a fine mist by an aerator or shower head. These particles, intermediate in size between drops and droplet nuclei, can contain infectious microorganisms and tend to quickly settle from the air such that risk of disease transmission is usually limited to persons in close proximity (e.g. at least 1 metre) to the droplet source.
Engineering controls	Removal or isolation of a workplace hazard through technology.
Epidemic	A widespread outbreak of an infectious disease. Many people are infected at the same time.
Fit check	A quick check to ensure that the respirator is fitting each time it is put on.
Fit test	A method of ensuring that a respirator is fitted correctly and suitable for use by a specific individual.
Hand hygiene	A general term applying to processes aiming to reduce the number of microorganisms on hands. This includes: application of a waterless antimicrobial agent (e.g. alcohol-based hand rub) to the surface of the hands; and use of soap solution (plain or antimicrobial) and water (if hands are visibly soiled), followed by patting dry with single-use towels.
Healthcare facility	Any facility that delivers healthcare services. Healthcare facilities could be hospitals, general practice clinics, dentistry practices, other community-based office practices, day surgery centres, emergency services, domiciliary nursing services, long-term care facilities, Indigenous medical services, alternative health provider facilities and other community service facilities, such as needle exchanges.
Healthcare workers	All people delivering healthcare services, including students and trainees, who have contact with patients or with blood or body substances.
Healthcare-associated infections	Infections acquired in healthcare facilities ('nosocomial' infections) and infections that occur as a result of healthcare interventions ('iatrogenic' infections), and which may manifest after people leave the healthcare facility.
High level disinfection	Minimum treatment recommended for reprocessing instruments and devices that cannot be sterilised for use in semi-critical sites

High-efficiency particulate air (HEPA) filter	An air filter that removes >99.97% of particles > 0.3 microns (the most penetrating particle size) at a specified flow rate of air.
High-risk patients	Patients with an increased probability of infection due to their underlying medical condition. Often refers to patients in intensive care units, those receiving total parenteral nutrition, and immunocompromised patients.
Hospital-grade disinfectant	ATGA-registered disinfectant for surfaces for use in healthcare or healthcare-related applications.
Hypochlorite	A chlorine-based disinfectant.
Immunocompromised	Having an immune system that has been impaired by disease or treatment.
Incidence	The number of new events (e.g. cases of disease) occurring in a population over defined period of time.
Infectious agent	An infectious agent (also called a pathogen or germ) is a biological agent that causes disease or illness to its host . Most infectious agents are microorganisms, such as bacteria, viruses, fungi, parasites and prions.
Instrument disinfectant	ATGA-registered disinfectant for medical devices.
Intermediate level disinfection	Minimum treatment recommended for reprocessing instruments and devices for use in non-critical sites, or where there are specific concerns regarding contamination of surfaces with species of mycobacteria (e.g. <i>Mycobacterium tuberculosis</i>)
Invasive procedure	Entry into tissues, cavities or organs or repair of traumatic injuries.
Key parts	Parts of the procedure equipment or solutions that must remain aseptic throughout clinical procedures, in order to protect the patient from contamination or infection. For example a wound dressing, catheter lubrication, syringe tip, needle etc. In IV therapy, key parts are usually those that come into direct contact with the liquid infusion e.g. needles, syringe tips, exposed central line lumens.
Key sites	Susceptible open or broken wounds, surgical or intravenous access sites.
Klebsiella pneumoniae	Gram-negative bacteria frequently responsible for healthcare associated infections of wounds and urinary tract, particularly in immunocompromised patients; may also cause pneumonia.
Long-term care facilities	A range of residential and outpatient facilities designed to meet the bio-psychosocial needs of persons with sustained self-care deficits.
Low-level disinfection	An alternative treatment to cleaning alone when devices for use in non-critical sites are reprocessed and when only vegetative bactericidal activity is needed.
Medical device	A device that is intended for use with humans and used in therapeutic processes, being entered onto the ARTG.
Methicillin-resistant Staphylococcus aureus (MRSA)	Strains of <i>Staphylococcus aureus</i> that are resistant to many of the antibiotics commonly used to treat infections. Epidemic strains also have a capacity to spread easily from person-to-person.
Multi-drug resistant organisms (MROs)	In general, bacteria that are resistant to one or more classes of antimicrobial agents and usually are resistant to all but one or two commercially available antimicrobial agents.
Needle-free devices (also needleless intravascular catheter connectors)	Intravascular connector systems developed to help reduce the incidence of needlestick injury while facilitating medication delivery through intravascular catheters. There are three types of needle-free connectors: blunt cannula (two-piece) systems, one-piece needle-free systems, and one-piece needle-free systems with positive pressure.
Negative pressure room	A single-occupancy patient-care room used to isolate persons with a suspected or confirmed airborne infectious disease. Environmental factors are controlled in negative pressure rooms to minimise the transmission of infectious agents that are usually transmitted from person to person by droplet nuclei associated with coughing or aerosolisation of contaminated fluids.

P2 respirator	A particulate filter personal respiratory protection device or P2 respirator is a close fitting mask worn for airborne precautions, which is capable of filtering 0.3µm particles. A P2 respirator must comply with AS/NZS 1716:2009.
Pandemic	An epidemic that is geographically widespread, occurring throughout a region or even throughout the world.
Patient contact	Involves touching the patient and their immediate surroundings, or performing any procedure on the patient.
Patient surroundings	All inanimate surfaces that are touched by or in physical contact with the patient (such as bed rails, bedside table, bed linen, invasive devices, dressings, personal belongings and food) and surfaces frequently touched by healthcare workers while caring for the patient (such as monitors, knobs and buttons).
Patient-care area	The room or area in which patient care takes place.
Percutaneous injury	An injury that results in a sharp instrument/object, e.g. needle, scalpel, cutting or puncturing the skin.
Personal protective equipment (PPE)	A variety of barriers used alone or in combination to protect mucous membranes, skin, and clothing from contact with infectious agents. PPE includes gloves, masks, respirators, protective eyewear, face shields, and gowns.
Phlebitis Inflammation of the wall of a vein.	
Powered air-purifying respirator (PAPR)	Powered air-purifying respirator (PAPR) devices should conform to AS/NZS 1715 and AS/ANZS 1716, and must only be used by healthcare workers who are trained in their use. The manufacturer's instructions for cleaning, decontaminating and maintenance must be followed. PAPR may be suitable for healthcare workers with facial hair and those who fail fit testing for P2 respirators.
Prevalence	The number of events (e.g. cases of disease) present in a defined population at one point in time.
Procedure	An act of care for a patient where there is a risk of direct introduction of a pathogen to the patient.
Randomised controlled trial (RCT)	A clinical trial where at least two treatment groups are compared, and non-randomised control trial (NRCT) one of them serving as the control group, and treatment allocation is carried out using a random, unbiased method. A non-randomised controlled trial compares a control and treatment group but allocation to each group is not random. Bias is more likely to occur in NRCT.
Respiratory hygiene and cough etiquette	A combination of measures designed to minimize the transmission of respiratory pathogens via droplet or airborne routes in healthcare settings.
Routine	Performed as part of usual practice (as opposed to the use of additional measures in specific circumstances e.g. where invasive procedures are conducted or in the event of an outbreak).
Sharps	Instruments used in delivering healthcare that can inflict a penetrating injury, e.g. needles, lancets and scalpels.
Single-use	Single-use means the medical device is intended to be used on an individual patient during a single procedure and then discarded. It is not intended to be reprocessed and used on another patient. Some single-use devices are marketed as non-sterile which require processing to make them sterile and ready for use. The manufacturer of the device will include appropriate processing instructions to make it ready for use.
Single-use devices	Single-use devices are medical devices that are labelled by the original manufacturer as 'single use' and are only intended to be used once. http://www.tga.gov.au/devices/fs-sudman.htm
Standard precautions	Work practices that constitute the first-line approach to infection prevention and control in the healthcare environment. These are recommended for the treatment and care of all patients.

Standard-ANTT	An approach to ANTT used for technically simple aseptic procedures.
Sterile	Free from all living microorganisms; usually described as a probability (e.g. the probability of a surviving microorganism being 1 in 1 million).
Sterile technique	Sterile technique aims to eliminate microorganisms from areas and objects, and should be undertaken by all healthcare workers undertaking invasive medical procedures. This includes: ensuring that everything within a defined radius is clean and sterile, or as a minimum subject to high level chemical or thermal disinfection; use of skin antiseptics and sterile personal protective equipment; and reprocessing of instruments between patient uses. Due to the natural multitude of organisms in the atmosphere it is not possible to achieve a true sterile technique for most invasive procedures in a typical hospital environment (even when wearing sterile gloves). Sterile techniques can only be achieved in controlled environments such as a laminar air flow cabinet or a specially equipped theatre. The commonly used term, 'sterile technique' is therefore inaccurate, as practitioners are not actually achieving their stated objective.
Sterilisation	Use of a physical or chemical procedure to destroy all microorganisms including substantial numbers of resistant bacterial spores.
Strain	A strain is a genetic variant or subtype of a microorganism (e.g. a virus, bacterium or fungus). Some strains may be more dangerous or difficult to treat than others.
Surface barrier	Barriers (e.g. clear plastic wrap, bags, sheets, tubing or other materials impervious to moisture) designed to help prevent contamination of surfaces and equipment.
Surgical hand preparation	The process of eliminating transient and reducing resident flora prior to surgery. This comprises removal of hand jewellery, performing hand hygiene with liquid soap if hands are visibly soiled, removing debris from underneath fingernails and scrubbing hands and forearms using a suitable antimicrobial formulation.
Surgical masks	Loose-fitting, single-use items that cover the nose and mouth. These include products labelled as dental, medical procedure, isolation and laser masks.
Surgical-ANTT	An approach to ANTT used for technically complex aseptic procedures.
Surgical-site infection	An infection at the site of a surgical operation that is caused by the operation.
Surveillance	Disease surveillance is an epidemiological practice by which the spread of disease is monitored in order to establish patterns of progression. The main role of disease surveillance is to predict, observe and minimise the harm caused by outbreak, epidemic and pandemic situations, as well as increase knowledge as to what factors might contribute to such circumstances.
Targeted surveillance	A process in which data are collated on the susceptibilities and resistances of disease-causing microbes to various antimicrobial treatments. Targeted surveillance gathers data that is not generated by routine testing: specific species or groups of species are examined in detail to answer important questions that cannot be addressed by passive surveillance.
Transmission-based precautions (formerly additional precautions)	Extra work practices in situations where standard precautions alone may be insufficient to prevent infection (e.g. for patients known or suspected to be infected or colonised with infectious agents that may not be contained with standard precautions alone).
Vancomycin resistant enterococci (VRE)	Enterococci are Gram-positive bacteria that are naturally present in the intestinal tract of all people. Vancomycin is an antibiotic to which some strains of enterococci have become resistant. These resistant strains are referred to as VRE and are frequently resistant to other antibiotics generally used to treat enterococcal infections.

Abbreviations and Acronyms

ACH	air changes per hour
ACSQHC	Australian Commission on Safety and Quality in Health Care
ADEC	Australian Drug Evaluation Committee
AGREE	Appraisal of guidelines research and evaluation
AICA	Australian Infection Control Association
ANTT	aseptic non-touch technique
ARTG	Australian Register of Therapeutic Goods
AusHFG	<i>Australasian Health Facility Guidelines</i>
AusHFG	Australasian Health Facility Guidelines
BCG	Bacillus Calmette-Guérin
BSI	bloodstream infection
CA-MRSA	community-acquired methicillin-resistant <i>Staphylococcus aureus</i>
CAUTI	catheter-associated urinary tract infection
CBIC	Certification Board of Infection Control
cCJD	classical Creutzfeldt-Jakob disease
CDC	Centers for Disease Control and Prevention (US)
CDNA	Communicable Diseases Network Australia
CEO	chief executive officer
CHG	chlorhexidine-impregnated
EPP	exposure-prone procedures
ESBL	extended spectrum beta-lactamase
GPP	good practice point
HAI	healthcare-associated infection
HBeAg	hepatitis B e antigen
HBsAg	HBV surface antigen
HBV	hepatitis B virus
HCV	hepatitis C virus
HEPA	high efficiency particulate air
HIV	human immunodeficiency virus
HTLV-I	human T-cell lymphotropic virus type I
IHI	Institute for Healthcare Improvement (US)
IPC	infection prevention and control
IVD	intravascular device
LAS	laminar airflow filtration
MMR	measles mumps rubella vaccine
MRGN	multi-resistant Gram negative
MRO	multi-resistant organism
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>
NaOH	sodium hydroxide
NATA	National Association of Testing Authorities

nCJD	new Creutzfeldt-Jakob disease
NHHI	National Hand Hygiene Initiative
NHIG	normal human immunoglobulin
NHMRC	National Health and Medical Research Council
NICE	National Institute for Health and Clinical Excellence (NICE)
NNDSS	National Notifiable Diseases Surveillance System
NPS	National Prescribing Service
NRL	natural rubber latex
OH&S	occupational health and safety
OMT	outbreak management team
PAPR	powered air-purifying respirator
PBS	Pharmaceutical Benefits Scheme
PEG	percutaneous endoscopic gastrostomies
PEP	post-exposure prophylaxis
PICC	peripherally inserted central venous catheter
PPE	personal protective equipment
PPE	personal protective equipment
PSAE	<i>Pseudomonas aeruginosa</i>
PVL	panton-valentine leukocidin
RPBS	Repatriation Pharmaceutical Benefits Scheme
RSV	respiratory syncytial virus
SAL	sterility assurance level
SARS	severe acute respiratory syndrome
SSI	surgical-site infection
TB	tuberculosis
TGA	Therapeutic Goods Administration
VAP	ventilator-associated pneumonia
VRE	vancomycin-resistant enterococci
WHO	World Health Organization
ZIG	Zoster immune globulin

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